

Risk of introduction and spread of ISAV into Ireland through imports of fertilized eggs and milt

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BACKGROUND

The import of aquatic animals and aquatic animal products will always involve a degree of disease risk to the importing country. The implementation of risk assessments try to identify (and quantify) which pathogens and which pathways may pose higher risk, so risk reduction measures can be implemented. In Ireland several hazards for the salmon farming industry have been identified (Figure 1).

In this study we aimed to quantify the risk of introduction and spread of infectious agents to the Irish salmon farming industry, using Infectious Salmon Anemia (ISAV) as a working example, in order to understand its current level of risk and the pathways that involve higher risk, and to generate a framework on which to base future quantitative risk analyses in the country.

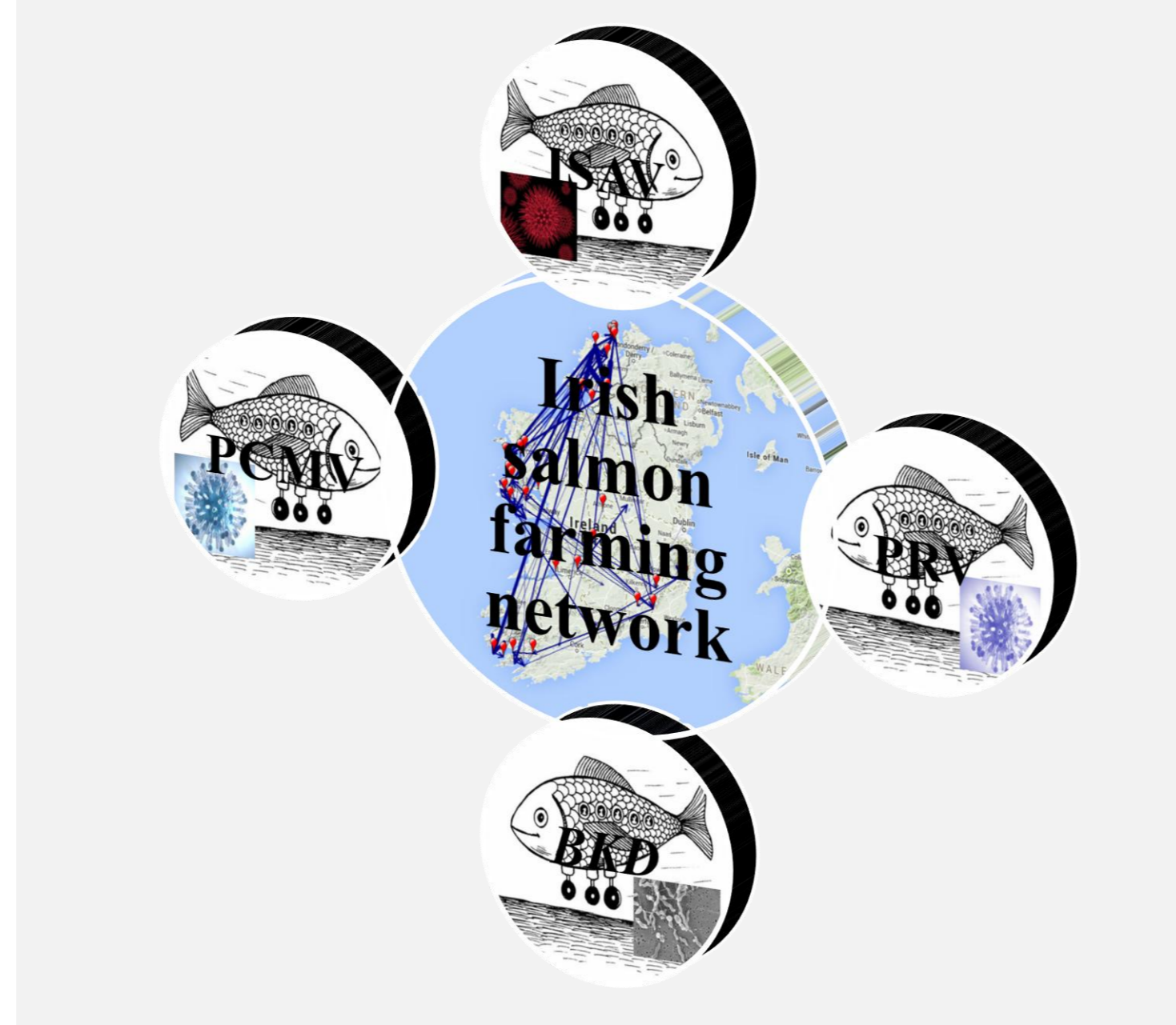


Figure 1. Identified hazards associated with the import of Atlantic salmon eggs or milt into Ireland

METHODS

We used OIE recommended methodology for qualitative import risk assessment (Figure 2). Figure 3 describes the scenario trees considered for the import of eggs and milt. The probability and uncertainty associated to each step of the pathway was estimated using literature review. The matrix to estimate the likelihood of entry and exposure of ISAV is shown in Table 1.



Figure 2. Methodological framework used for this import Risk Assessment



Figure 3. Scenario trees for the introduction and establishment of ISAV in Ireland through the import of fertilized eggs (left) or milt (right). Green, orange, red: entry, exposure and consequence assessment, respectively

Table 1. Matrix for estimating the likelihood of entry and exposure to ISAV, and results for milt (left circle) and eggs (right circle)

Exposure/Entry	Negligible (N)	Extremely low (EL)	Very low (VL)	Low (L)	Slight (S)	Moderate (M)	High (H)
High (H)	N	EL	VL	L	S	M	H
Moderate (M)	N	EL	VL	L	S	M	M
Slight (S)	N	N	EL	VL	L	S	S
Low (L)	N	N	N	EL	VL	L	L
Very low (VL)	N	N	N	N	EL	VL	VL
Extremely low (EL)	N	N	N	N	N	EL	EL
Negligible (N)	N	N	N	N	N	N	N

RESULTS

For the importation of a consignment of A. salmon eggs, the combined likelihood of entry and exposure and their derived consequences was estimated to be in the range of **very low** (surface contamination of eggs) to **low risk** (vertical transmission). For the importation of a consignment of milt the combined likelihood of entry and exposure and consequences was estimated to produce a **very low risk** for all pathways (Table 2).

Table 2. Risk matrix integrating likelihood of entry and exposure with consequences for estimating the risk of introduction and spread of ISAV into Ireland, with results for eggs (top circle) and milt bottom circle)

Consequences/Likelihood	Negligible (N)	Very low (VL)	Low (L)	Moderate (M)	High (H)	Extreme (E)
High (H)	N	VL	L	M	H	E
Moderate (M)	N	VL	L	M	H	E
Slight (S)	N	VL	L	M	H	E
Low (L)	N	N	VL	L	M	H
Very low (VL)	N	N	N	VL	L	M
Extremely low (EL)	N	N	N	N	VL	L
Negligible (N)	N	N	N	N	N	VL

CONCLUSIONS

The most significant risk pathways for introduction and spread of ISAV into Ireland are those related to **vertical transmission**. While discarded in the early stages of research about the disease^{1,2}, there's an increasing body of literature describing the possibility of vertical transmission^{3,4}. Recently, ISAV-HPR3 viable viral particles were detected inside eggs coming from asymptotically infected salmon in Chile⁵. Based on these findings, **the likelihood of vertical transmission cannot be deemed as negligible**.

Considering the above, the most critical measure to reduce the risk of ISAV introduction and spread, without disrupting trade, would be the **application of quarantine measures at the importing hatcheries and testing of fish before leaving the quarantine facility**. These measures would prevent the transmission of ISAV (and other hazards) to susceptible populations both within the importing hatchery and to the rest of the Irish salmon farming network, which has been shown to be **highly connected into a unique country-wide compartment**⁶.

As a result of this analysis, and of effective risk communication, these measures are currently being implemented in some of Ireland's most relevant hatcheries, which concentrate a significant amount of the imports of Atlantic salmon eggs and milt into the country.

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