United States Department of Agriculture

Animal and Plant Health Inspection Service

Veterinary Services

Strategy and Policy

Center for Epidemiology and Animal Health

November 2020

Assessment of the Risk of Introduction of Tilapia Lake Virus (TiLV) by Live Tilapia Imported to Terminal Markets

Key Results

The Center for Epidemiology and Animal Health (CEAH) previously assessed the risk posed to relevant industries by the introduction of tilapia lake virus (TiLV) via tilapia frozen fillets and live fingerlings. This work was completed in November 2019, and the results are available in the document entitled *Rapid Risk Assessment for Tilapia Lake Virus (TiLV)*.

This current assessment supplements previous work by evaluating the additional entry pathway of live tilapia imported from Canada to terminal live markets in the United States for human consumption.

The likelihood TiLV will enter the United States via market-sized tilapia imported from Canada destined for terminal live markets is estimated to be *low* with a *moderate* degree of uncertainty.

The likelihood that live market-sized tilapia carrying TiLV imported from Canada for sale in terminal live markets will cause infection in farm-raised tilapia is *negligible*, with a *moderate* degree of uncertainty.

The overall risk that live tilapia imported from Canada and destined for sale in terminal markets will present an exposure pathway for U.S. tilapia aquaculture is estimated to be *negligible*.

As described in previous assessments, the consequences of TiLV if introduced to U.S. industries could be high, depending upon the magnitude of spread before detection and the time needed to respond to the outbreak. Estimated trade losses may be as high as $15,974,671.

Background

In November 2019, CEAH completed a rapid risk assessment of the potential risk of introduction of TiLV to U.S. aquaculture industries resulting from importation of frozen tilapia fillets and live fingerlings. Based on the estimated high risk of entry associated with imported live fingerlings, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service issued Federal Order DA-2019-01 in November 2019 to mitigate the entry risk. This assessment is supplementary to this previous work and estimates the likelihood of entry and subsequent exposure to relevant U.S. aquaculture industries of TiLV associated with importation of live tilapia to terminal live markets for sale and human consumption.

TiLV disease was identified in Israel in 2014. Subsequently, the disease has been reported globally. In 2019, a TiLV outbreak occurred in the United States, involving three tilapia aquaculture facilities in Idaho, Wyoming, and Colorado. There have been no further reports of the disease in the United States following appropriate disease response measures and issuance of Federal Order DA-2019-01.

Because previous assessments already included information describing global TiLV distribution, hazard identification, and a consequence assessment, as well as an assessment of trade, this report is solely focused on the assessment of risk and uncertainty associated with import of live tilapia to terminal live markets. For additional information on the distribution, pathogen characteristics, potential

consequences of TiLV in the United States, and U.S. trade in live tilapia and eggs/milt, please see the reports entitled *Rapid Risk Assessment for Tilapia Lake Virus (TiLV)* and (*Analysis of U.S. Imports/Exports of Live Tilapia and Eggs/Milt)*.

Entry Assessment

The likelihood TiLV will enter the United States via market-sized tilapia imported from Canada destined for terminal live markets is estimated to be *low* with a *moderate* degree of uncertainty. Currently, Canada is the only country exporting live food-sized tilapia to live terminal markets in the United States. This likelihood assessment is based on:

- In some cases, U.S. producers exported the fish in this entry pathway from the United States to Canada as fingerlings for grow-out and imported the fish back to the United States when they reached appropriate size. Fish exported from the United States as fingerlings and re-imported for marketing are unlikely to have TiLV because tilapia reared in the United States are unlikely to be infected with TiLV. The United States is designated free of TiLV, and the import of tilapia fish, fingerlings, eggs, or gametes is regulated by Federal Order DA-2019-01.

- Canada does not require TiLV disease freedom certification of tilapia prior to import; it is plausible that U.S. fish imported for grow-out may be comingled with tilapia sourced from other countries and be infected with TiLV, increasing the risk of TiLV entry via import of live market-sized tilapia from Canada.

Exposure Assessment

The likelihood that live market-sized tilapia carrying TiLV imported from Canada for sale in terminal live markets will cause infection in farm-raised tilapia is *negligible*, with a *moderate* degree of uncertainty. The likelihood assessment is based on:

- Fish are driven across the U.S.-Canada border in trucks and delivered directly to the live terminal markets so exposure to U.S. aquaculture is not likely.
- The imported fish are sex-reversed males and have no value as broodstock, so will not be diverted from terminal live markets to aquaculture pathways.
- It is plausible that some fish may be bought for pets or placement in ornamental ponds, but it is unknown if these would expose aquaculture.
- Most live markets are in urban centers (i.e., cities) and are not near tilapia aquaculture locations, so it is unlikely that water used to transport fish or fish not sold in live markets will reach aquaculture pathways.
- This is a terminal pathway. Final disposition of these fish is human consumption; it is unlikely that live tilapia sold via this pathway or their tissues will enter U.S. tilapia aquaculture.

The *moderate* degree of uncertainty associated with this pathway is based on:

- Lack of information regarding the volume of tilapia imported to live terminal markets.
- Lack of information regarding the number and locations of the live terminal markets.

- Knowledge gaps associated with the disposition of waste fish, trim, offal, or other tissues associated with food preparation.
    - These materials are likely sent to landfills. Landfills used by cities are not likely located near tilapia aquaculture facilities. Landfills are required to monitor groundwater for contamination; however, it is not known how the methods used correlate to the potential presence of aquatic animal pathogens. Scavenging gulls, other birds, or wildlife could serve as fomites or vectors.
    - Use of such materials as bait or food for aquatic animals is generally unknown.
- Lack of knowledge regarding State requirements for transport water treatment and disposal and transport truck cleaning and disinfection.
    - This reflects the lack of knowledge of terminal market locations.
    - Some producers/retailers provide oversight to ensure transport water is disinfected and disposed of properly and that trucks are cleaned and disinfected appropriately.
    - Transport water may be disposed of via municipal water systems.

Risk Estimation

The overall risk that live tilapia imported from Canada and destined for sale in terminal markets will present an exposure pathway for U.S. tilapia aquacuture is estimated to be *low*. Presently, Canada is the ony country exporting live tilapia to U.S. terminal markets. Some of the fish imported for this purpose are reared to fingerling size in the United States, exported to Canada for grow-out, and then imported back by U.S. producers for sale in live terminal markets. Post issuance of Federal Order DA-2019-01, it is unlikely that fish raised in the United States will be infected with TiLV virus. While Canada does not require TiLV disease freedom certification of tilapia prior to import, it is plausible that U.S. fish imported for grow-out may be comingled with tilapia sourced from other countries or share water sources with other tilapia. However, if this should occur, the risk posed to the U.S. tilapia industry by the tilapia raised and imported in this specific pathway remains low because these fish are sex-reversed males and are of no value as broodstock, and the terminal markets are located in urban centers (i.e., cities) and not near tilapia aquaculture locations. While the final disposition of the fish is generally assumed to be food, some fish may be bought for pets or placement in ornamental ponds. As such, these fish are unlikely to pose a threat to U.S. aquacuture unless they are intentionally, accidentally, or maliciously released into U.S. tilapia aquaculture systems. While the final disposition of waste fish and trim and offal associated with processing of tilpia purchased in live terminal markets is generally unknown, the risks of exposure to U.S. aquaculture via these pathways is low. Although the trucks used to transport the fish from Canada to the United States and the transport water could serve as potential TiLV introduction pathways, cleaning and disinfecting of the trucks and disposal of the transport water are often performed under observation and must comply with regulations in some States. Finally, municipal waste water is treated prior to release into natural water systems; therefore, the risk of TiLV introduction via this pathway is low.

Limitations

In this assessment, we aimed to identify the primary pathways of entry and exposure and estimate the chances of these events occurring, given our knowledge of current production practices and existing biosecurity measures. To more accurately characterize the risk, a variety of additional information is needed. Some of these needs include:

- General knowledge associated with the
    - Epidemiology of TiLV
    - Final disposition of tilapia sold at live markets, and
    - International and domestic tilapia trade movements and the geographical distribution of TiLV
- Data pertaining to the
    - Export of fingerling tilapia to Canada for grow-out
    - Import of live tilapia from Canada for sale in U.S. live terminal markets, and
    - The final disposition of tilapia that do not get sold in the live markets

'Rapid Risk Assessment' Defined

A rapid risk assessment is designed to provide a quick and approximate estimate of the risk (i.e., the combined likelihoods of entry and exposure and potential consequences given that the risk event occurs) for a pathogen of interest. The objectives include 1) estimating the likelihood and potential impacts of emerging or evolving animal health threats; and 2) identifying data gaps.

These assessments often have the following characteristics:

- Are done when there is relatively limited information on either the pathogen or the transmission pathways
- Are qualitive in nature and do not provide numerical estimates of likelihood or the variability associated with the estimated likelihood
- Serve to guide additional data collection for in-depth risk assessments or risk analyses
- Are often performed with limited resources
- Discuss the most likely pathways of entry and do not attempt to list or evaluate all potential pathways
- Do not evaluate potential consequences in detail
- Do not discuss potential impact of future mitigations

Likelihood, Uncertainty, Consequence, and Risk Categories

For this risk assessment, we have assigned qualitative likelihoods for expressing how likely it is that something would occur. We also use qualitative terms for discussing the uncertainty and information quality associated with these likelihoods.

Table 1. Definition of likelihood categories for risk assessment

Term	Definition
Negligible	This event would almost certainly never occur
Low	This event would be unlikely to occur
Moderate	This event would be nearly as likely to occur as to not occur
High	This event would be likely to occur
Very High	This event is almost certain to occur

Table 2. Definition of levels of uncertainty

Term	Definition
Low	Available data are well supported, reliable, complete, and accessible from multiple sources or published references, and are in general agreement
Moderate	Data are available, but have high interpretability issues, potential biases, reliability issues, and/or underreporting
High	Some data are available but may be incomplete, unreliable, from a small number of published sources, and/or demonstrate conflicting evidence. Includes the combination of anecdotal evidence, personal communications, and expert opinion with available published data, if all sources are in general agreement

Table 3. Definition of consequence levels

Term	Definition
Indiscernible	The consequences of exposure are so low as to be undetectable.
Minor	Minor increases in morbidity/mortality, and some decreases in production. Effects of exposure are controllable or reversible.
Significant	Morbidity/mortality are great enough to impose moderate production losses. Effects of exposure may not be reversible.
Major	Morbidity and mortality are great enough threaten the economic viability of the sector for a lengthy period. Effects of exposure may not be reversible.

Table 4. Definition of risk levels

Term	Definition
Negligible	The determination of "negligible risk" suggests that the risk is low enough that it need not be considered, and no further mitigations are necessary.
Low	The determination of "low risk" suggests that although not a strict requirement, resources to further evaluate or mitigate this risk should be considered. A low risk is greater than a negligible risk due to a potential likelihood of occurrence, associated consequences, or a combination of both.
Moderate	The determination of "moderate" risk suggests that the risk is of a sufficient magnitude that measures to prevent or mitigate the risk should be considered. A moderate risk is greater than a low risk due to a greater likelihood of occurrence, greater consequences, or a combination of both.
High	The determination of "high risk" suggests that the risk is of sufficient magnitude that measures to prevent or mitigate the risk are necessary and the consequences will have significant impact at the regional or national level. A high risk is greater than a moderate risk due to a greater likelihood of occurrence, greater consequences, or a combination of both.

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