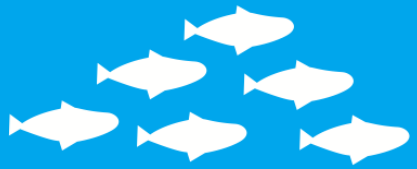
Veterinærinstituttet
Norwegian Veterinary Institute

WOAH Collaborating Centre for Epidemiology and Risk Assessment of Aquatic Animals (Europe)
Reference Centre
World Organisation for Animal Health
Founded as OIE

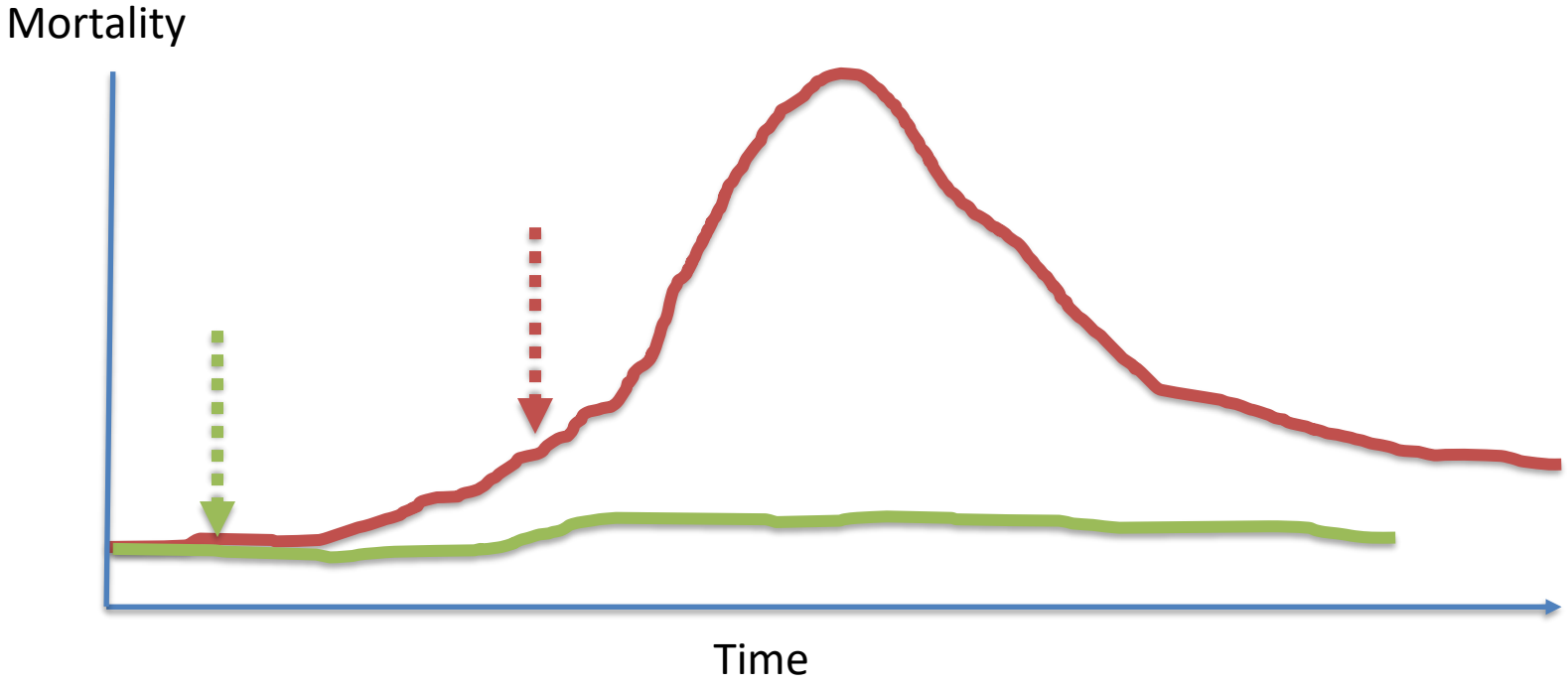
Main Steps in Fish Disease detection focusing on Outbreak Investigation

Epidemiology and Risk Assessment of Aquatic Animal Diseases Collaborating Centre (Europe)

Saraya Tavornpanich
Maria Fernanda Serrano



DETECTION OF DISEASE



When did this happen?

Where are the dead fish located?

What kind of fish?

Have local authorities been notified?

How many dead fish are there?

Are there visible signs of trauma or diseases?

What can be done to stop fish from dying?

What are the environmental conditions?

What can be done to prevent future incidents?

WHAT IS THE OUTBREAK INVESTIGATION?

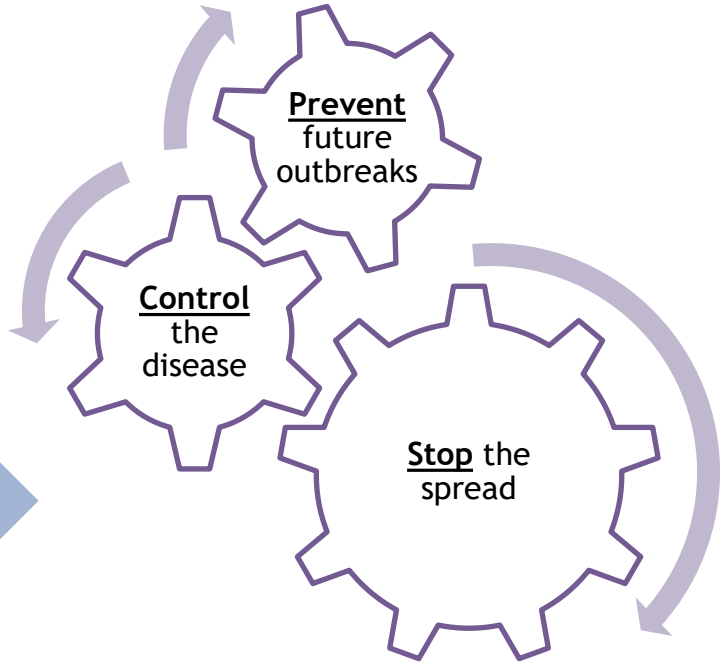
A **systematic** procedure to identify:

- Patterns of occurrence
- Cause, or factors associated with cause
- Source of introduction or new exposures
- Population at risk: Are all involved species identified? (Clinical, Subclinical, Reservoir)
- Investigate for future cases

WHY IS IT IMPORTANT?

Understand the real situation

Establishment of measures



FIRST AT ALL WE HAVE TO DEFINE…

OUTBREAK

An occurrence of one or more cases in an epidemiological unit.

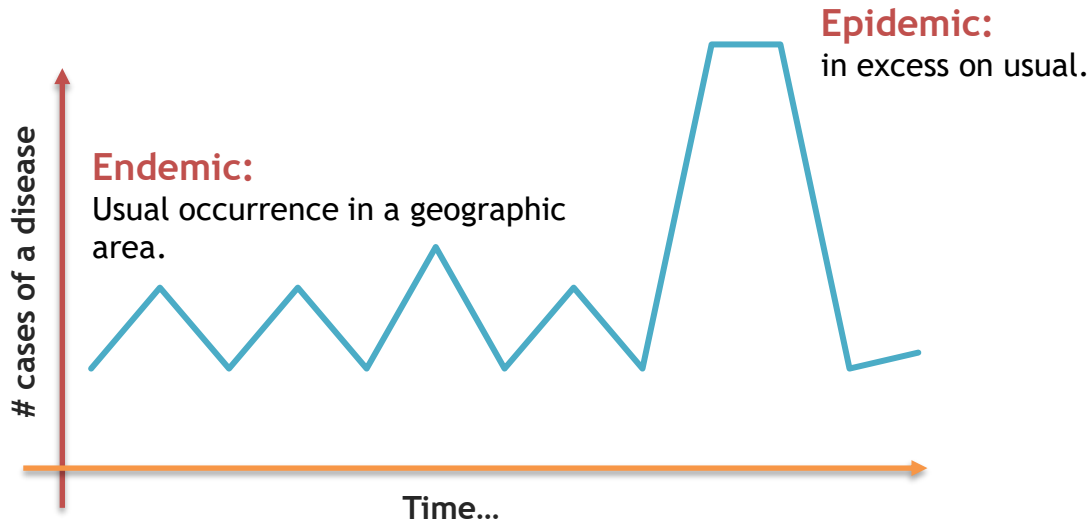
CASE

An individual aquatic animal infected by a pathogenic agent, with or without clinical signs.

EPIDEMIOLOGICAL UNIT

- An occurrence of one or more cases in an epidemiological unit.
- This may be because they share a common aquatic environment (e.g. fish in a pond, caged fish in a lake),
- Or because management practices make it likely that a pathogenic agent in one group of animals would quickly spread to other animals (e.g. all the ponds on a farm, all the ponds in a village system).

DEFINING AN OUTBREAK



Disease Free	Outbreak	Occurrence
Endemic Disease	Outbreak	**Higher than usual** frequency

DEFINING AN OUTBREAK

Determine the threshold level for outbreak

Historical data and a statistical package

- STATA, SAS, R, etc.

Expert Opinion

(Farmer, veterinarian, etc.)

- Define 'obvious reason'
- Set mortality threshold at 0.05% per day
- If mortality exceeds 0.05% per day without obvious reason

Start Investigation

Let's do this Step by Step

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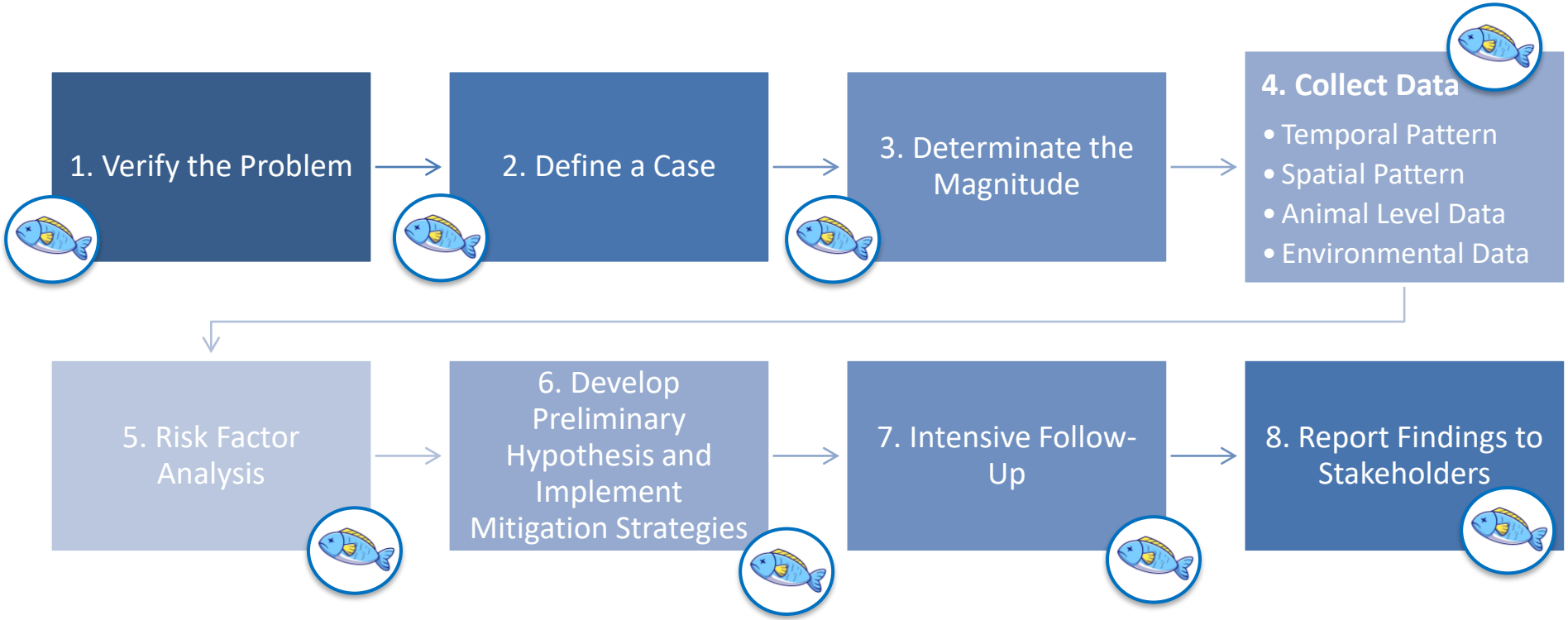
8 Steps Procedure



Modified from Subasinghe et al., 2004

Verifying the Problem

Modified from Subasinghe et al., 2004

1. Verifying the Problem

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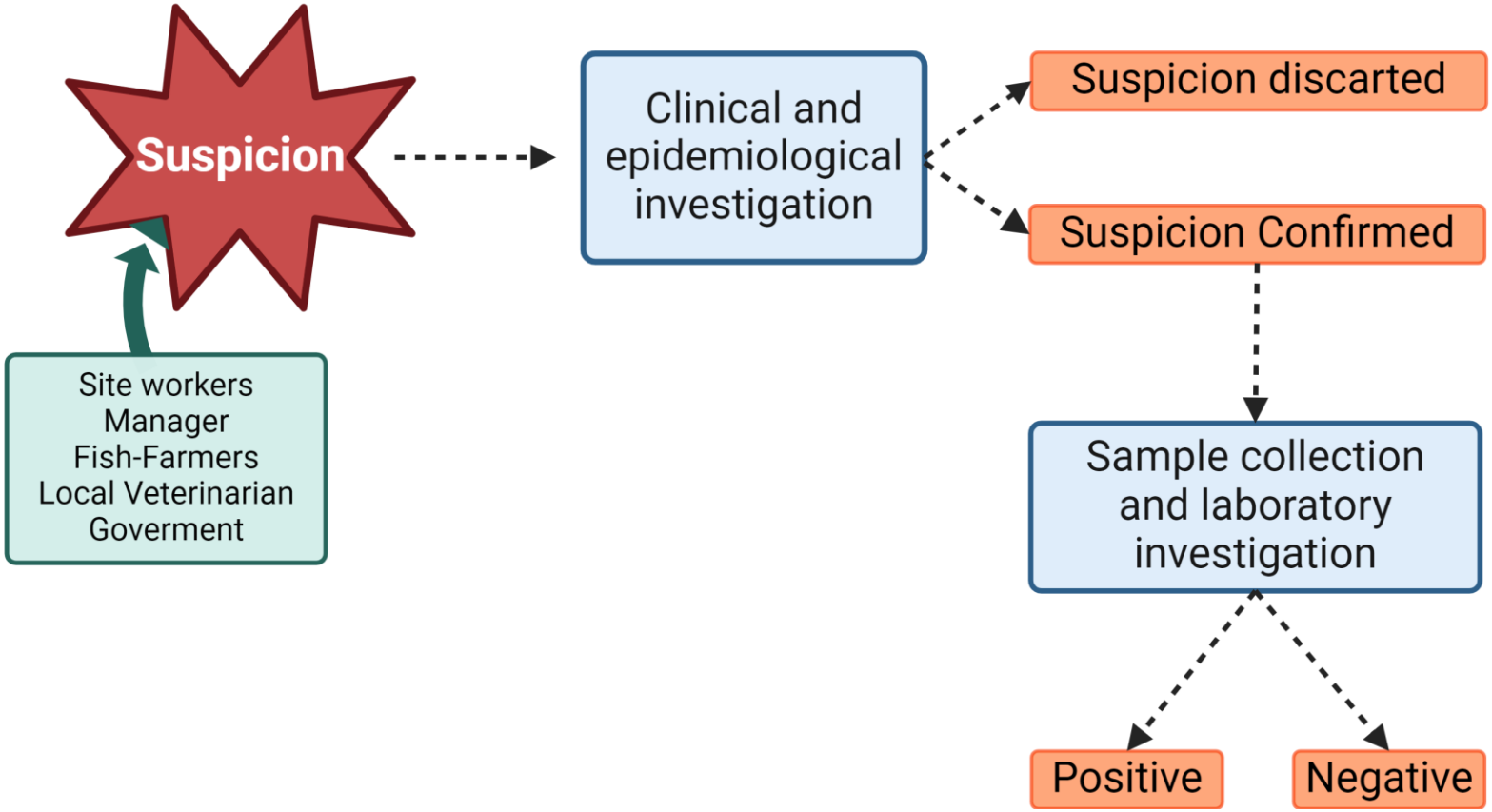
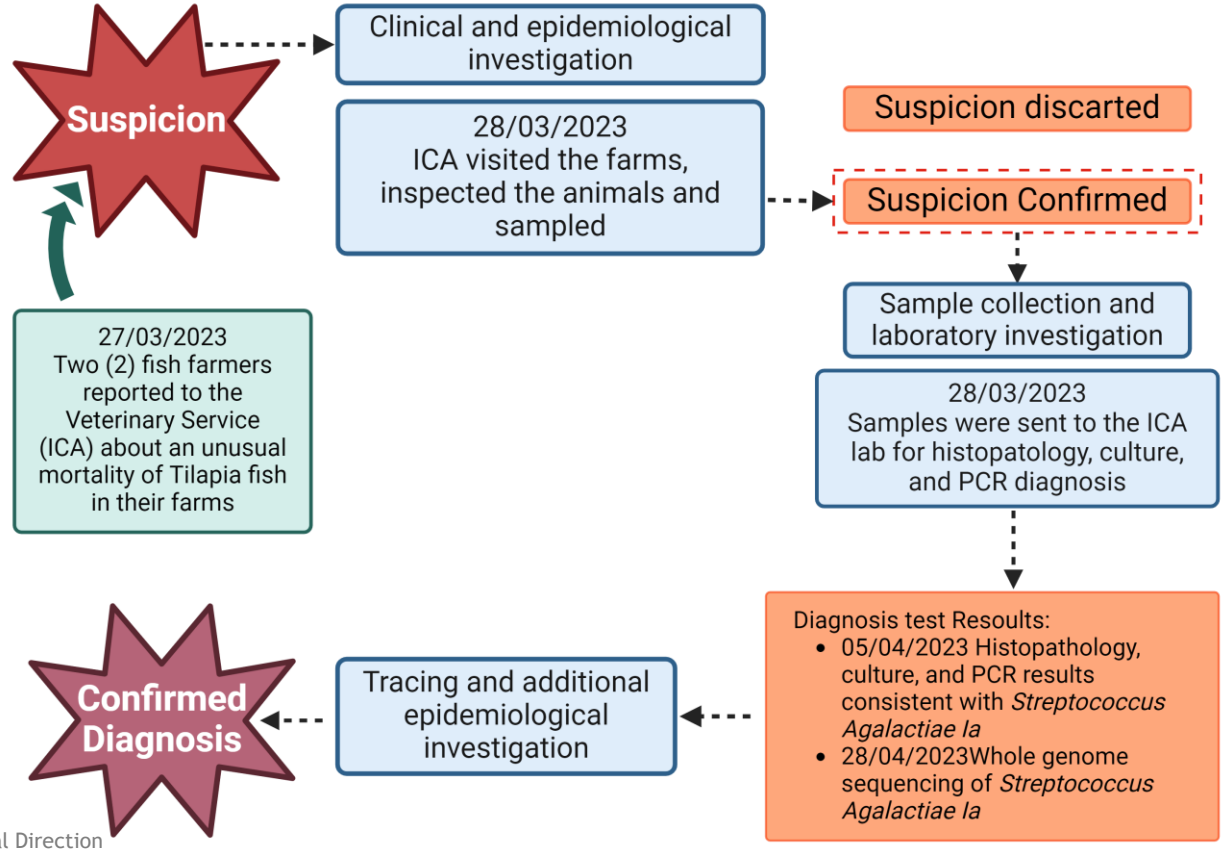


Adapted from OIE 2012, guidelines for Animal Disease Control

1. Verifying the Problem

Example- *Streptococcus Agalactiae* Ia Outbreak



ICA- Colombia Animal Health Technical Direction

1. Verifying the Problem

WOAH Collaborating Centre for Epidemiology and Risk Assessment of Aquatic Animals (Europe)

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Colombian Example - What was found

Affected specie	Tilapia
Causal Agent	Streptococcus Agalactiae ST7 Serotype Ia Gram+
Clinical sings	Loss of appetite, lethargy, erratic swimming, exophthalmia, and death.
Gross lessons	Hemorrhagic and friable liver, empty intestine, large gallbladder, skin lesions, congested brain, opaque eye.
Diagnosis Test	Histology, Bacteriology and Molecular Biology (PCR, RT-PCR)
Impact	High morbidities High mortalities Economic losses

NO WOAH LISTED DISEASE

Define a Case

Modified from Subasinghe et al., 2004

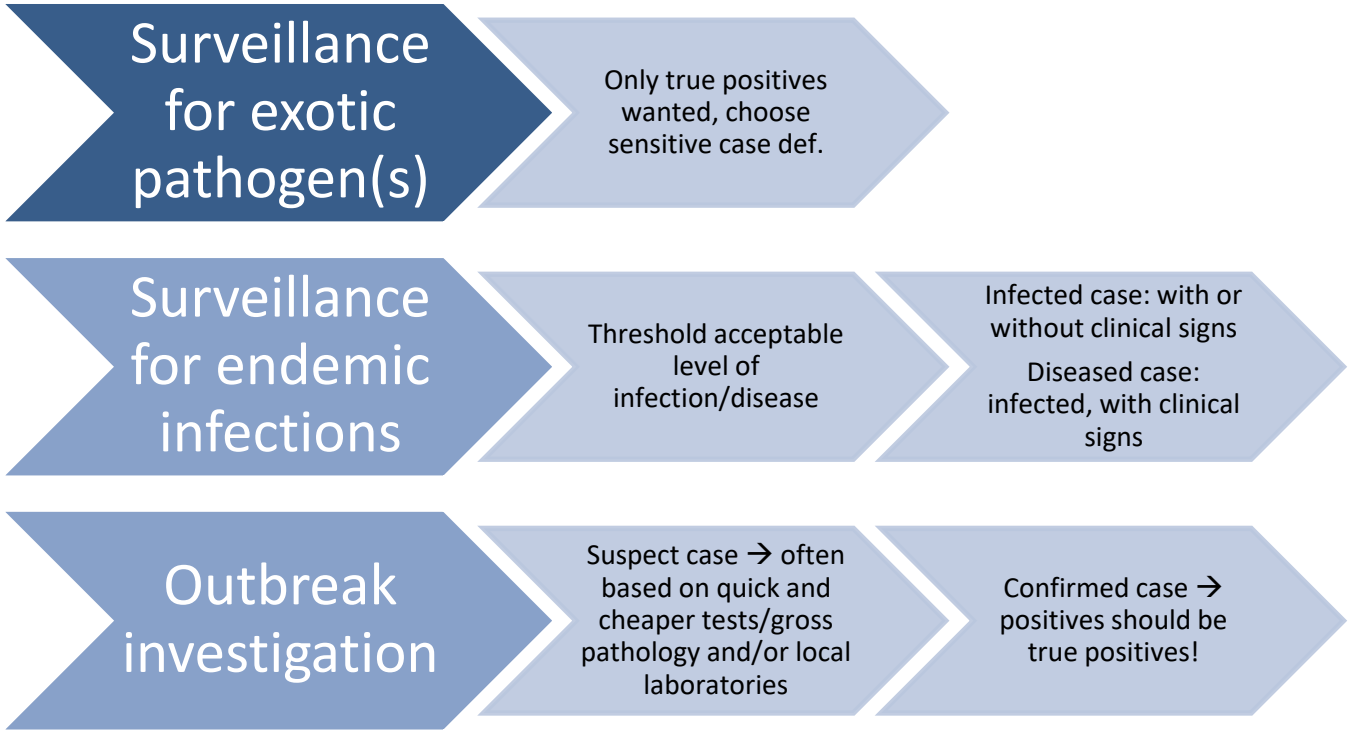
2. Define a Case

CASE DEFINITION

Is a set of criteria used to distinguish a case from a non-case.

2. Define a case

By the goal



2. Define a case

Case definition in Aquatic Animals

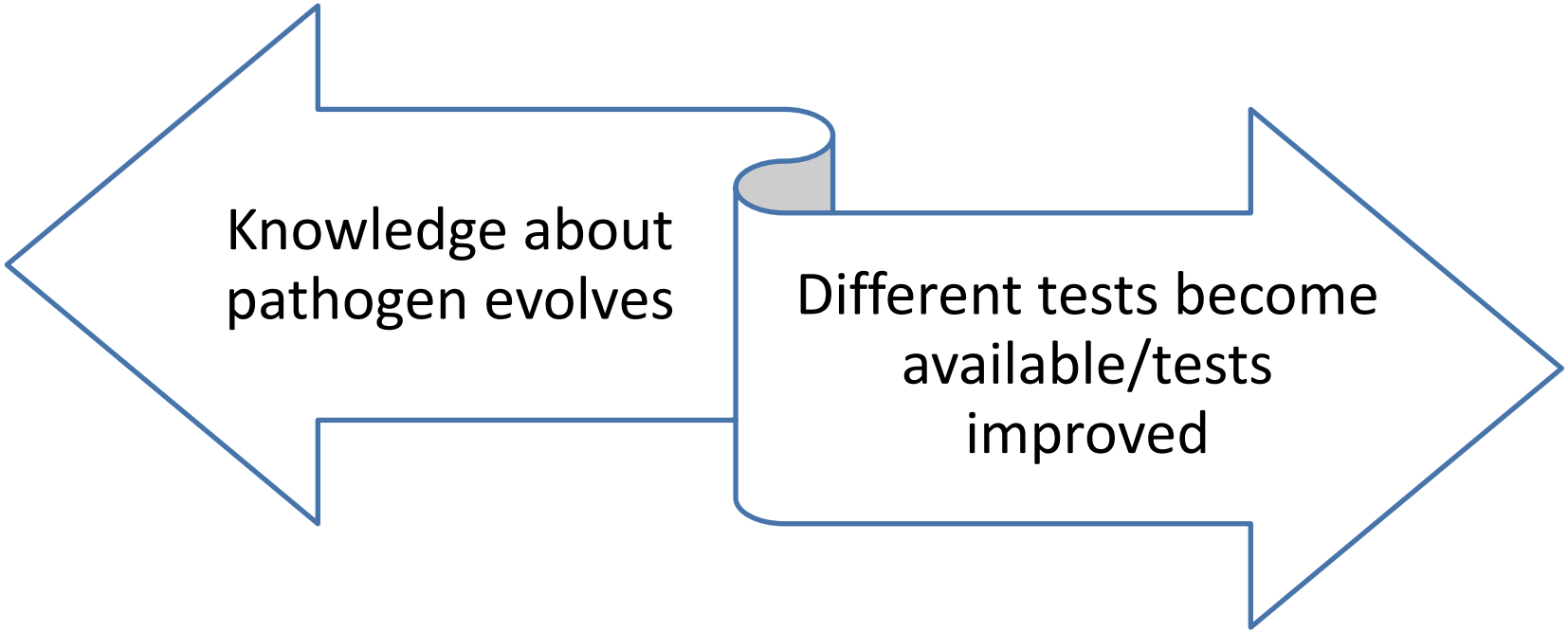
Can be non-specific clinical signs

Can be infection without disease

Can be modified as knowledge increase throughout the investigation

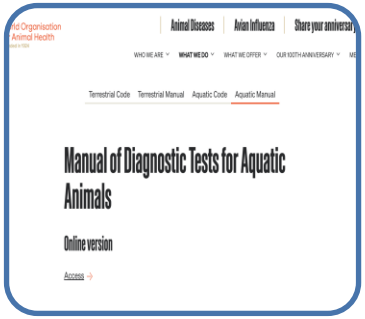
2. Define a case

When definition Change



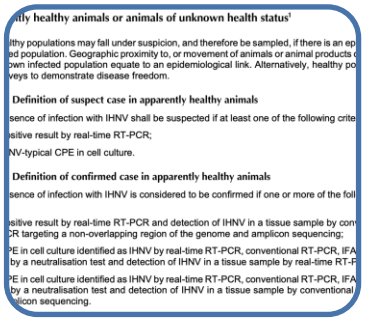
2. Define a Case

WOAH Listed Diseases



The relevant disease-specific chapter of the Aquatic Manual:

6. Corroborative Diagnosis Criteria



Provides Case definition for:

* Suspect and confirmed Case in apparently healthtly animals or animals of unknown health status

* Suspect and confirmed case in clinically affected animals.

2. Define a case

NO WOAH LISTED DISEASE

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Example- *Streptococcus Agalactiae* Ia Outbreak

Suspected Case

If at least one of the following criteria is met:

- Presence of unusual mortality
- Gross pathology or clinical signs associated with the disease, with or without unusual mortality
- Histopathological changes characteristic of infection with *Streptococcus Agalactiae* Ia

Confirmed Case:

If at least one of the following criteria is met:

- Histopathological changes characteristic of infection with ST-Ia, and Positive result by real-time PCR, and culture of Hemolytic Streptococcus Agalactiae spp., followed by whole genome sequencing of Streptococcus Agalactiae Ia.
- Histopathological changes characteristic of infection with ST-Ia, and Positive result by real-time PCR, or culture of Hemolytic Streptococcus Agalactiae spp.
- Histopathological changes characteristic of infection with ST-Ia, and epidemiological link with positive farms

Determine the Magnitude

Modified from Subasinghe et al., 2004

3. Determine the Magnitude

Compute the Affected Proportion (AP)

$$AP = \frac{\text{No. of affected animals}}{\text{Population at risk at start of epidemic}}$$

Case definition is crucial!

Magnitude could be over or under-estimated

3. Determine the Magnitude

Media – Risk Communication

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Potential pressure/interest from media can be expected at this stage

3. Determine the Magnitude

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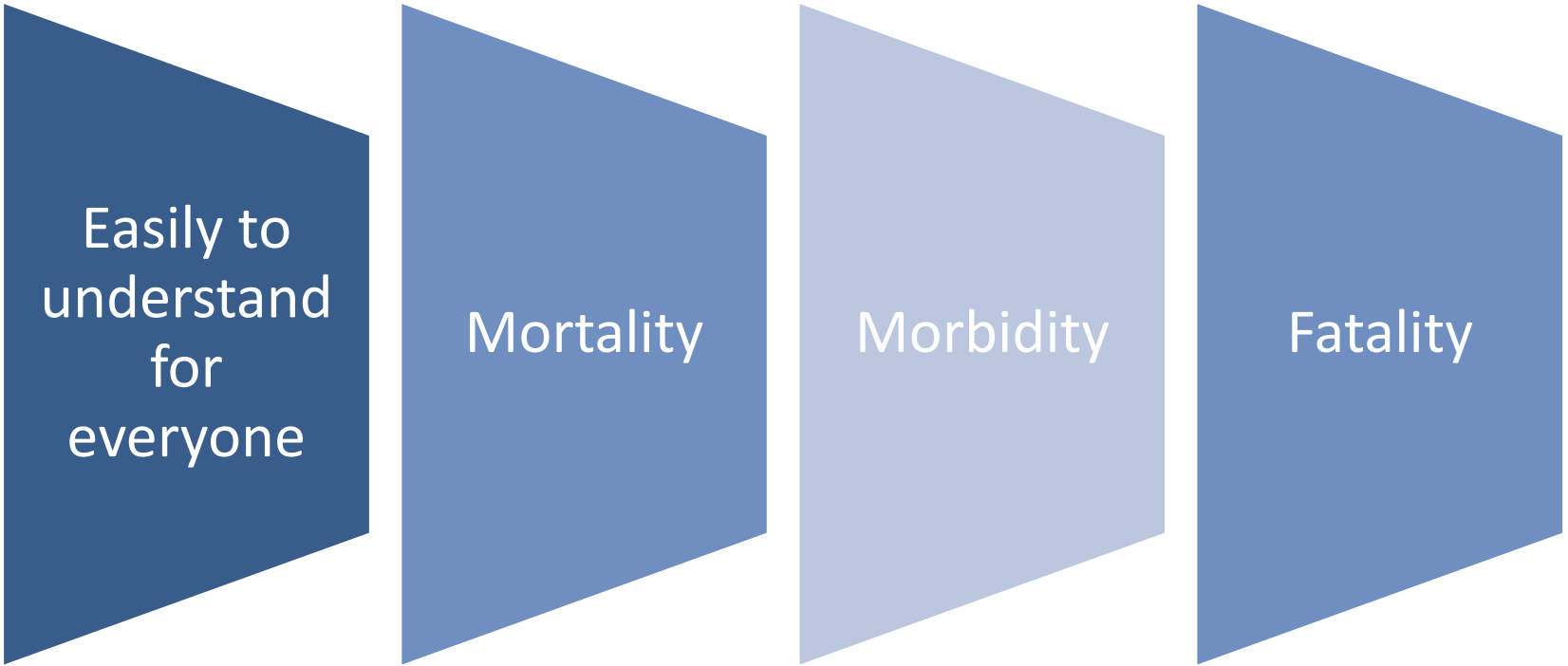
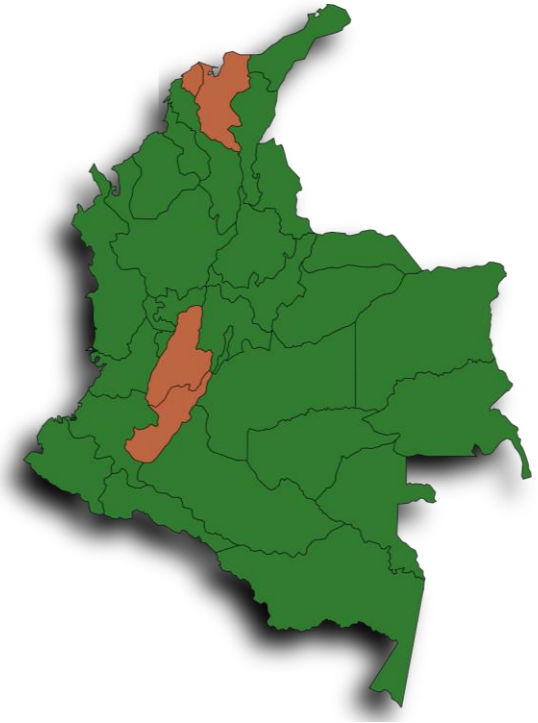
Measures of Disease



3. Determine the Magnitude

Example- *Streptococcus Agalactiae* Ia Outbreak



HUILA
- 15% Morbidity (5.604.190)
- 12% Mortality (4.554.598)
- 81% Fatality

ATLÁNTICO
- 100% Morbidity (3.481.632)
- 47% Mortality (1.621.665)
- 47% Fatality

MAGDALENA
- 43% Morbidity (12.001)
- 37% Mortality (10.301)
- 86% Fatality

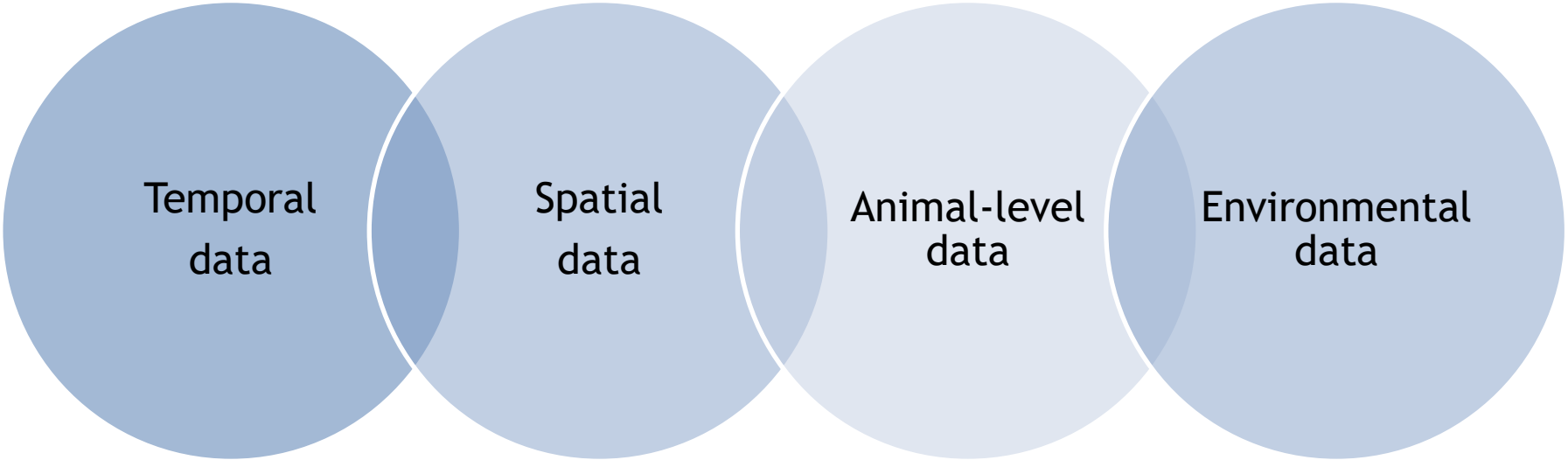
TOLIMA
- 10% Morbidity (50.000)
- 10% Mortality (50.000)
- 100% Fatality

Collect Data

Modified from Subasinghe et al., 2004

4. Collect Data

Purpose



4. Collect Data

How to Collect Data

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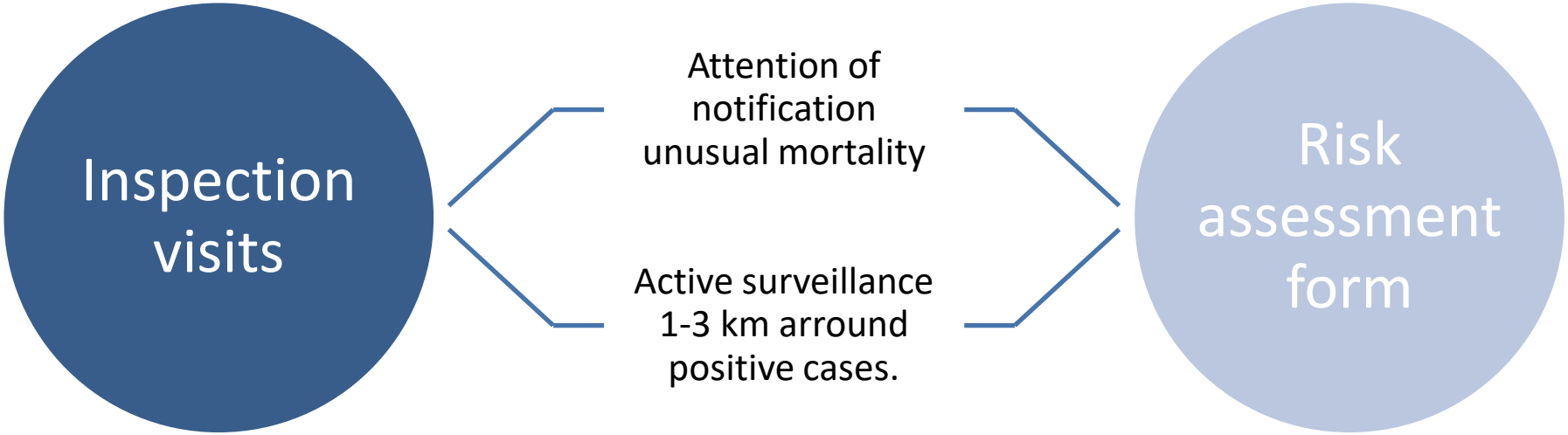
4. Collect Data

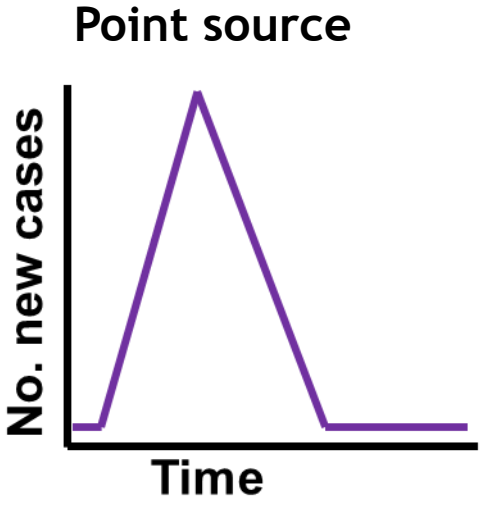
How to Collect - Example - *Streptococcus Agalactiae* Ia Outbreak

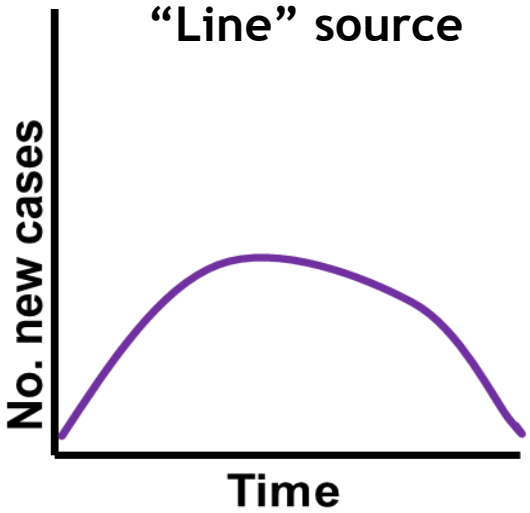


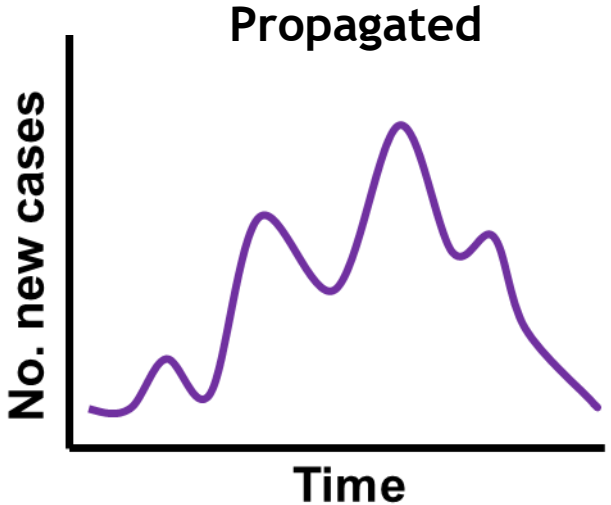
4. Collect Data

Temporal Pattern

An epidemic curve (often created as a bar/column chart or histogram) should be plotted using an appropriate time interval. The epidemic curve will help determine etiology type (distinguish between common source and propagated outbreak)

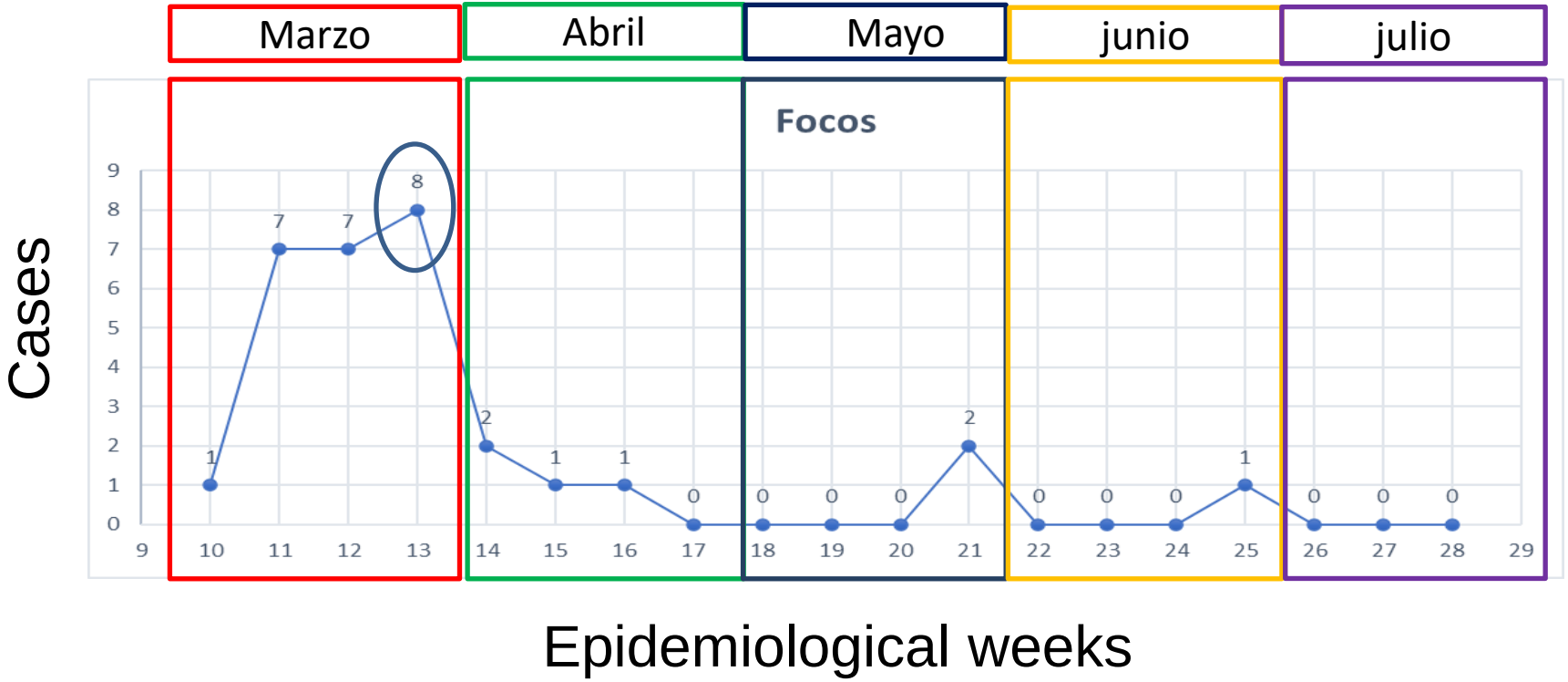






4. Collect Data

Temporal Pattern – Example - *Streptococcus Agalactiae* Ia Outbreak



4. Collect Data

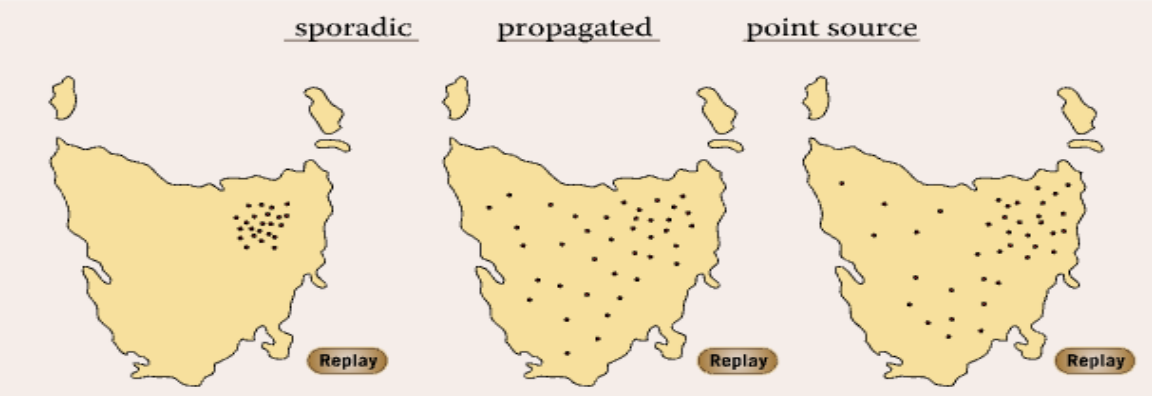
Spatial Pattern

Where is the Infection started?

Spatial mapping of cases and dates can help to:

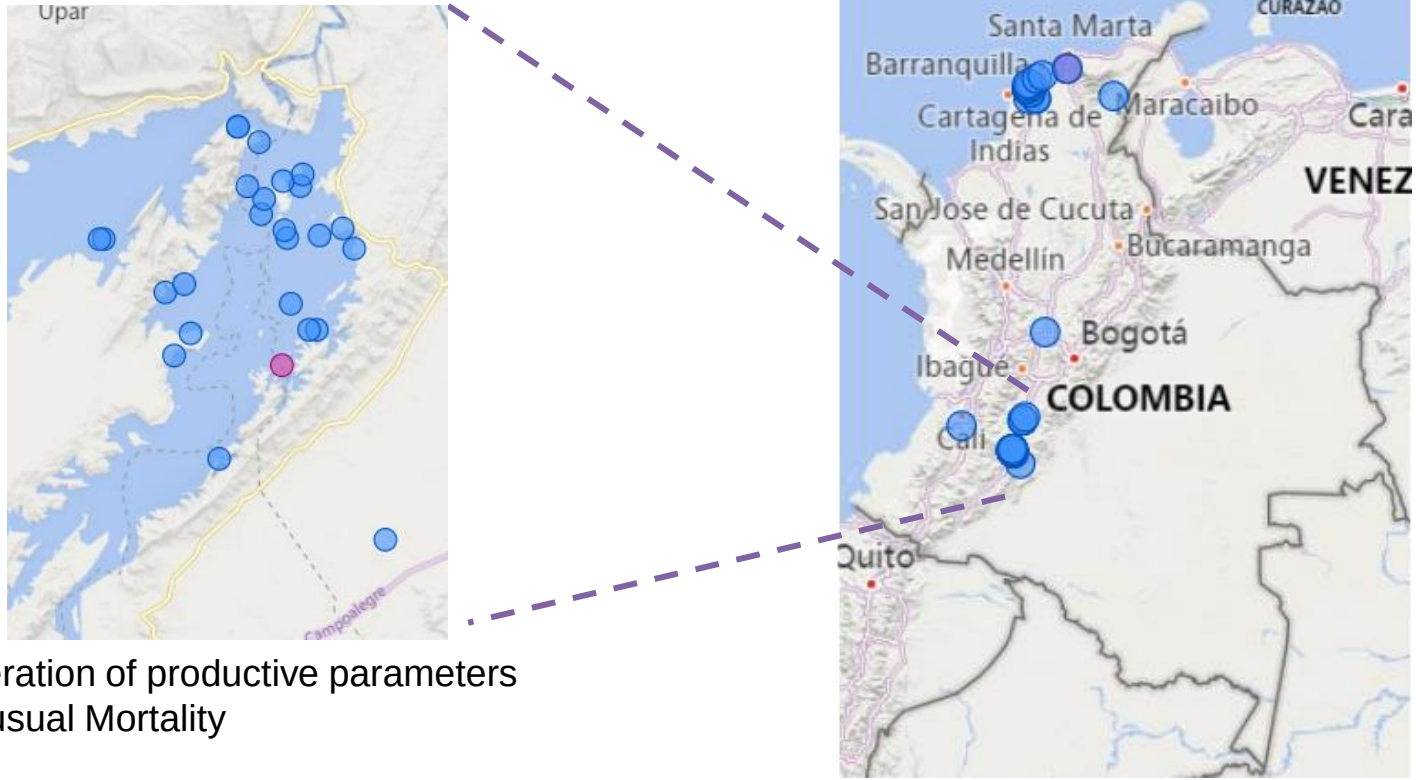
determine spatial pattern

Identify transmission routes



4. Collect Data

Spatial Pattern - Example - *Streptococcus Agalactiae* Ia Outbreak



- Alteration of productive parameters
- Unusual Mortality

ICA- Colombia, Interactive Bulletin- Epidemiological Surveillance Technical Direction
https://app.powerbi.com/view?r=eyJrIjoiYjY4YjBjNDYtZWUwZi00MjFlLTljZjEtOGQyYzg5OWM5NjUxIiwidCI6Im13YWVkYTBjLTY0Y2QtNDlkMi05YTRkLTMwNjIzNjc0MzJlMyIsImMiOjR9

4. Collect Data

Animal and Environmental Pattern

Animal pattern

Data on species, age, sex, and other outbreak-specific factors should be collected for analysis

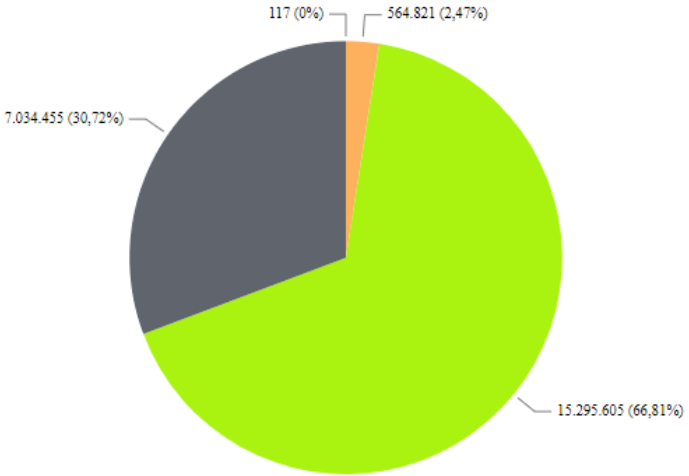
Environmental pattern

Data concerning general management (e.g., feed and water) and weather should be evaluated

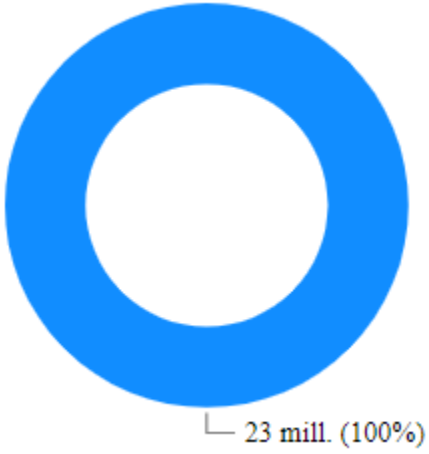
4. Collect Data

Animal Pattern- Example - *Streptococcus Agalactiae* Ia Outbreak

Age Category

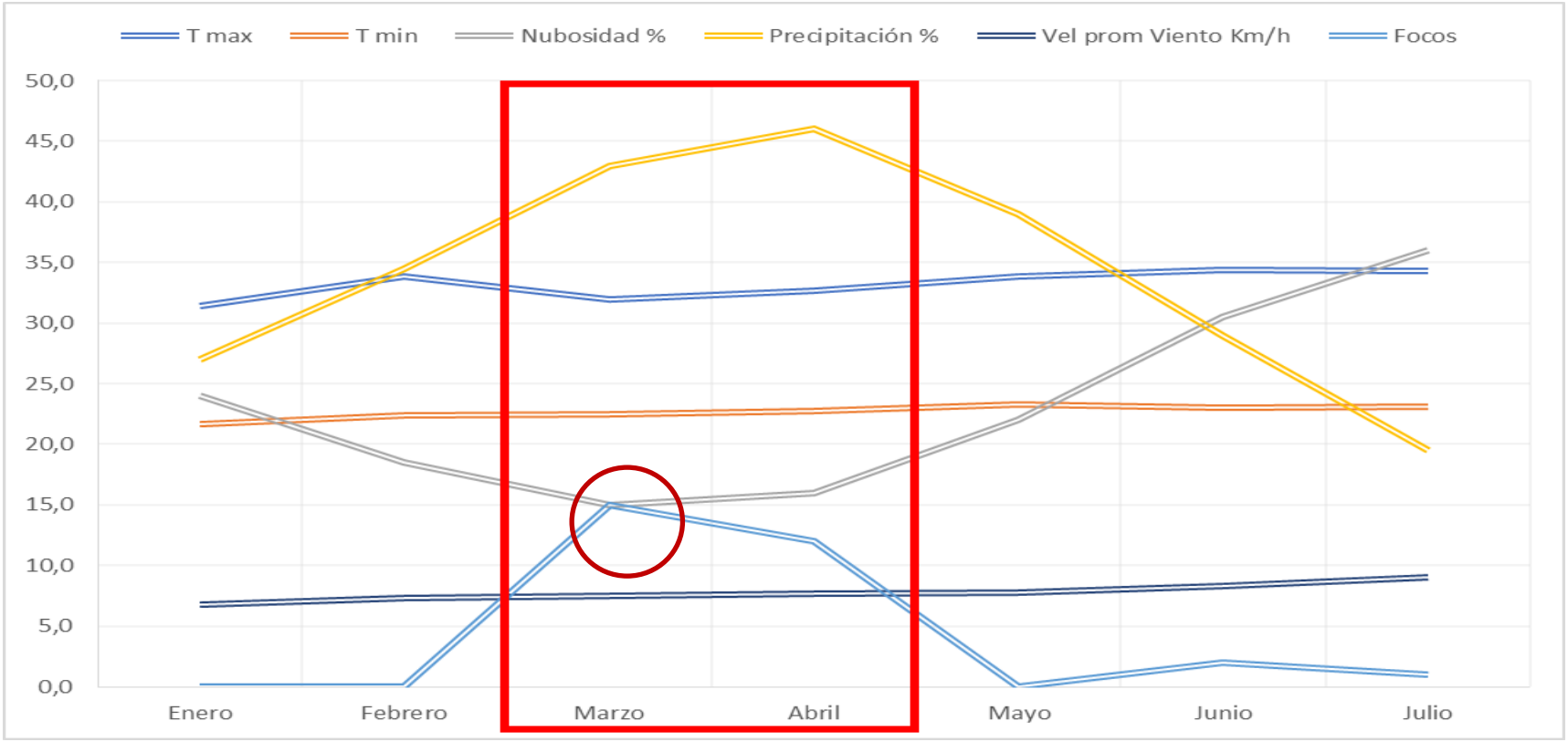


Affected Specie



4. Collect Data

Environmental Pattern- Example - *Streptococcus Agalactiae* Ia Outbreak



Risk Factor Analysis

Modified from Subasinghe et al., 2004

5. Risk Factor Analysis

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Reference Centre

World Organisation for Animal Health
Founded as OIE

What is a Risk Factor?

It is a factor that can be associated with disease

Increasing the possibility to

- Become infected
- Become diseased once infected

5. Risk Factor Analysis

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Reference Centre
World Organisation for Animal Health
Founded as OIE

What is a Risk Factor?

A risk factor can be

- generic
- disease specific

Method to identify risk-factors for a disease

+

Epidemiological study.

=

Compare cases to non-cases

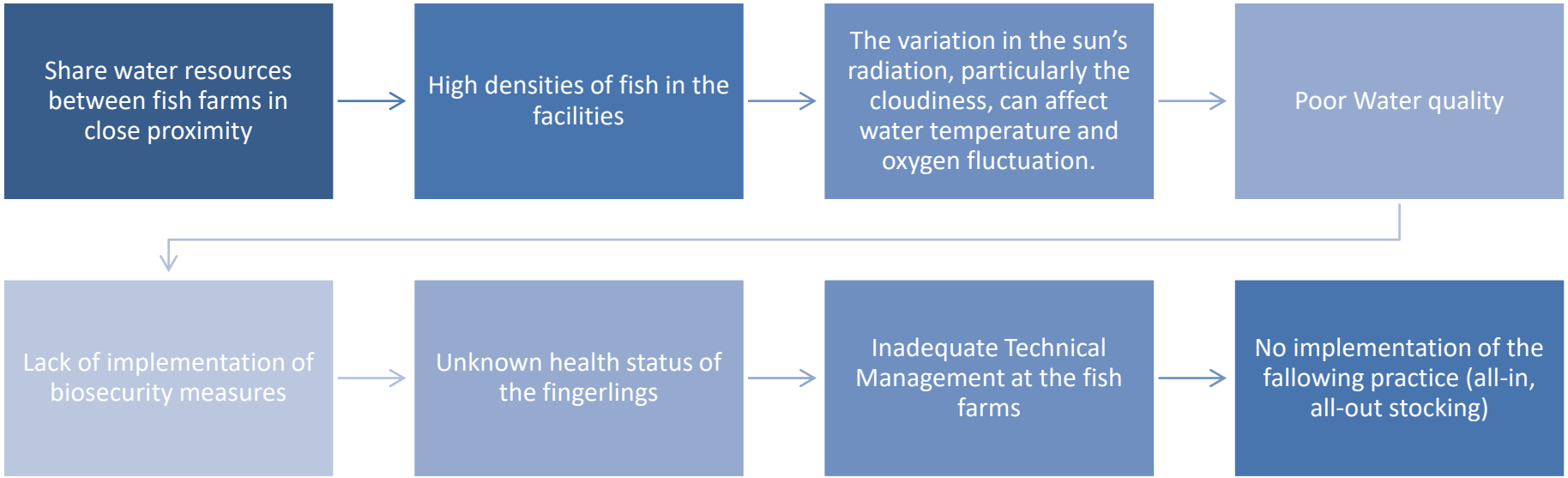
5. Risk Factor Analysis

Measures of Association

- Relative Risk
- Odds Ratio
- Incidence Rate Ratio
- Prevalence Ratio

5. Risk Factor Analysis

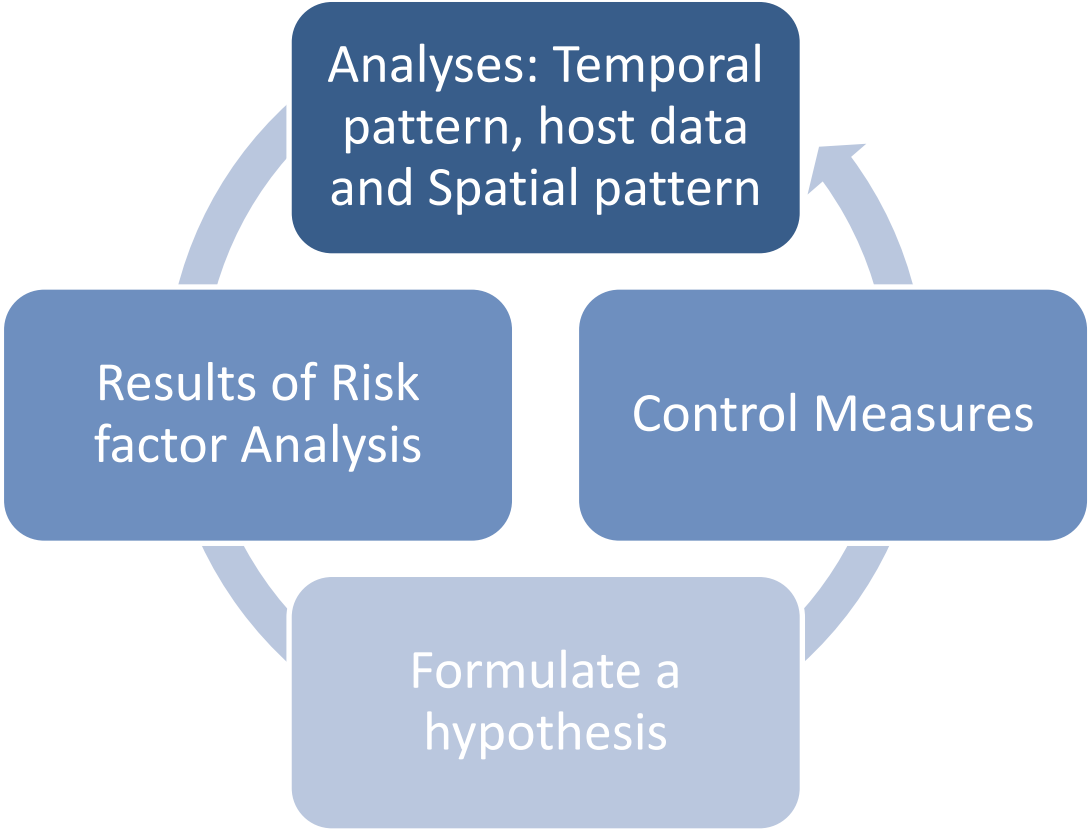
Example Risk Factors Related to- *Streptococcus Agalactiae* Ia Outbreak



Develop a Preliminary hypothesis and Implement Mitigation strategies

Modified from Subasinghe et al., 2004

6. Preliminary hypothesis and mitigation strategies



6. Preliminary hypothesis and mitigation strategies

Common control measures in Aquaculture

Zoning (infected) and compartmentalization (as preventive)

Biosecurity measures (e.g. disinfection)

Treatment

Depopulation

6. Preliminary hypothesis and mitigation strategies

Example Preventive Measures- *Streptococcus Agalactiae* Ia Outbreak

Increase biosecurity measures, and control entry of vehicles, objects, and personnel to fish farms.

Maintain the density of cultured fish according to the licensed permit, environmental conditions (temperature, cloudiness, etc.), and water quality related to available oxygen.

Implement cleaning and disinfection procedures for vehicles, objects, and supplies entering and leaving the establishment.

Report the unusual mortality or alteration of productive parameters in fish farms immediately to ICA.

ICA- Colombia, Sanitary Emergency Resolution 6535/2023

6. Preliminary hypothesis and mitigation strategies

Example Control Measures- *Streptococcus Agalactiae* Ia Outbreak

Discard the mortality following the environmental authority recommendations immediately

Vaccination should be conducted against the specific serotype that has been previously authorized by the ICA.

Epidemiological monitoring of the disease in accordance with the strategies established by ICA.

ICA- Colombia, Sanitary Emergency Resolution 6535/2023

6. Preliminary hypothesis and mitigation strategies

Example Control Measures- *Streptococcus Agalactiae* Ia Outbreak

When infected animals leave the farm, the producer should:

Clean and disinfect the facilities, vehicles, equipment, and any objects that were in contact with the infected animals.

Eliminate disposable equipment such as nets, porous air hoses, and plastic buckets, or any other equipment whose material cannot be effectively disinfected or is damaged by disinfectants.

Once the cleaning and disinfection process is completed, implement a fallowing for at least 15 days

ICA- Colombia, Sanitary Emergency Resolution 6535/2023

6. Preliminary hypothesis and mitigation strategies

Example Prohibitions- *Streptococcus Agalactiae* Ia Outbreak

Movement or commercialization of fish with clinical signs

Feeding of tilapia with fresh or live diets, mortality, or waste human food.

Disposal of dead fish or fish exhibiting clinical signs from water bodies and other water sources

Share equipment, vehicles or supplies with other fish farms.

ICA
Instituto Colombiano Agropecuario

Use vaccines without ICA authorization.

Use of veterinary supplies that are not registered or authorized by ICA

ICA- Colombia, Sanitary Emergency Resolution 6535/2023

Intensive Follow up

Modified from Subasinghe et al., 2004

7. intensive Follow-up

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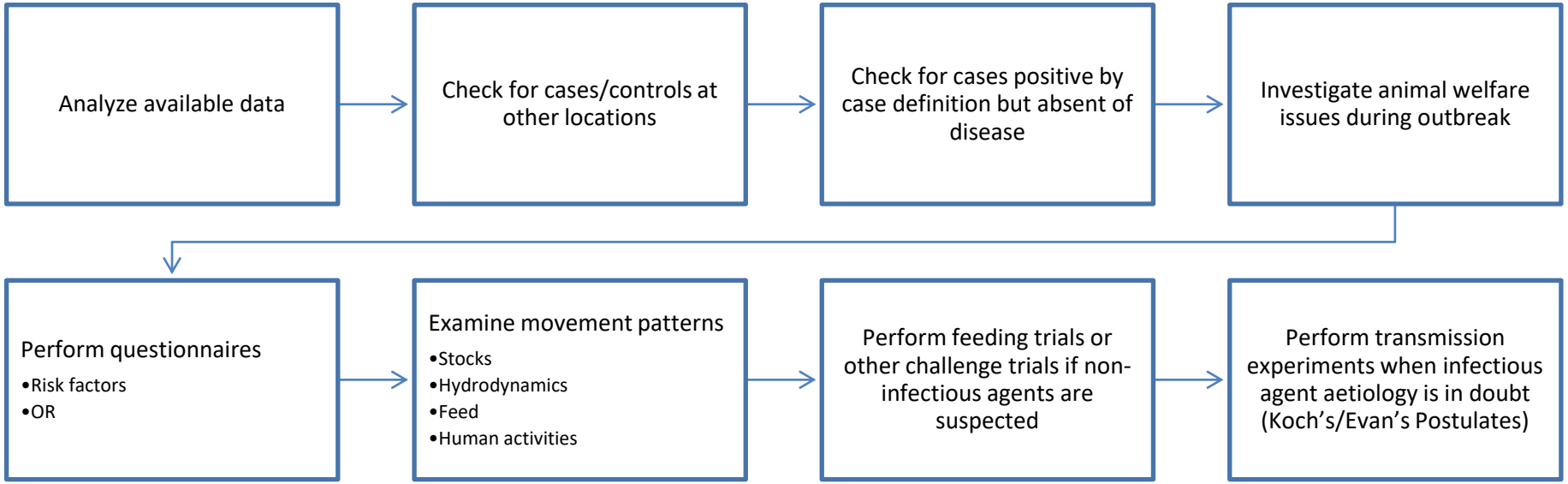
Follow up



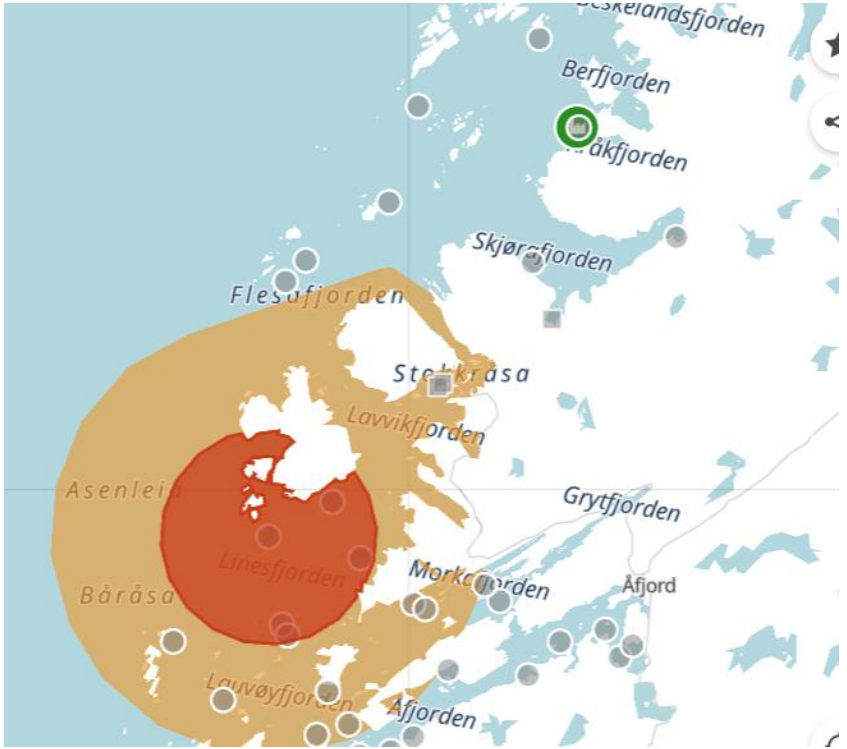
7. intensive Follow-up

Results of follow up- Establishment of Zones

Infected zones — Defined to encompass geographically clustered infected populations.

Protection Zones — will prevent spread from the zone and should be based on the epidemiology and transmission potential of the agent

Infected Zone
Protection Zone
Free Zone



7. intensive Follow-up

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World Organisation for Animal Health
Founded as OIE

Example Active Surveillance and Monitory -*Streptococcus Agalactiae* Ia Outbreak

121 Fish farms	Surveillance visits to farms between 1 to 3 km around positive farms.
5 Fish farms	Broodstock Farms Traceability.
80 Fish farms	Monitoring to positive farm , After vaccine
19 Fish farms	Monitoring in negative regions with high production

Report Findings to Stakeholders

Modified from Subasinghe et al., 2004

8. Report Findings to Stakeholders

Where report?

Local level
- Brief discussion with the site manager(s)/company owners
  - Actions for control
  - Surveillance

→ Provincial level → National level

World (WOAH)
- Ensure transparent reporting to trade partners

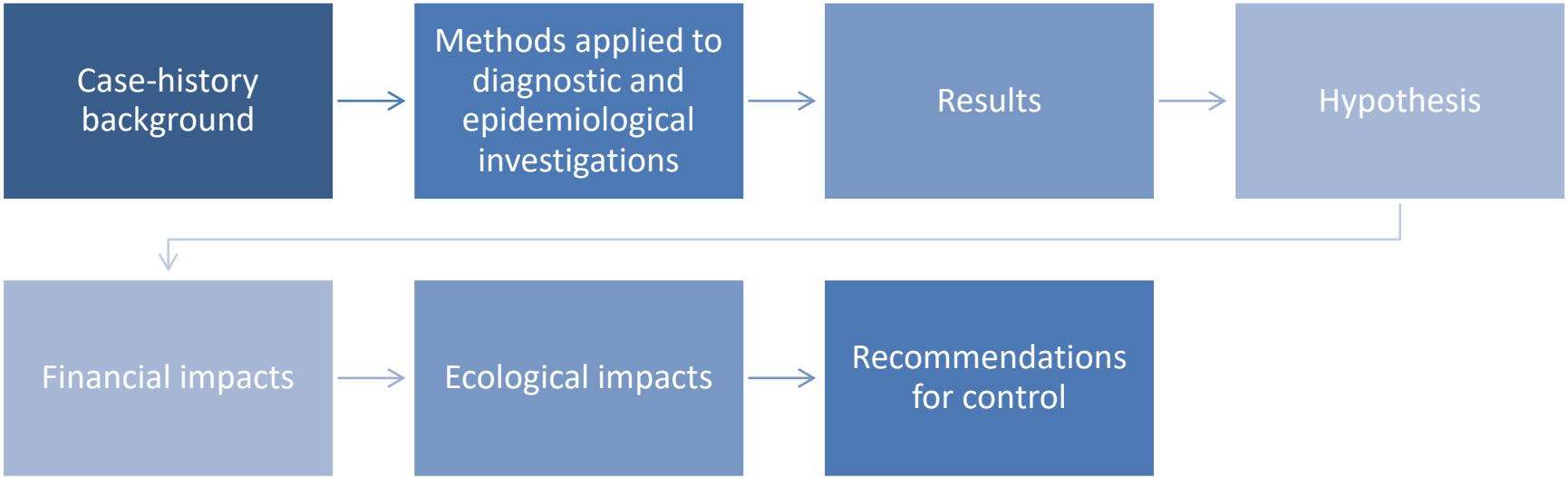
→ Science
- Peer-reviewed scientific literature

8. Report Findings to Stakeholders

WOAH Collaborating Centre for Epidemiology and Risk Assessment of Aquatic Animals (Europe)

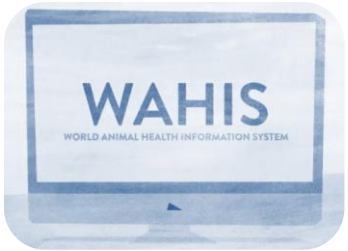
Reference Centre World Organisation for Animal Health Founded as OIE

What report?



8. Report Findings to Stakeholders

Who report to WOAH?



Authorized Access

Competent Authority

- WOAH Members
- No Members

- Animal Disease Notification
  - Aquatic Animals
  - Wildlife

Delegates / Focal points

8. Report Findings to Stakeholders

When report to WOAH?

24 HOURS OF ANY OF THE FOLLOWING EVENTS

- First occurrence of a listed disease in a country, a zone or a compartment;
- Recurrence of a listed disease in a country, a zone or a compartment following the final report that declared the outbreak ended;
- First occurrence of a new strain of a pathogenic agent of a listed disease in a country, a zone or a compartment;
- A sudden and unexpected change in the distribution or increase in incidence or virulence of, or morbidity or mortality caused by the pathogenic agent of a listed disease, present within a country, a zone or a compartment;
- Occurrence of a listed disease in a new host species;

8. Report Findings to Stakeholders

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WOAH Immediate Notification

Weekly reports subsequent to a notification

These reports should continue until the disease has been eradicated or the situation has become sufficiently stable.

For each event notified

To provide further information on the evolution of the event which justified the notification.

For the time necessary to have reasonable certainty that:

A final report should be submitted.

the disease has been eradicated; or

the situation has become stable;

8. Report Findings to Stakeholders

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Reference Centre World Organisation for Animal Health Founded as OIE

WOAH Immediate Notification

In addition of Notifying findings

Countries shall provide information on measures taken to prevent the spread

Quarantine measures	Restrictions applied to movement	Again vectors (if applied)

8. Report Findings to Stakeholders

Colombia Example

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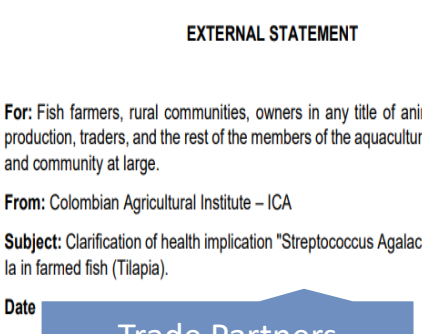
Reference Centre — World Organisation for Animal Health, Founded as OIE

NO WOAH LISTED DISEASE

Regionals Stakeholders meetings

Official Social Media

Official Webpage



EXTERNAL STATEMENT

For: Fish farmers, rural communities, owners in any title of ani production, traders, and the rest of the members of the aquacultur and community at large.

From: Colombian Agricultural Institute – ICA

Subject: Clarification of health implication "Streptococcus Agalac la in farmed fish (Tilapia).

Date

Trade Partners Communications

Challenges of Outbreak Investigation

Modified from Subasinghe et al., 2004

CHALLENGES OF OUTBREAK INVESTIGATION

- Data sharing
- Transparency
- Competing objectives
- Confidentiality
- Law (differs per country, province)
- Responsible interpretation
- Economics
- Trade position
- Integrity and quality of data

Faglig ambisiøs, fremtidsrettet og samspillende - for Én helse!

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