



New technology to detect viral diseases affecting the aquaculture industry

Essa Suleman (RGL)

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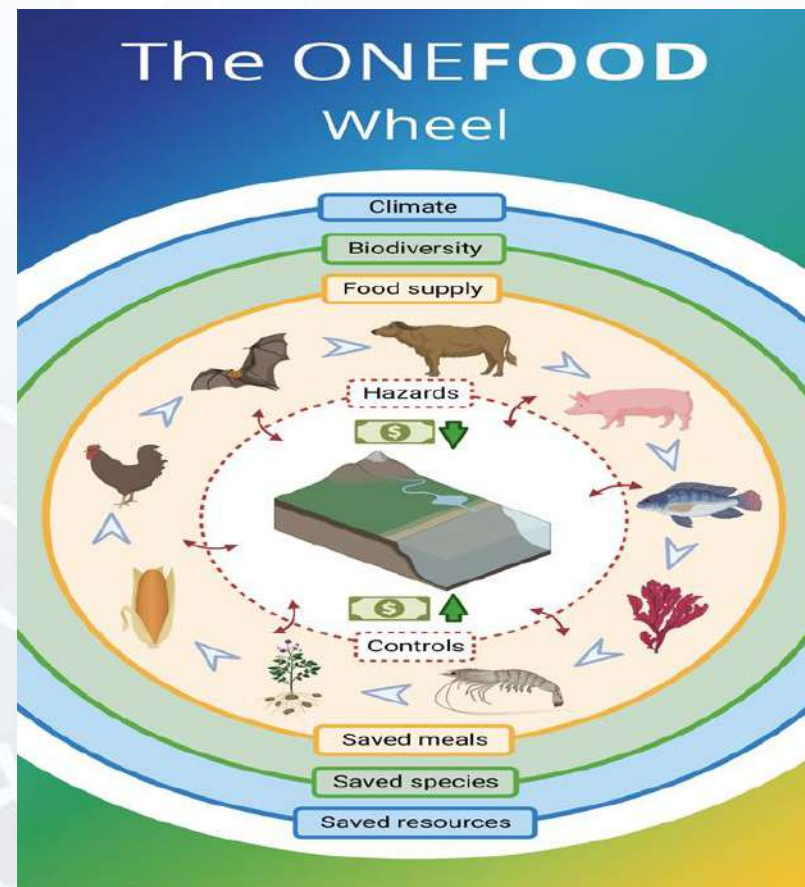
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One Health and One Food



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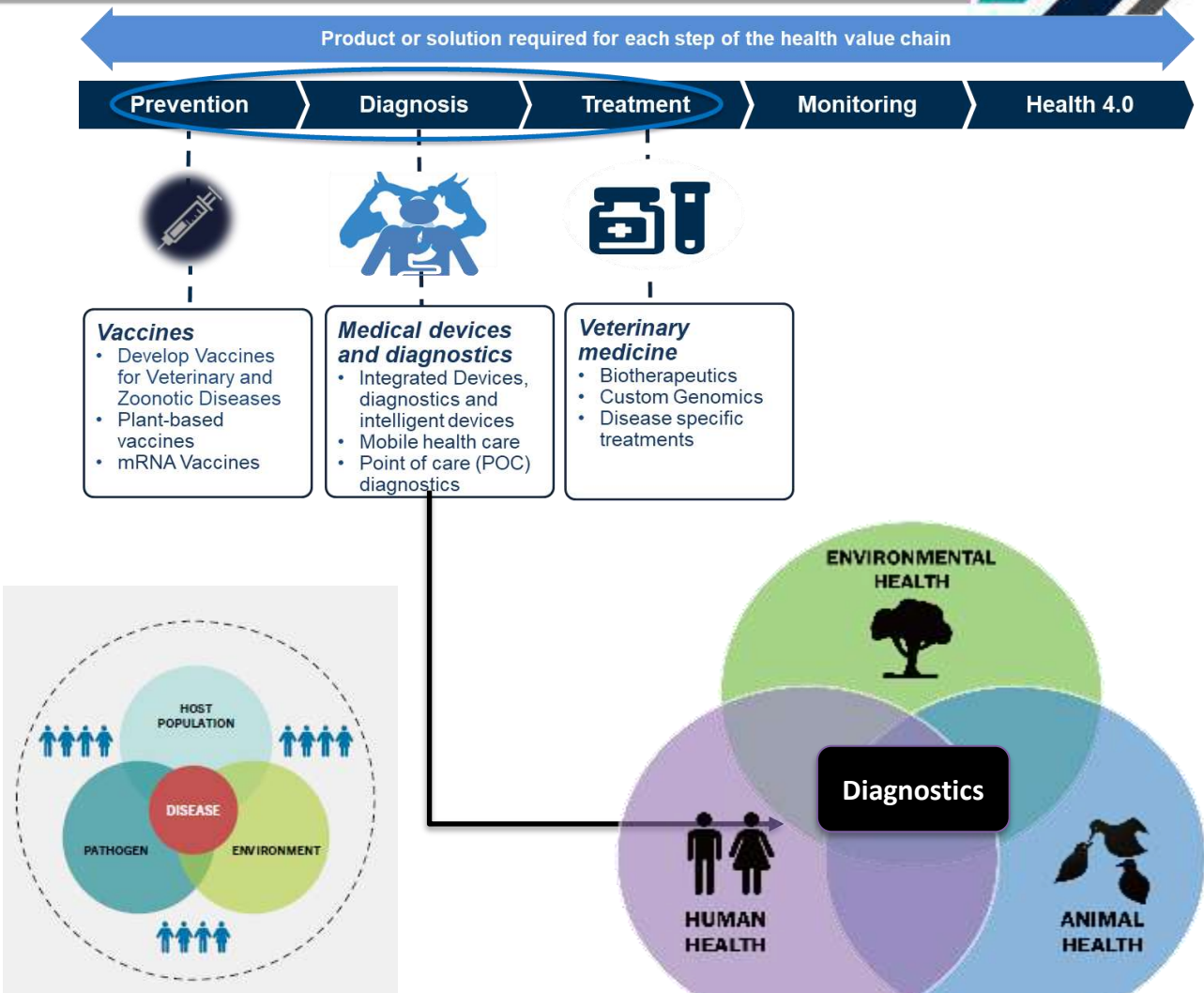


Cefas

Next Generation “One Health” Approach

- ❑ **Aim:** To integrate One Health approach to address societal health challenges and reduce the burden of disease.
- ❑ **Focus:** To develop local technologies in Diagnostics and Vaccines targeting Human, Animal and Zoonotic diseases relevant to South Africa and continent.
- ❑ **Impacts:**
 - ❑ Improved human and animal health via better food production systems and reduced burden of disease.
 - ❑ Grow the aquaculture sector (**Blue economy**) – socio-economic impacts
 - ❑ **Improved biosafety and biosecurity**

Strategy	Key Focus
National Development Plan- Goal 8	Promoting health- a long and healthy life for all
Bioeconomy Strategy	Support and strengthen the country’s local research, development and innovation capabilities
National Health Strategic Plan	Health innovations for communicable diseases (HIV, TB, sepsis) and non-communicable diseases (cancer diabetes, cardiovascular diseases) and Digital health
DSI Decadal Plan	Health technologies to prevent and treat ill-health and advance well-being for those who are marginalized
Sustainable Development Goals	Good health and well-being
Africa Agenda 2063	Healthy and well-nourished citizens
National Digital Health Strategy	Digitization of health technologies
Aquatic animal health and welfare management Plan	Improve technical and diagnostic capabilities
Veterinary Strategy	Improve diagnostics and vaccines capabilities
Biosecurity hub	Molecular diagnostics technologies to Improve food safety and security



Blue economy



Blue Economy

Increased **fish stocks**
and improved **fisheries**

Better jobs for people
living along the coast

Coastal communities **more resilient**
to climate change

Cleaner and more
attractive coasts and
oceans

New ocean sectors
(e.g. Offshore wind energy)

Oceans are a primary
source of income



3-5%
OF GLOBAL GDP



Ocean-based jobs are
expected to increase

120% between
2010 AND 2030

Fisheries & Aquaculture
assure livelihoods of



10-12%
OF WORLD POPULATION

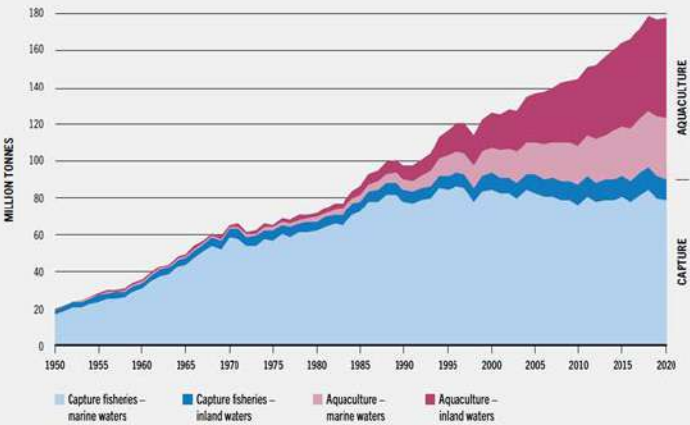
90% OF EXCESS HEAT HAS
been stored in the ocean



State of world fisheries and aquaculture – FAO report 2022

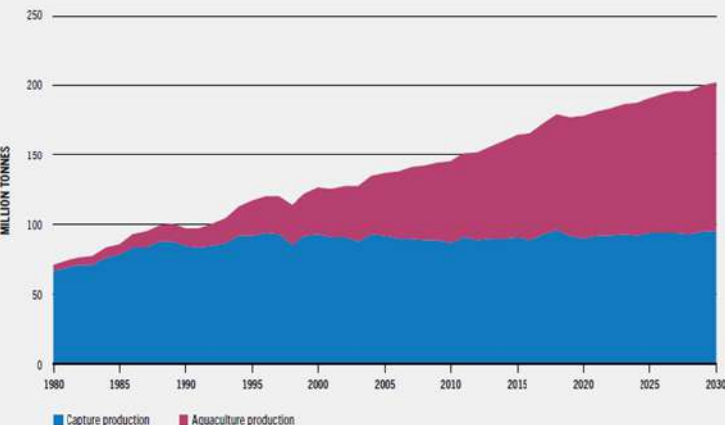


FIGURE 1 WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



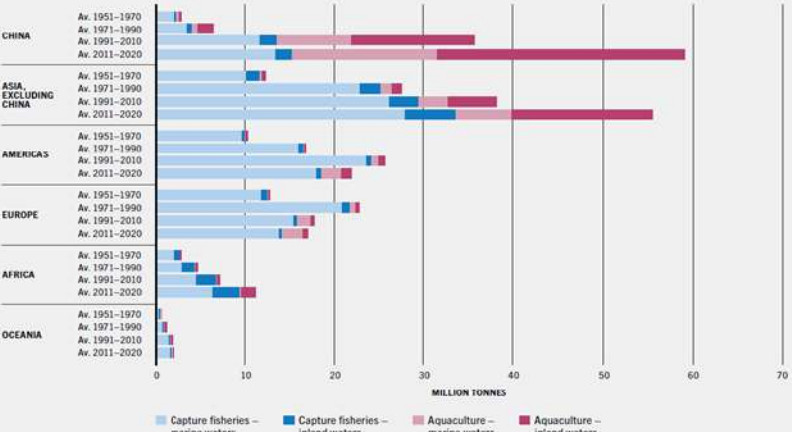
NOTES: Excluding aquatic mammals, crocodiles, alligators, caimans and algae. Data expressed in live weight equivalent.
SOURCE: FAO.

FIGURE 70 WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION, 1980–2030



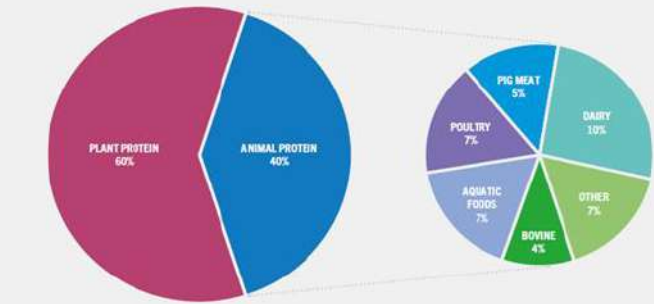
NOTES: Excluding aquatic mammals, crocodiles, alligators, caimans and algae. Data expressed in live weight equivalent.
SOURCE: FAO.

FIGURE 5 REGIONAL CONTRIBUTION TO WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



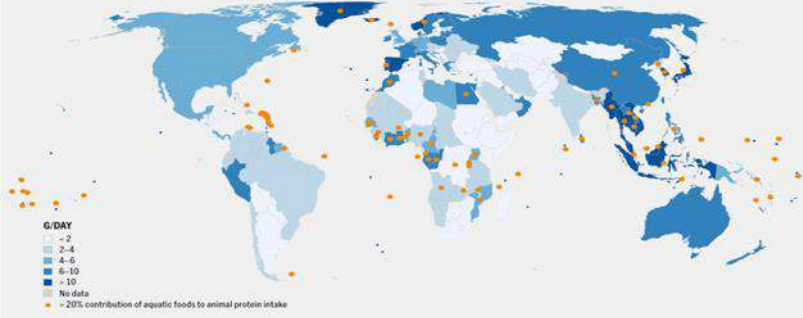
NOTES: Excluding aquatic mammals, crocodiles, alligators and caimans and algae. Data expressed in live weight equivalent.
SOURCE: FAO.

FIGURE 42 CONTRIBUTION OF PLANT AND ANIMAL PROTEINS TO GLOBAL AVERAGE DAILY PROTEIN INTAKE, 2019



SOURCE: FAO.

FIGURE 48 CONTRIBUTION OF AQUATIC FOODS TO ANIMAL PROTEIN SUPPLY PER CAPITA, AVERAGE 2017–2019



The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).
SOURCE: FAO.

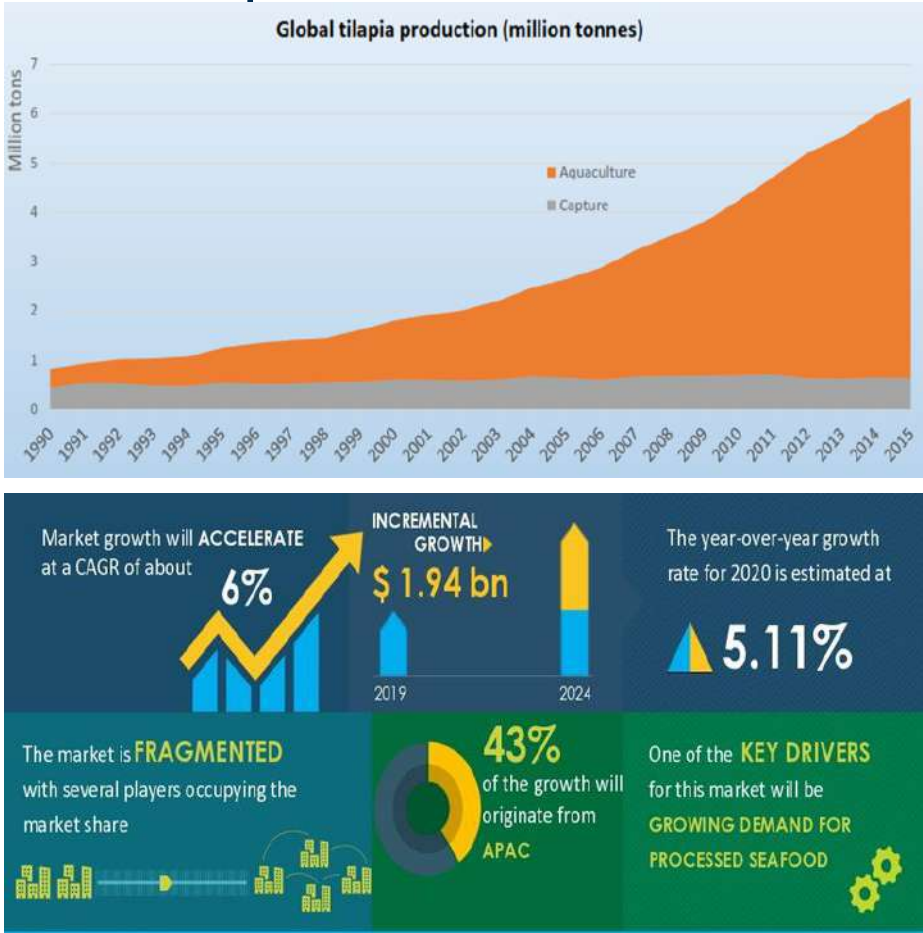
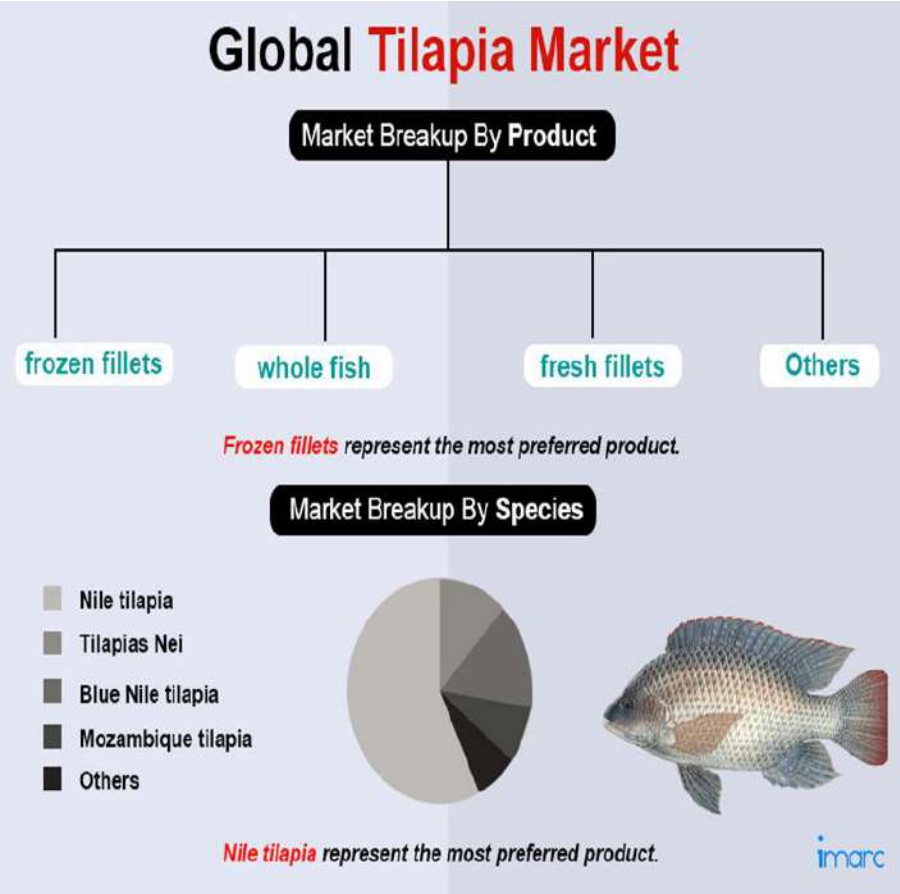
FIGURE 53 TRADE FLOWS OF AQUATIC PRODUCTS BY REGION (SHARE OF TOTAL IMPORTS, IN VALUE), 2020



Aquaculture – Tilapia Industry



Current estimates of the global value of Tilapia aquaculture production range between **\$7.9 billion** to **\$12.8 billion** per annum.



Aquaculture Diseases – TiLV and ISKNV



- **Aquaculture Diseases**

- Freshwater production hampered by need for rapid diagnostics
- No testing possible for certain pathogens in Africa at all
- **Tilapia Lake Virus (TiLV) - >85% Mortality**
- **Infectious Spleen and Kidney Necrosis Virus (ISKNV) - 50-80% mortality**

- **Impacts of TiLV and ISKNV**

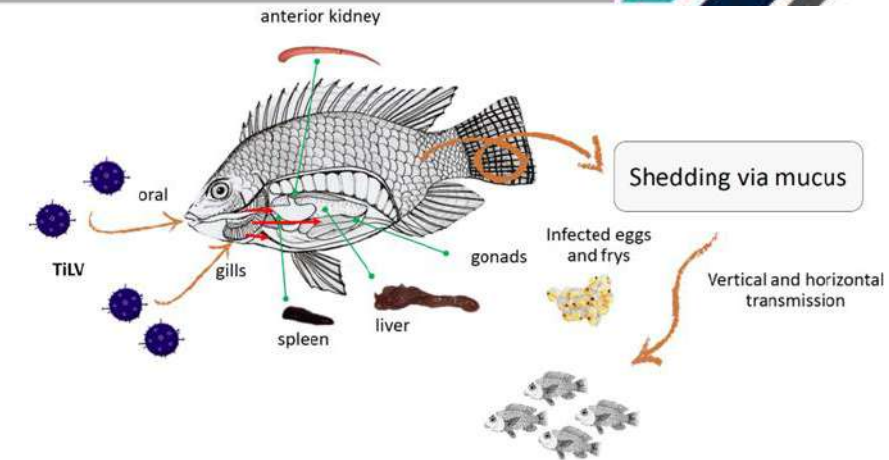
- **Economic losses of ~\$100 million (Egypt) = production losses of 98 000 metric tons.**
- in sub-Saharan Africa (SSA) TiLV outbreaks may affect **~6 Million jobs directly and 18 million livelihoods indirectly.**
- In SSA countries, **>400 million lives** may be affected by food insecurity with losses of **~US\$ 3billion** per year due to TiLV.

- **Challenge**

- *No commercially available molecular diagnostic assays for TiLV and ISKNV*

- **Solution**

- *CSIR diagnostics for TiLV and ISKNV*



TiLV and ISKNV Molecular Diagnostic Assay Development

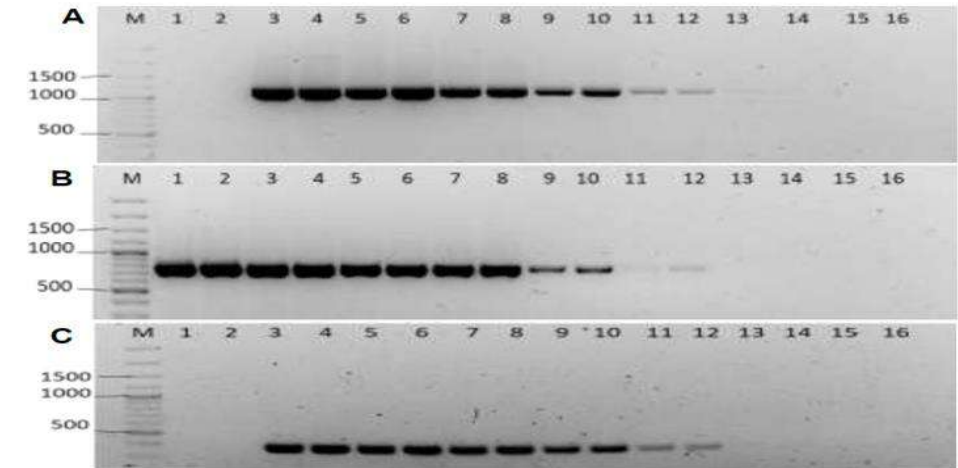
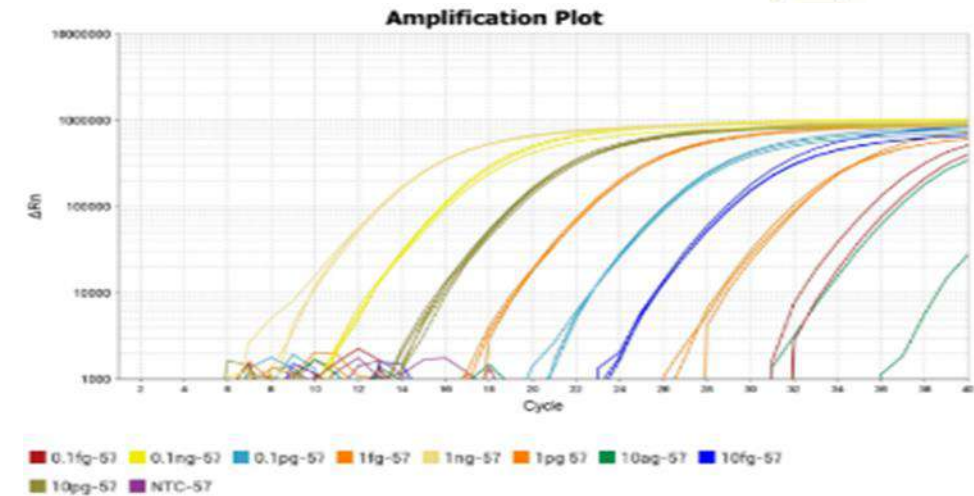


- **Tilapia Lake Virus (TiLV)**

- 1 x SYBR Green Real-Time PCR assay developed
- 1 x Taqman Real-Time PCR assay developed
- RT-PCR assays target unique region of TiLV genome
- Analytical sensitivity for both assays range from 1 to 10 copies per reaction
- **TRL6**

- **Infectious Spleen and Kidney Necrosis Virus (ISKNV)**

- 3 x conventional PCR assays developed
- 1 x nested PCR assay developed
- Conventional assays have a detection limit of 10 copies of ISKNV
- Nested PCR assay 100-1000 fold more sensitive than conventional PCR
- **TRL6**



CSIR Aquaculture Molecular Diagnostics Program

• Phase I (2020-2023)

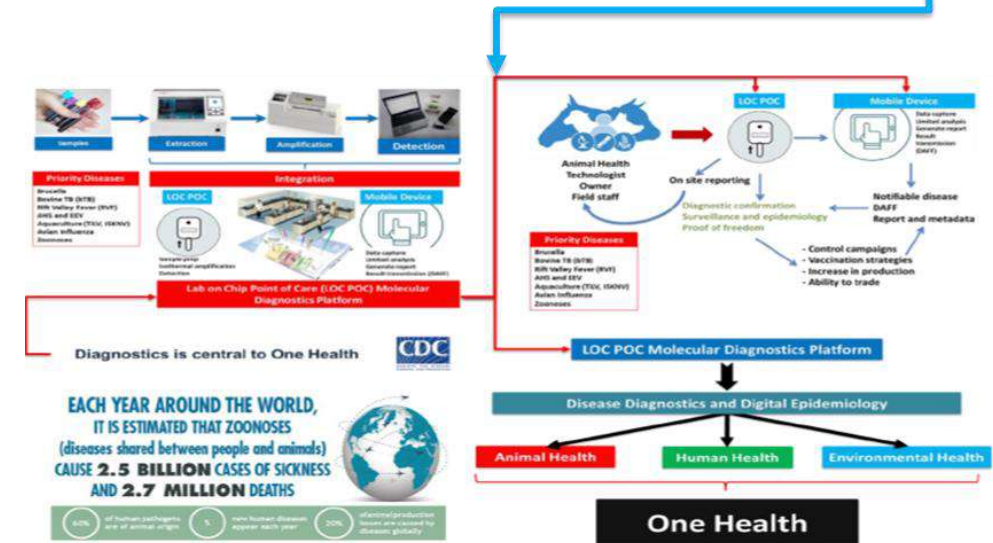
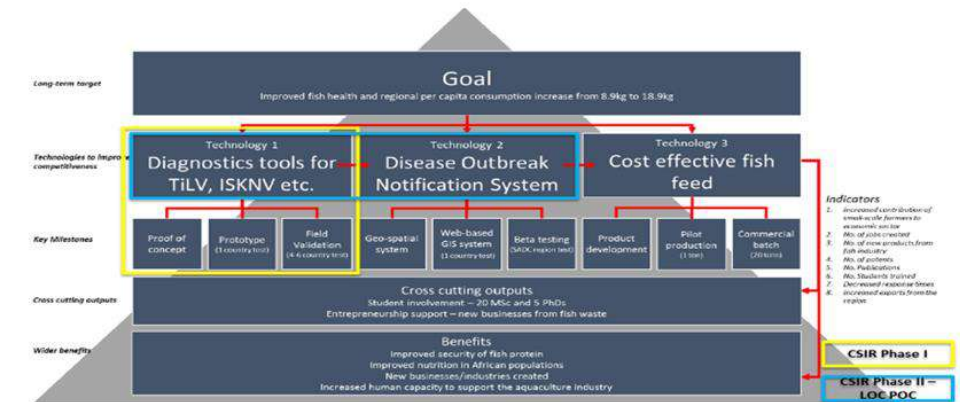
- Develop **conventional molecular diagnostic assays** (PCR and qPCR) for TiLV and ISKNV (**COMPLETE**)
- Develop prototype diagnostic kits for TiLV and ISKNV (**COMPLETE**)
- Field testing of prototype diagnostic kits (**COMPLETE – Ghana 2022**)
- Capacity building and training (**Ongoing**)
- **Expanded field trials (Egypt, Brazil, India, Ghana, Malawi)**
- Licensing and Commercialisation of conventional molecular diagnostic kits (**2023**)

• Phase II (2022-2025)

- Develop **isothermal molecular diagnostic assays** (LAMP and/or RPA) for LOC POC Mol Dx platform
- Develop prototype LOC POC Aquaculture Mol Dx cartridges
- Enable pond-side preliminary diagnostics of ISKNV & TiLV (lab confirmation still necessary)
- Field testing of prototype (2023/24)
- Commercialisation of LOC POC diagnostics platform (2025/26)

• Phase III (2023 onward)

- Establish WOA reference laboratory for Aquaculture Disease Diagnostics for Africa at CSIR – **freedom from disease will enable broader market access**



Summary



- Blue economy and aquaculture industry are important avenues for growth, revenue and other socio-economic impacts
- Aquaculture industry is growing but infectious diseases are a major challenge
- Freedom from disease, biosafety and biosecurity are important factors for growth of local aquaculture industry
- CSIR has developed novel diagnostics technologies for 2 important viruses (TiLV and ISKNV) which pose significant socio-economic threats to Tilapia aquaculture
- Availability of these technologies will enable:
 - Better disease diagnostics and surveillance
 - Reduced burden of disease
 - Improved access to lucrative export markets by demonstration of freedom of disease
 - Improve biosafety and biosecurity – SA now has tools to monitor aquaculture industry and screen for TiLV & ISKNV from imported products (e.g. fry, fish stocks etc.)



THANK YOU