Disease outbreak investigation

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Urgent response to an increase in sick and dying fish

Objectives

- Minimize lag-time between identification of a disease outbreak and the investigation
- Collection of key data and information

Requires following a:

- Logical process
- Streamlined investigation
- Seamless reporting
- Consistent national approach in response – AVOID DELAYS

Where do we start?

- Reports of increase in sick and dying fish

- Field investigation → Laboratory investigation → Laboratory confirmation

Crowding induced injury opens up the innate immune system to invasion by bacterial pathogens. Tilapia being fed by mechanical means.

Let’s take a closer look at the fish and see what information we can get from this

Field investigation

Observe presenting clinical features.

Note husbandry practices. Are these likely to influence disease expression?

Look for damage to components of the non-specific immune system

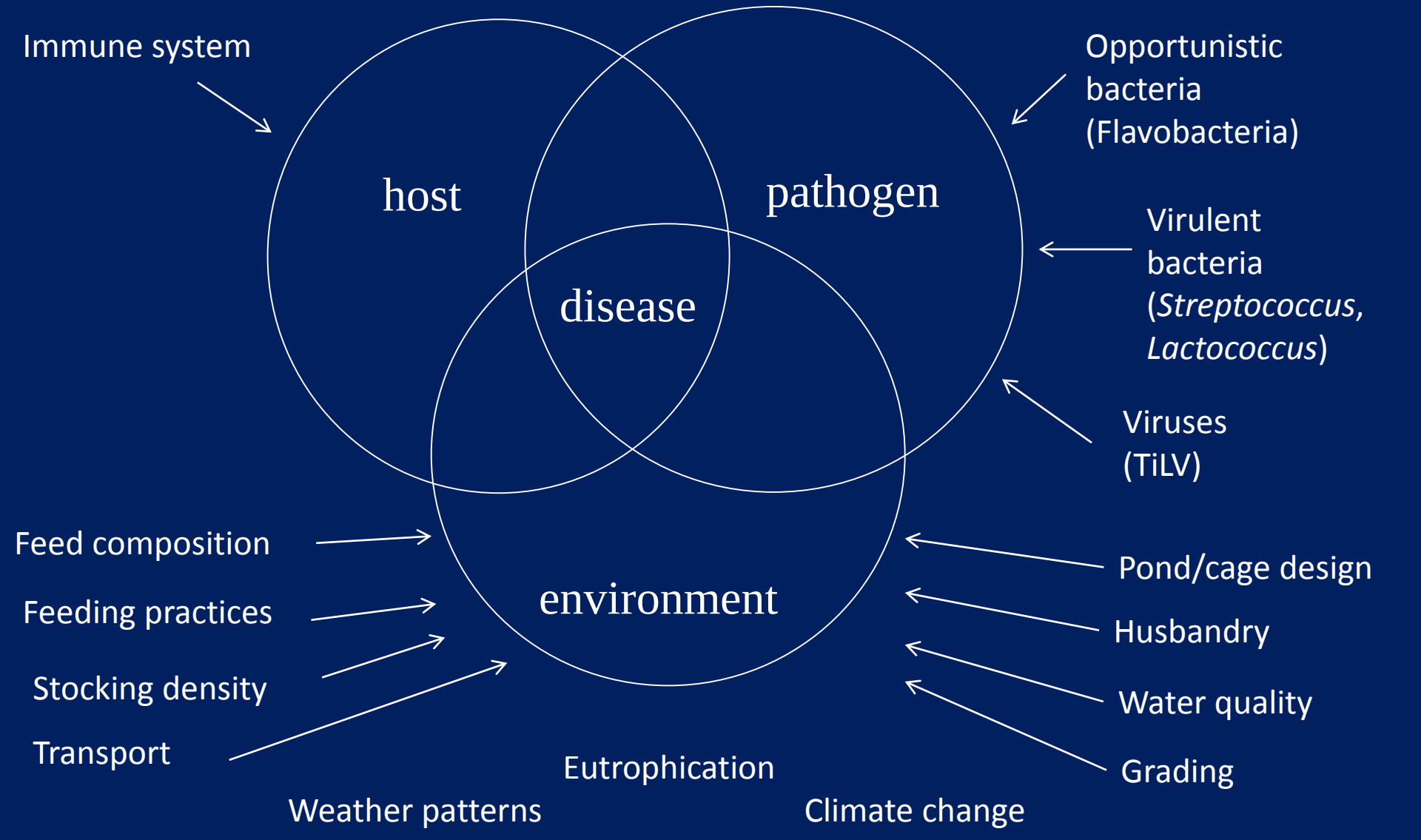
- Fish do not have eyelids and the cornea is vulnerable to physical trauma
- Once damaged by sharp pelvic fins during the feeding frenzy an entry point for bacterial infection into the eye is created
- Observe for overlap with disease-specific clinical features – e.g. eye lesions described with TiLV

Are these features a consequences of primary eye trauma or a clinical feature of a disease such as TiLV?

Differentiate disease outbreaks from common natural and anthropogenic causes of fish kills

- Oxygen depletion
- Nutrient enrichment
- Cyanobacterial blooms
- Ammonia toxicity
- Sediment disturbance – chemical oxygen demand
- Stratification and turnover of water bodies
- Gas supersaturation
- Metal pollution
- Persistent organic pollutants
- Pesticides
- Piscicides

Multifactorial aetiology of fish disease – what we need to consider



Suspicion of a disease outbreak

Information is received from a reporting party (e.g. fishermen, fish farmers, recreational fishermen, members of the public, media, researchers, etc.)

Site-based investigation – conducted by a responding investigator or team

Preliminary diagnosis

Collection of relevant data and samples for further laboratory analysis

Collection of more targeted data and samples

Laboratory testing of samples

Detailed investigation - incorporating laboratory analysis/tests and interpretation of results – consultation with relevant specialists

Preparation

Scientific and investigative

Requires:

- Scientific knowledge
- Supplies
- Equipment

Management and operational

Define team members
roles and responsibilities

May include:

- Aquatic veterinary specialist
- Veterinary laboratory specialist
- Ichthyologist
- Technologist
- Translator/interpreter
- Local contacts
- Various agencies - Fisheries
  - Veterinary
  - Environmental
  - Agricultural etc.

- FAO
- OIE

Scientific preparation

Consult with relevant disease specialists and applicable literature

Consider:

- Identifying the infectious agent
- Sources of infection
- Modes of transmission
- Risk factors for disease expression
- Species susceptibility
- Prevention strategies

Consult relevant laboratories

Consider:

- Availability of applicable tests
- Correct sampling and presentation of materials
- Proper collection, storage and transportation

Devise a plan of action

- Objectives of the investigation
- Order of activities
- Communication

Standardized approach for field investigation

Fish disease investigation kit for site-based investigation should include:

- Data collection form
- Dichotomous key to reach a preliminary diagnosis
- List of suitable techniques for the preservation, storage and transport of samples collected during the initial investigation.
- List of veterinary laboratories that may be contacted, including contact details.
- Dissecting and sampling instruments and suitable sampling and preservation chemicals and containers

Managemental and operational preparation

- Follow approval processes and define budgetary limits
- Establish a communications plan, prepare disease alerts and press releases
- Operational and logistical – field equipment, laptop, cell phone, camera etc.
- Arrange in advance where and when to meet with local officials and contacts
- Travel
- Lodging
- Local transportation

Establish existence of an outbreak

"The occurrence of more cases of disease than expected in a given area or among a population of fish over a particular period of time"

- Epidemic applies to situations involving large numbers of fish over a wide geographic area
- An outbreak applies to a localized increase in incidence of disease
- A cluster is an aggregation of disease cases in a given location over a particular period without regard to whether the number of cases is more than expected.

Subject to the type of reporting, a cluster of cases may/may not represent an outbreak

Other factors to consider:

- Severity of the disease
- Potential for spread
- Availability of control measures
- Political considerations
- Public relations
- Available resources
- Environmental

Verify the diagnosis

- Review clinical findings and laboratory results –

confirmation by a disease-specific reference laboratory

- Visit one or more outbreak sites

- Summarize clinical features using frequency distributions. Confirm that the clinical signs are consistent with the diagnosis.

Construct a working case definition

"A standard set of criteria for deciding whether an individual case should be classified as having the disease under investigation"

Simple objective measures:

- Clinical criteria
- Restrictions by time/season, place and individual/species

Case definition does not include exposure or risk factors

Categories of uncertainty:

- Confirmed cases – verified by laboratory examination
- Probable cases – typical clinical features without laboratory verification
- Possible or suspect cases – fewer of the typical clinical features

Case definition for TiLV

Suspicious case:
A tilapia farming system in which the farmer has observed, during the previous or ongoing production cycles, sudden mortalities and/or clinical signs such as skin redness/erosions and/or eye protrusion/cloudiness/rupture and/or abdominal swelling and/or scale protrusion/loss attributable to the presence of TiLV (e.g. farmer answers YES to question whether TiLV has occurred or not in the farm of interest).

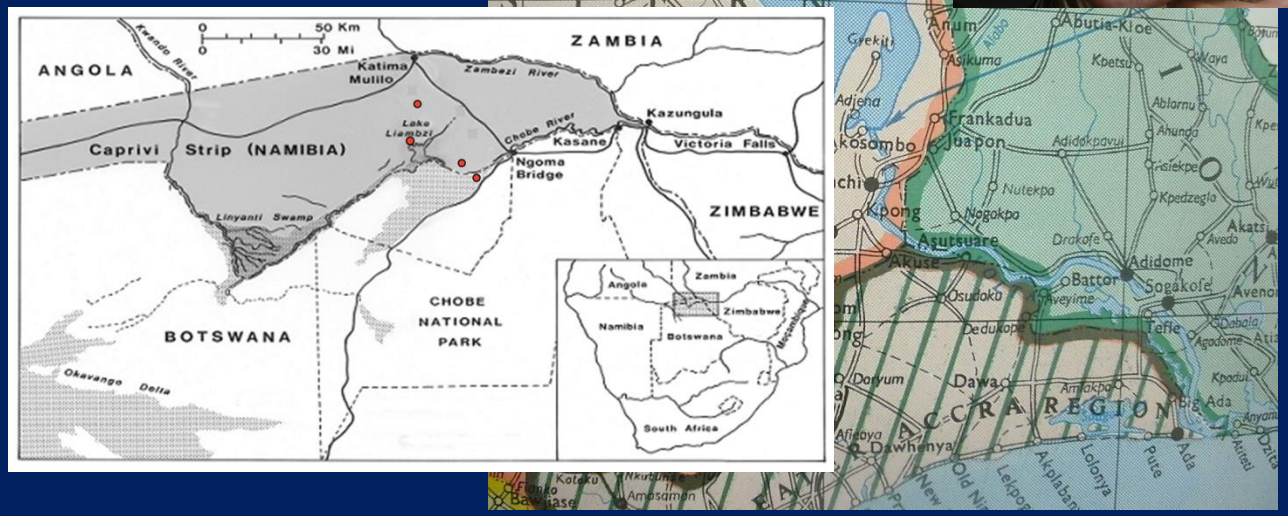
Confirmed case:
Upon collection of 30 moribund or sick fish samples, TiLV is confirmed by a positive test result using PCR AND the detection of histopathological signs of TiLV.

Initiate active surveillance

Systematic search for cases to establish the true geographic extent of the out break

Data collection:

- Identifying information – location etc.
- Population description
- Clinical features
- Risk factors
- Reporter information



Examples of basic data collection

- Characteristics of the affected water body/ farming system
- Preceding and current weather conditions
- Physical and chemical characteristics of the water body (temperature, pH, turbidity, odours, conductivity, dissolved oxygen, etc.)
- Characteristics of the fish disease outbreak – morbidity, mortality, duration, extent, location, species affected, size/age affected, behavioral changes, visible lesions, etc.
- Evidence of coincidental fish translocations (live fish imports, translocations of farmed fish from hatcheries, live-bait fish, ornamental fish, etc.)

- Fish sourced from local hatcheries
- Fry imported from hatcheries in other countries

Descriptive epidemiology

Characterize the outbreak by:

- Time – epidemic curve
  "distribution of cases over time"

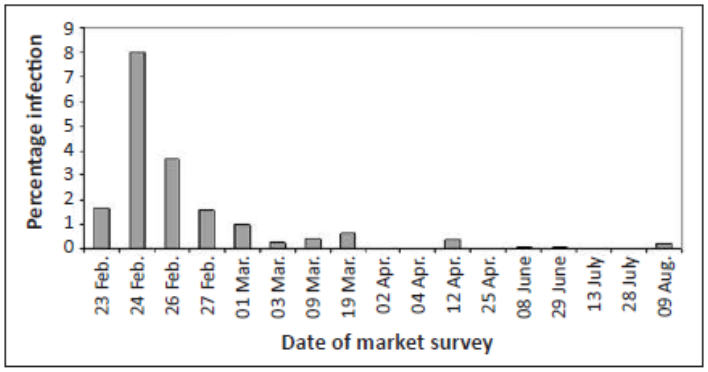
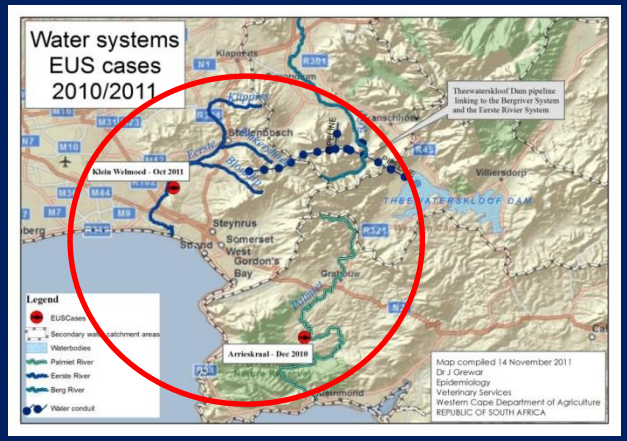
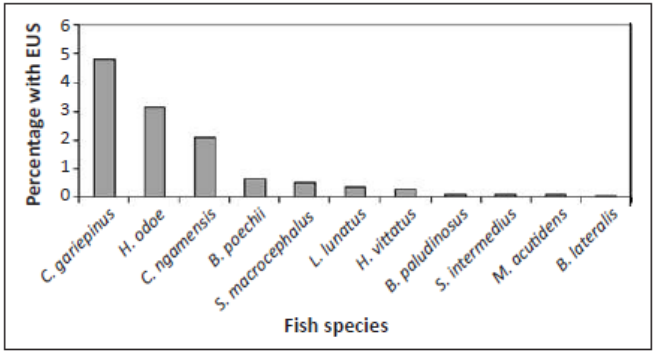


FIGURE 5: Prevalence of diseased fish recorded on the Katima Mulilo Open Market between February and August 2007.

- Place – geographic extent



- Species/population – species, age group, etc.



EUS, epizootic ulcerative syndrome.

FIGURE 2: Occurrence of epizootic ulcerative syndrome amongst fish species sampled during six surveys in Caprivi, from February 2007 to February 2008.

Develop hypotheses

- Developed from the outset of the investigation

Hypotheses may address::

- The source of infection
- Mode of transmission
- Likelihood of exposure

Hypotheses should be testable

Hypotheses are usually formulated considering what is known about a disease

- The usual reservoir of the infective agent
- How the agent is transmitted
- Transmission vehicles that may be implicated
- Known risk factors

Epidemiological evaluation of hypotheses

"Is the hypothesis plausible?"

When clinical, laboratory and environmental evidence is obvious

Compare the hypothesis with established facts

When circumstances are not straight forward and information is insufficiently compelling or convincing

Use analytical epidemiology to quantify relationships and assess the role of chance

Compare observed pattern in diseased fish with the expected pattern in non-diseased fish

Further steps

- Reconsider, refine and re-evaluate the hypothesis
- Compare and reconcile findings with laboratory and environmental studies
- Implement control and prevention measures
- Maintain surveillance – establish whether control measures are effective and determine when an outbreak is over
- Communicate findings

What can be done should tilapia lake virus (TiLV) be confirmed as cause of an outbreak?

Implement contingency plans?

- Depopulate farms? - hatcheries
  - ponds
  - cages
- Fallow and disinfect?
- Surveillance on biosecure hatcheries (borehole/well water fed RAS) to supply SPF fry and fingerlings?
- Restock with TiLV-free fish?

Business as usual?