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Self-declaration of country freedom from infection with infectious salmon anaemia virus (ISA) and *Gyrodactylus salaris* by the Republic of Korea.

Self-Declaration sent to the World Organisation for Animal Health (WOAH) on 27 February 2024 by Dr Dongsik Lee, the Delegate of the Republic of Korea to the WOAH on behalf of the National Fisheries Products Quality Management Service (NFQS), Ministry of Oceans and Fisheries.

1. Introduction

The Republic of Korea's previously self-declared disease freedom from infection with infectious salmon anaemia virus (ISA)¹ and *Gyrodactylus salaris* (*G. salaris*) were published by WOAH on 01 September 2019² and 1 August 2020³ respectively, and have continued to maintain an active status ever since. The Republic of Korea's self-declaration of disease freedom is hereby resubmitted to reflect the adopted amendments to the *Aquatic Animal Health Code* (*Aquatic Code*) and evolutions in the standard operating procedure for self-declarations in the intervening period.

The Republic of Korea has implemented targeted surveillance of infection with ISA and infection with *G. salaris* for at least the last two years with no detection of the disease, as well as continuously met the basic biosecurity conditions at least for one year prior to commencement of targeted surveillance, thereby meeting the requirements for self-declaration of freedom from ISA provided in Chapters 1.4. and 3.1. and Articles 10.4.5. and 10.4.6., and *G. salaris* provided in Chapters 1.4. and 3.1. and Article 10.3.4. of the *Aquatic Code*. In addition, the Republic of Korea fulfilled the conditions defined in Pathway 3 - Targeted surveillance in Article 1.4.3. of the *Aquatic Code*.

The country has conducted targeted surveillance demonstrating no detection of the diseases, for the last four years (since 2020), for *G. salaris* and ISA in susceptible species as specified in Articles 10.3.2. and 10.4.2., respectively, of the *Aquatic Code* and in accordance with Chapter 1.4. of the *Aquatic Code* and Chapters 2.3.3. and 2.3.4., respectively, of the *Manual of Diagnostic Tests for Aquatic Animals* (the *Aquatic Manual*). Salmonids are farmed inland-based facilities, in which rearing water is supplied from the groundwater, so fish escaping from farms during floodings are

¹ This self-declaration applies to both (HPR)-deleted ISAV and the non-pathogenic HPRO (non-deleted highly polymorphic region) ISAV

² [Publication of self-declaration of country freedom from infection with infectious salmon anaemia virus \(ISA\) by the Republic of Korea \(1 September 2019\)](#)

³ [Publication of self-declaration of country freedom from infection with *Gyrodactylus salaris* by the Republic of Korea \(1 August 2020\)](#)

not supposed to survive. Salmonid aquaculture farms operated in the Republic of Korea neither share nor are bordered by waters of any other country.

A statement of responsibility for this self-declaration signed by the WOA Delegate of the Republic of Korea is contained in Annex I.

2. Basic biosecurity conditions in the Republic of Korea

2.1. Aquatic biosecurity system in the Republic of Korea

Under its Aquatic Life Disease Control Act enacted in 2008, the Republic of Korea has established a systematic national disease control and quarantine infrastructure along with financial resources to support the system and implemented the system as follows.

- Under Articles 7 and 9 of the Act, the national aquatic life disease control system has established an early detection and reporting system for aquatic life diseases.
- The early detection system has been in place since 2008. The occurrence of an infectious aquatic animal disease leads to clinical and technical follow-up measures at the affected farms by trained aquatic animal health professionals or veterinarians.
- Under Article 38 (Education on Disease Control) of the Act, the government provides education on the control of aquatic organism diseases for farmers and aquaculture business entities every two years. Under Article 10 of the Enforcement Rule of the Aquatic Life Disease Control Act, aquatic organism disease control officers, who either are aquatic organism disease inspectors or veterinarians, have received education on the control of aquatic organism diseases.
- Clinically infected animals reported by farms or animals sampled during surveillance activities are sent to disease identification institutions for aquatic organisms or the National Fishery Products Quality Management Service (NFQS) for laboratory diagnosis under Article 10 of the Act.
- If tested positive, the animals are sent for confirmatory diagnosis by the NFQS. With a confirmed case, the Korean government implements a systematic epidemiological investigation to understand the scale of the disease outbreak, trace the source of infection, and identify the transmission mechanism under Article 11 of the Aquatic Life Disease Control Act, as well as develop reasonable control measures to prevent the recurrence of the disease.
- If an occurrence of aquatic infectious disease is confirmed, the equipment, tools, etc., of the affected facility shall be disinfected, incinerated, or buried and affected aquatic organisms shall be subject to measures like stamping out and isolation/movement control, etc., under Articles 13-19 of the Act.

The Republic of Korea carries out quarantine of imported aquatic organisms to prevent the introduction of exotic diseases into the country and protect its ecosystem. Aquatic organisms imported for transplant, human consumption, ornament, and research & survey shall undergo quarantine inspections according to Articles 22-32 of the Act. The Republic of Korea improved quarantine efficiency by adopting a standard form of health certificate. The country enhanced import quarantine by mandating a health certificate for all imported fishery products using the standard form as well as adding emerging overseas diseases of concern identified through import risk analysis to its list of notifiable diseases subject to quarantine.

2.2. Basic Biosecurity Conditions for *Gyrodactylus salaris* and ISA in the Republic of Korea

G. salaris and ISA are listed as nationally notifiable diseases in the Republic of Korea under Article 2 of the “Enforcement Rule of the Aquatic Life Disease Control Act”. All measures related to surveillance and disease control are implemented as specified in the Aquatic Life Disease Control Act to ensure that basic biosecurity conditions for this disease are properly achieved.

In terms of surveillance of *G. salaris* and ISA, both targeted (twice a year) and general surveillance are carried out, and the surveillance data are all uploaded and maintained in the national integrated network for aquatic life disease control as stipulated in Article 5-2 of the Aquatic Life Disease Control Act. The detection or any suspicious case of *G. salaris* and ISA must be reported to the competent authority through the early detection system. A laboratory test as well as a confirmatory diagnosis of *G. salaris* and ISA are performed following the procedure specified in Articles 2.3.3.5. and 2.3.4.5. of the *Aquatic Manual*, using conventional (RT)-PCR and sequencing of amplicons of *G. salaris* and ISA. If both *G. salaris* and ISA are finally confirmed by a confirmatory diagnosis, epidemiological investigations and control measures shall be implemented to prevent the transmission and spread of the disease.

3. Control and Management of Infection with *G. salaris* and ISA in the Republic of Korea

3.1. Susceptible species to *G. salaris* and ISA in the country

Article 10.3.2 of the *Aquatic Code* refers to Arctic char (*Salvelinus alpinus*), Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), grayling (*Thymallus thymallus*), North American brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss*) as susceptible to *G. salaris*. And Article 10.4.2 of the *Aquatic Code* refers to Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) as susceptible to ISA.

The Republic of Korea currently farms rainbow trout and Atlantic salmon. Rainbow trout is farmed and produced using the freshwater flow-through culture system in Korea. Atlantic salmon has been listed as a potential risk species by the Ministry of Environment since 2016, and an introduction of this species into the country should be approved by the ministry. In Korea, 5 local government research institutes (2 institutes of Gangwon-do; 1 Chungcheongbuk-do; 1 Gyeongsangbuk-do; and 1 Busan Metropolitan City) import eyed Atlantic salmon eggs to farm at laboratory for the purpose of researching on the land-based aquaculture technology, with no commercial production. These farmed Atlantic salmon are currently kept in separate rearing tanks and go through regular disease tests (at least twice a year), with fish carcasses being treated and disposed of by the Ministry of Environment. There are no wild species susceptible to *G. salaris* and ISA in the country.

As of 2023, there are 161 rainbow trout farms in Korea, most (>89.4%) of which are in the provinces of Gangwon-do (58.4%), Gyeongsangbuk-do (19.9%), and Chungcheongbuk-do (11.2%) (Table 1 & Figure 1). The national annual production of rainbow trout is approximately 2,759 tons as of 2023 (Table 2). However, there was a noticeable decrease in production in 2020 and 2021. In the period 2020 and 2021, the global COVID-19 pandemic negatively affected rainbow trout economic activities. Particularly, it affected rainbow trout markets such as restaurants and local festivals. The producers estimated the optimal supply based on demand forecasting.

Table 1. Number of rainbow trout (*O. mykiss*) farms in the Republic of Korea in 2023. (Source: NFQS)

Province	Gyeonggi-do	Gangwon-do	Chungcheongnam-do	Chungcheongbuk-do	Jeollabuk-do	Gyeongsangnam-do	Gyeongsangbuk-do	Total
No. of farms	7	94	5	18	3	2	32	161

Table 2. Total production of rainbow trout (*O. mykiss*) in the Republic of Korea. Unit: M/T (Source: Statistics Korea)

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Rainbow trout	3,304	3,064	3,066	3,358	3,179	3,285	2,414	2,483	3,043	2,759

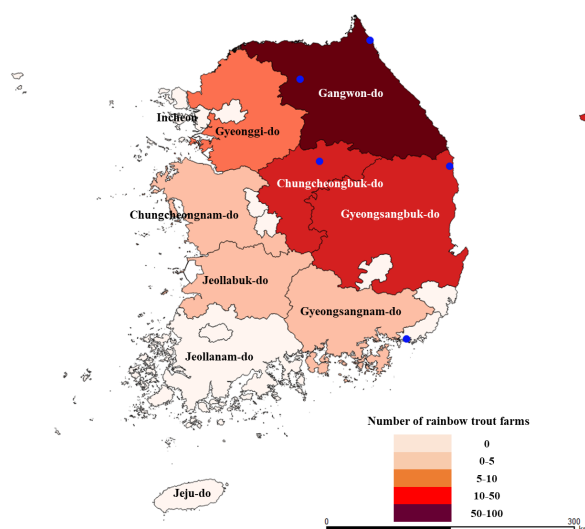


Figure 1. Distribution of rainbow trout (*O. mykiss*) farms and (*S. salar*, ●) institutes in Korea in 2023.

3.2. General Surveillance of *G. salaris* and ISA

Infections with *G. salaris* and ISA have been listed as notifiable diseases since 2008 in the country and a year-round routine surveillance system has been put in place. General surveillance of *G. salaris* and ISA is routinely implemented for persons that own, manage, and operate aquaculture premises subject to surveillance. In general surveillance activities, inspectors carry out interviews and questionnaire surveys to obtain information on the history and the current status of disease occurrence, mortalities, etc. The information helps operate the early detection system of disease introduction. Since 2011, inspectors have made on average at least two visits per farm every year to perform inspections on *G. salaris* and ISA occurrences (Table 3).

Table 3. Number of general surveillance activities for Salmonids from 2011 to 2023. (Source: NFQS)

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
No.	19	19	203	648	743	714	602	424	170	277	448	764	754	5,785

3.3. Targeted Surveillance of *G. salaris* and ISA

To demonstrate the country's freedom from *G. salaris* and ISA, the targeted surveillance program that is carried out twice a year, in the first and second half of the year to capture potential seasonal variations was designed according to Chapter 1.4 of the *Aquatic Code*. The sample size required to demonstrate the country's freedom from the disease every year from 2020 to 2023 was calculated using the FreeCalc two-stage sampling (Table 4 & Figure 2). The number of units to be sampled from the population of 161 rainbow trout farms (sample size) was calculated using the two-stage sampling method. The first sampling stage to select aquaculture establishments (farms) employed parameters of 2% farm-level prevalence, 35% individual-level prevalence, 95% test sensitivity, 90% target cluster sensitivity (SeH), and 95% target system sensitivity (SSe, confidence level). The farm sample size required for targeted surveillance was calculated as 95 farms. The number of sample farms was divided by administrative units (cities and provinces) to plan a targeted surveillance program. In the second stage, the animal sample size per farm was calculated by applying the following parameters: 95% test sensitivity, 97% test specificity, 35% individual-level prevalence, 5% type I error, 5% type II error, and a population of 60,000 animals. From these parameters, the required animal sample size was calculated as 15 per farm.

Between 15-30 animals per farm were sampled from 95 or 96 rainbow trout farms every year from 2020 to 2023. A total of 2,919, 5,764, 3,797 and 3,800 animals were selected in 2020, 2021, 2022 and 2023, respectively to be tested for *G. salaris* and ISA, and all showed negative results (Table 4).

These results indicate that the country has been free from *G. salaris* and ISA for the last 4 years at a confidence level of 95%. The global outbreak of the COVID-19 pandemic in the period 2020 to 2021 negatively affected rainbow trout economic activity. Particularly, those affected rainbow trout markets such as restaurant and local festivals. Therefore, the producers had no stocking of rainbow trout in certain provinces (for example Chungcheongnam-do and Gyeongsangnam-do). As a result, no samples could be collected in these provinces in 2020 and 2021.

Table 4. Targeted surveillance of rainbow trout (*O. mykiss*) from 2020 to 2023 with two-stage sampling. (Source: NFQS)

Year	Targeted surveillance	Gyeonggi-do	Gangwon-do	Chungcheongnam-do	Chungcheongbuk-do	Jeollabuk-do	Gyeongsangnam-do	Gyeongsangbuk-do	Total	
2020	Total No. of farms	7	94	5	18	3	2	32	161	
	Required sample size	No. of farms	4	55	3	11	2	1	19	95
		No. of samples (2 times)	96	1,320	72	264	48	24	456	2,280
	Tested sample size	No. of farms	3	60	–	13	1	–	19	96
		No. of tested samples (2 times)	89	1,790	–	403	31	–	606	2,919
	2021	Total No. of farms	7	94	5	18	3	2	32	161
Required sample size		No. of farms	4	55	3	11	2	1	19	95
		No. of samples (2 times)	96	1,320	72	264	48	24	456	2,280
Tested sample size		No. of farms	7	55	–	12	2	1	19	96

	No. of samples (2 times)	420	3,300	—	690	420	60	874	5,764	
	Total No. of farms	7	94	5	18	3	2	32	161	
2022	Required sample size	No. of farms	4	55	3	11	2	1	19	95
	No. of samples (2 times)	96	1,320	72	264	48	24	456	2,280	
Tested sample size	No. of farms	6	55	1	11	2	1	19	95	
	No. of tested samples (2 times)	240	2,200	40	439	80	40	758	3,797	
	Total No. of farms	7	94	5	18	3	2	32	161	
2023	Required sample size	No. of farms	4	55	3	11	2	1	19	95
	No. of samples (2 times)	96	1,320	72	264	48	24	456	2,280	
Tested sample size	No. of farms	4	56	3	9	2	1	20	95	
	No. of tested samples (2 times)	160	2240	120	360	80	40	800	3,800	

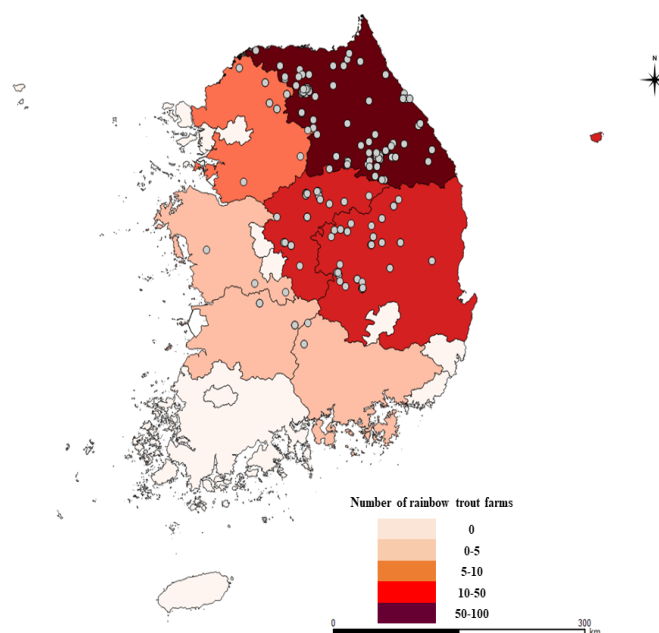


Figure 2. Sampling sites (●) of rainbow trout (*O. mykiss*) farms for targeted surveillance from 2020 to 2023 with two-stage sampling.

4. Import requirements for species susceptible to *G. salaris* and ISA.

The Republic of Korea has been carrying out quarantine of imported aquatic organisms since December 2008, under the Aquatic Life Disease Control Act to prevent the introduction of exotic diseases into the country and protect its ecosystems. As specified in Articles 22 (Quarantine of exported and imported organisms), 23 (Things designated for quarantine purpose), 27 (Quarantine inspection on imports), and 31 (Quarantine inspection on exports) of the Act, the government carries out quarantine inspections for 26 kinds of notifiable diseases in live fish, shellfish, crustacean species for transplant, human consumption, ornament, testing, research and survey, frozen and chilled abalone, oysters, and shrimps, and diagnostic reagents including pathogens.

The country formulated a standard form of health certificate, which improved quarantine efficiency by encouraging exporting countries to issue health certificates using the standard form. The Republic of Korea enhances import quarantine by mandating a health certificate for all imported fishery products and adding emerging overseas diseases identified through import risk analysis on its list of notifiable diseases subject to quarantine.

The standard form of health certificate should be included the following requirements:

- Health inspection was conducted in facilities designated by competent authorities in exporting countries.
- Any clinical signs of diseases listed in the Aquatic Life Disease Control Act of the Republic of Korea were not observed.
- Any pathogenic agent of diseases* was not detected from laboratory tests based on the *Aquatic Manual* or the diagnostic methods approved by the Republic of Korea.

* For salmonids: epizootic haematopoietic necrosis virus (EHN), salmon anaemia virus (ISA), viral haemorrhagic septicaemia virus (VHS), salmonid Alphavirus (SAV) and *Gyrodactylus salaris*

The Republic of Korea requires all imports of species susceptible to *G. salaris* and ISA for transplant to go through laboratory examinations of the disease and only those that pass the examinations are allowed to enter the country. Those that fail the exams are returned or incinerated. Susceptible species to *G. salaris* and ISA that were imported to the country for transplant from 2014 to 2023 are eyed eggs of Atlantic salmon (*S. salar*) and rainbow trout (*O. mykiss*) (Table 5). It is required that eyed eggs of these two species that are to be imported for transplant in the country should pass laboratory tests to demonstrate the absence of *G. salaris* and ISA and obtain a health certificate before leaving the exporting country. Once arriving in the country, the imported eyed eggs should go through a laboratory test for *G. salaris* and ISA in accordance with methods provided in the *Aquatic Manual* of WOA and those that have passed the test are only allowed for customs clearance. The quarantine procedure for importing susceptible species to *G. salaris* and ISA will be maintained even if the self-declaration of the country's freedom from the disease is published by the WOA.

Table 5. Import quarantine count for transplant from 2014 to 2023. (Source: NFQS)

Species	2014		2015		2016		2017		2018		2019		2020		2021		2022		2023	
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
Atlantic salmon (<i>S. salar</i> , eyed eggs)	–	–	1	34	1	65	1	30	1	30	0	0	0	0	1	7	8	38	5	18
Rainbow trout (<i>O. mykiss</i> , eyed eggs)	10	289	12	386	12	457	9	415	9	401	8	318	5	114	5	178	10	192	10	262

5. Measures implemented to maintain freedom

To maintain the country's freedom status from *G. salaris*, the Republic of Korea will continue its targeted surveillance activities and basic biosecurity conditions in accordance with the provisions of Article 10.3.8. of the *Aquatic Code* and the quarantine in accordance with the provisions of Articles 10.3.9-14 of the *Aquatic Code*. And to maintain the country's freedom status from ISA, the Republic of Korea will continue its targeted surveillance activities and basic biosecurity conditions in accordance with the provisions of Articles 10.4.11-12. of the *Aquatic Code* and the quarantine in accordance with the provisions of Articles 10.4.13-20 of the *Aquatic Code*. If infection with *G. salaris* or ISA is confirmed, epidemiological investigations and control measures shall be implemented (as described in Section 2.1. Aquatic biosecurity system in the Republic of Korea) to prevent the transmission and spread of the disease under Aquatic Life Disease Control Act in the Republic of Korea.

6. Conclusion

The Republic of Korea has continuously met the basic biosecurity conditions for at least one year prior to the commencement of targeted surveillance of *G. salaris* and ISA and has implemented targeted surveillance of the diseases for the past four years with no detection of either *G. salaris* or ISA, thereby meeting the requirements for self-declaration of freedom from *G. salaris* and ISA provided in Chapters 1.4 and 3.1 and Articles 10.3.5., 10.4.5. and 10.4.6. of the *Aquatic Code*.

G. salaris and ISA are reportable diseases under the Aquatic Life Disease Control Act enacted in 2008, and there are regular ongoing awareness programs in place to encourage prompt reporting of *G. salaris* and ISA suspicions.

The Republic of Korea carries out quarantine of imported aquatic organisms to prevent the introduction of exotic diseases and has implemented measures to maintain freedom from *G. salaris* and ISA.

Based on the above results, the Delegate of the Republic of Korea declares that the country complies with the requirements as a 'country free from infections with *G. salaris* and ISA' in accordance with Chapter 1.4 of the *Aquatic Code* and Chapter 2.3.3. and 2.3.4. of the *Aquatic Manual* and is consistent with the information provided in WAHIS.

