Emerging diseases – why report? Case study TiLV

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Overcoming the attitude "*its just fish*"

How serious is the impact of disease on aquaculture and fisheries?

- Should we bother to report?
- How soon should we report?

- Disease outbreaks are estimated to cost the global aquaculture industry some US$6 billion per year and represent the major farm-level risk (FAO)

Over 90% of world aquaculture takes place in developing countries - most diseases go undiagnosed and remain poorly documented.

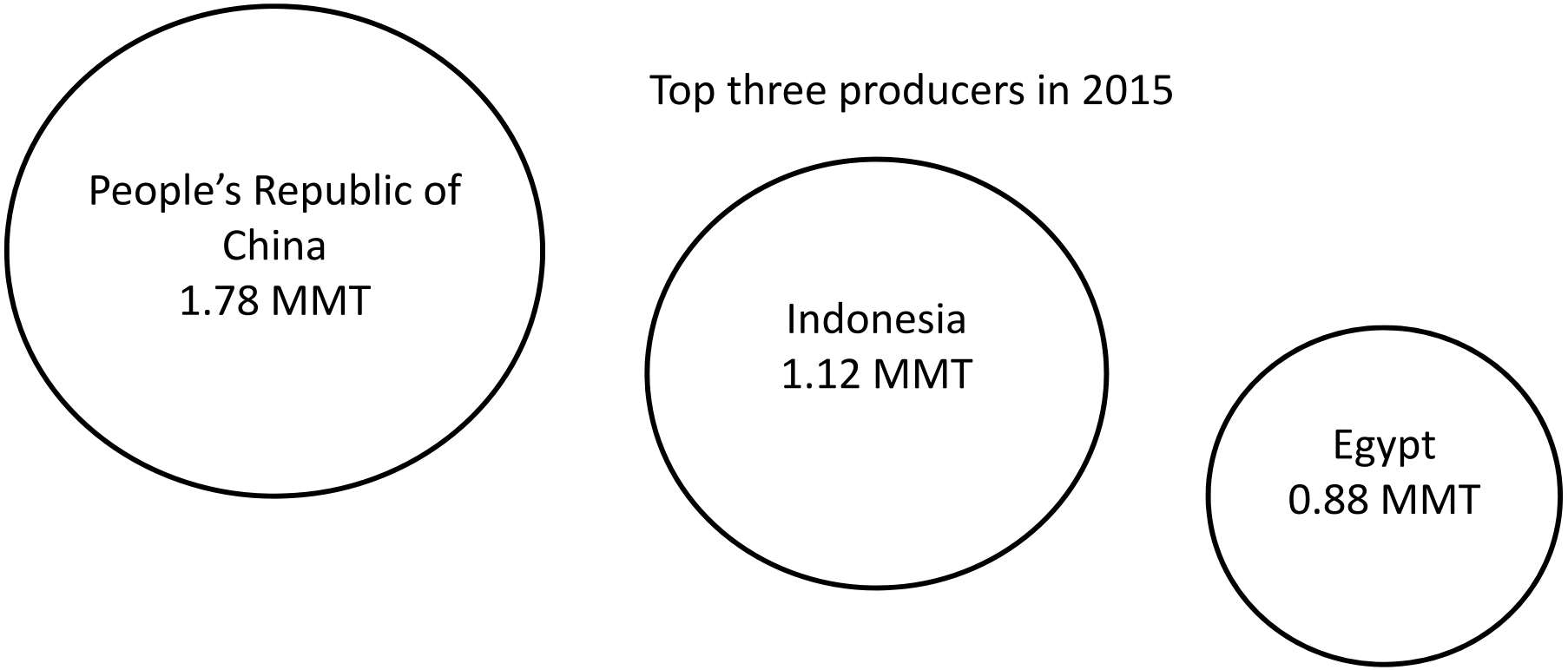
- US$100 billion of new investment estimated to meet the global food security and rural development objectives set out for aquaculture (The Global Aquaculture Alliance in Brummett et al 2014).

Brummett et al. 2014 World Bank Group. http://documents.worldbank.org/curated/en/110681468054563438/Reducing-disease-risk-in-aquaculture

Tilapia

Global production is estimated at 6.4 million metric tons (FAO 2017a)

Top three producers in 2015



Bangladesh, Vietnam and the Philippines are other leading producers

Subsaharan Africa – Ghana, Zambia and Zimbabwe

FAO 2017a

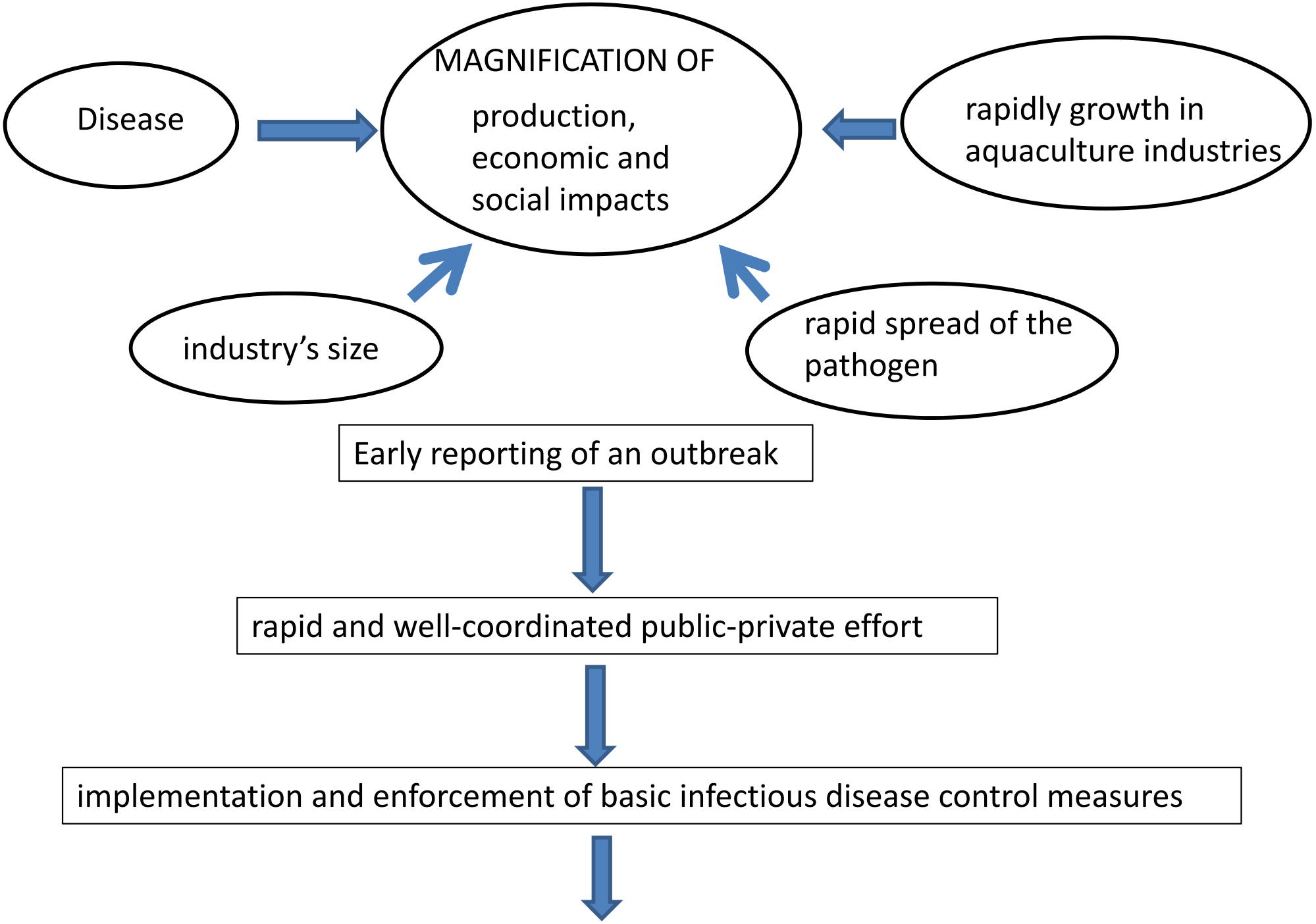
World Bank - Case study examples of economic and social impact of and lessons learned from recent major disease outbreaks in aquaculture

AGRICULTURE AND ENVIRONMENTAL SERVICES DISCUSSION PAPER 09

REDUCING DISEASE RISK IN AQUACULTURE

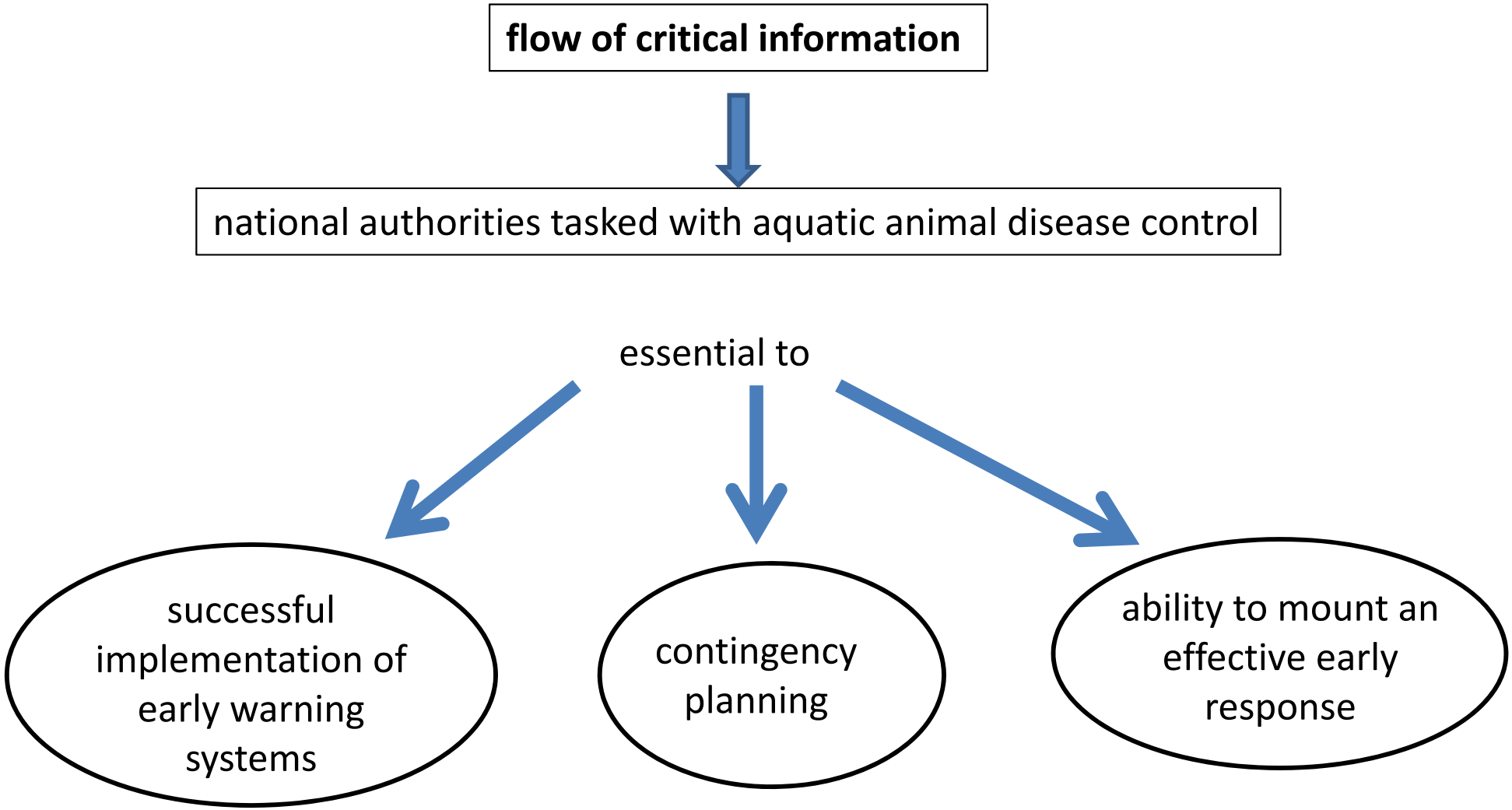
WORLD BANK REPORT NUMBER 88257-GLB

Brummett et al. 2014 World Bank Group. http://documents.worldbank.org/curated/en/110681468054563438/Reducing-disease-risk-in-aquaculture



(Brummett et al 2014).

Outcome of an emergency disease situation



Impact of recent major disease outbreaks in aquaculture

Case study : Infectious salmon anaemia (ISA)

2007 - outbreak in the Chilean salmon farming industry

estimated cost - US$2 billion dollars and 20,000 jobs lost

Brummett et al. 2014 World Bank Group.
http://documents.worldbank.org/curated/en/110681468054563438/Reducing-disease-risk-in-aquaculture

Impact of recent major disease outbreaks in aquaculture

Case study: Early mortality syndrome EMS (acute hepatopancreas necrosis syndrome, AHPNS)

Since 2009, outbreak in the Mekong Delta

- estimated cost to small-scale producers **US$800 million** per year (does not include the unknown number of jobs lost in the rest of the shrimp value chain)

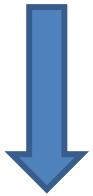
- consequential impacts on employment, social welfare, and international market presence caused by EMS/AHPNS is estimated in the **billions of US dollars**

Brummett et al. 2014 World Bank Group.
http://documents.worldbank.org/curated/en/110681468054563438/Reducing-disease-risk-in-aquaculture

Impact of recent major disease outbreaks in aquaculture

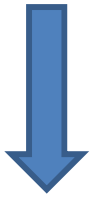
Case study: White spot syndrome virus (WSSV)

1992-93, outbreaks in Asia



estimated loss of US$6 billion

1999 outbreaks in Latin America



estimated loss of US$1–2 billion

In September 2011, WSSV outbreak was first reported from a shrimp farm in Quelimane, Mozambique and eight months later the first outbreaks of WSSV were reported from Madagascar.

Brummett et al. 2014 World Bank Group.
http://documents.worldbank.org/curated/en/110681468054563438/Reducing-disease-risk-in-aquaculture

In other countries similar enormous financial losses and socio-economic disruptions have been caused by the emergence and spread of:

- the viral diseases of shrimp: yellow head disease and Taura syndrome; and
- the parasitic disease Bonamia ostreae and the ostreid herpes virus in bivalves (Oidtmann et al., 2011).

Exotic disease incursions may also pose serious risk to natural fish stocks as illustrated by epidemics of Pilchard herpesvirus that decimated wild Australian pilchard stocks following introduction of the disease into these waters in the late 1990's.

Tilapia

The most important aquaculture species of the 21st century.

- Has emerged to become one of the most productive and internationally traded food fish in the world
- Farmed in more than 85 countries worldwide
- Second most important farmed fish globally, after carp
- Native to Africa and Middle East

1924 First scientific culture of tilapia recorded from Kenya spread throughout Africa.
Late 1940s introduced as farmed species in the Far East
1950s onwards established in the Americas.

- 98% of tilapia are produced in countries outside of their natural habitat

A review of global tilapia farming practices Modadugu V. Gupta and Belen O. Acosta 2004 WorldFish Center

Oreochromis species

- Within their native range, tilapia have been an important component of subsistence fisheries
- Prominence as a farming species and as food status has been largely as an exotic species outside of their natural distribution range.
- There are bout 70 species of tilapias, most of them native to Western rivers of Africa (Anon 1984). Of these, nine species are used in aquaculture worldwide
- Production is concentrated mainly on Nile tilapia (*O. niloticus*), Mozambique tilapia (*O. mossambicus*) and Blue tilapia (*O. aureus*).
- *O. niloticus* has for many decades been responsible for the significant increase in global tilapia production from freshwater aquaculture and has accounted for about 83% of total tilapias produced world wide
- *O. niloticus* has taken the lead as the principal species for culture in many parts of the world.

A review of global tilapia farming practices Modadugu V. Gupta and Belen O. Acosta 2004 WorldFish Center

Tilapia lake virus (TiLV)

- Segmented RNA virus resembling an Orthomyxovirus
- Recent emergence linked to serious disease outbreaks in tilapia
- First reported from Colombia,Ecuador, Egypt, Israel and Thailand
- Currently reported from three continents Asia, Africa and South America
- The geographic distribution of TiLV may be wider than currently reported

Israel and Taiwan Province of China have made a notification of TiLV as an emerging disease to the World Organisation for Animal Health (OIE).

- Disease associated with infection by TiLV may threaten the worldwide tilapia production and potentially result in socio economic losses and impacts on food security

Jansen MD and Mohan CV. 2017.

Disease caused by infection with TiLV

Currently known by two names

- tilapia lake virus disease (TiLVD) as in the OIE technical disease card (OIE 2017) and
- syncytial hepatitis of tilapia (SHT) as first referred to by Ferguson et al. (2014)
  - The origin of the virus is not known
  - Massive mortalities amongst tilapia in Israel since 2009 have been linked to infection with TiLV
  - The only known reservoirs of infection are Infected populations of both farmed and wild fish.
  - It is not known if the TiLV infection is life-stage specific but disease occurs mainly in fingerling and juvenile stages of tilapia
  - Mortality can be up to 90% of the fish population

There is urgent need for further knowledge regarding TiLV and its implications

Recent work in Thailand reports the detection of TiLV in clinically healthy tilapia of various ages that showed no symptoms of being infected.

- inapparent infection and a wide range of mortality rates might theoretically suggest the existence of a genetic variability of TiLV as also described in another fish orthomyxovirus called infectious salmon anemia virus (ISAV)

Knowledge gaps

- susceptibility of fish strains,
- culture methods
- co-infections
- risk factors for TiLVD manifestation
- potential carrier status

Investigation of inapparent infection should be included in TiLV surveillance programs and

Comparative genomic analysis of TiLV strains associated with clinical and subclinical infections might shed light on pathogenic diversity of the virus.

Senapin et al 2018

Species susceptibility

- To date only fish of the family Cichlidae (tilapines) comprising of more than 100 species have been shown to be susceptible.

- Mortalities attributed to TiLV have been observed in

  - wild tilapia *Sarotherodon (Tilapia) galil*aeus
  - farmed tilapia *Oreochromis niloticus*
  - commercial hybrid tilapia (*O. niloticus* X *O. aureus*)

  (Bacharach et al., 2016; Ferguson et al., 2014; Eyngor et al., 2014)

  - It is possible that other species will be found to be susceptible.
  - certain genetic strains of tilapia may show some resistance.

Disease reporting

The OIE Aquatic Code obliges member countries to submit notifications to the OIE within 24 hours of confirmation of any of the following events:

- a first occurrence or recurrence of any OIE-listed disease in a country or zone of the country if the zone or country was previously believed be free of that particular disease,
- an OIE-listed disease that has occurred in a new host species,
- an OIE-listed disease that has occurred with a new pathogen strain or in a new disease manifestation,
- there is potential for international spread of an OIE-listed disease,
- an OIE-listed disease has a newly recognized zoonotic potential, or
- **if in the case of an emerging disease or pathogenic agent not listed by the OIE there should be findings that are of epidemiological significance to other countries.**

Why report

Case studies of major disease outbreaks highlight the importance of collective action among and between farmers, government regulators and researchers, and the open sharing of information in identifying the causes and, thus the possible remedies, of aquatic animal diseases (Brummett et al 2014).

OIE plays the pivotal role in this

Central to disease reporting is a list of diseases notifiable to the OIE

Surveillance data required for reporting may be sourced through passive and/or targeted surveillance

And is complemented by:

- Documented field observations
- Research data
- Scientific publications
- Other sources of information

Brummett *et al.* (2014) identified five conditions that lead to major disease outbreaks amongst fish in the aquaculture industry

1. close proximity among farming operations and/or shared water supply and discharge

2. unregulated transfer of animals and/or gametes among farms and from sites outside of the farming area

3. lack of adherence to on-farm sanitary protocols

4. inadequate diagnostic and veterinary services.

5. a failure of farmers to share information and cooperate in collective action

What impact can we expect TiLV to have on the African continent?

- Impact on farmed fish is likely to be similar to that experienced in other continents where disease and mortality due to TiLV has been documented.

- Potential impact on wild fish and species diversity.

  - In many African countries, large inland populations of humans rely on floodplain fisheries to meet their nutritional needs. The richness of these fisheries depends on the large diversity of species that make up the floodplain ecosystem. In Africa and elsewhere, both EUS and TiLV pose an as yet unquantified risk to this species diversity.