Self-declaration for country freedom from infection with abalone herpesvirus by Republic of Korea.

Declaration sent to the OIE on 10 September 2021 by Dr Dongsik Lee, OIE Delegate for the Republic of Korea and Chief Veterinary Officer, Animal Health Policy Bureau, Ministry of Agriculture, Food and Rural Affairs.

1. Introduction

The National Fishery Products Quality Management Service (NFQS), the Ministry of Oceans and Fisheries, the Republic of Korea officially requests the publication by the World Organisation for Animal Health (OIE) of a self-declaration of freedom from infection with abalone herpesvirus of the entire country of the Republic of Korea as of 9 September 2021. This is the first self-declaration of freedom from the disease of the country.

1. The Republic of Korea declares that the entire country is free from infection with abalone herpesvirus as it has fulfilled the requirements described in Chapter 11.1.4. Point 3 of the OIE Aquatic Animal Health Code (Aquatic Code) and Chapter 2.4.1. of the OIE Manual of Diagnostic Tests for Aquatic Animals (Aquatic Manual).

2. The national aquatic disease control organization of NFQS has carried out targeted surveillance of Haliotis discus hannai for the last 12 years and of Haliotis diversicolor subspecies supertexta for the last 4 years as described in Chapter 1.4. of the Aquatic Code for susceptible species listed in Article 11.1.2 of the Aquatic Code following methods provided in Chapter 4.3. of the Aquatic Manual, without any detection of infection with abalone herpesvirus.

3. Although it has an unknown status of infection with abalone herpesvirus before targeted surveillance, the Republic of Korea has met the requirements for obtaining the status of freedom from infection of abalone herpesvirus of the country described in Articles 1.4.6. and 11.1.4. of the Aquatic Code Point 3 as (a) basic biosecurity conditions have been continuously met for at least the last two years and (b) targeted surveillance activities as described in Chapter 1.4. of the Aquatic Code has been carried out for at least the last two years without any detection of the disease.
Therefore, the Delegate of the Republic of Korea to the OIE declares that the country is free from infection with abalone herpesvirus.

2. Pathways to claim freedom from aquatic animal diseases

2.1. Aquatic Biosecurity System in the Republic of Korea

The Republic of Korea has established a systematic national disease control and quarantine infrastructure based on its Aquatic Life Disease Control Act along with financial resources to support for system. The Aquatic Life Disease Control Act is aimed to contribute to the stable production and supply of aquatic organisms, the conservation of aquatic ecosystem, and the enhancement of citizens’ health by establishing a comprehensive disease control system to prevent outbreaks or the spread of contagious aquatic organism disease (Annex II-Figure 1).

As of 1 March 2021, the National Fishery Products Quality Management Service (NFQS) is the competent authority for the disease control and quarantine service for aquatic organisms in the Republic of Korea.

In the Republic of Korea, the early detection and reporting system for aquatic life diseases is established under Articles 7 (Aquatic organism disease control officer) and 9 (Reporting on dead or diseased aquatic organisms) of the Aquatic Life Disease Control Act. Clinically infected animals reported by farms or apparently healthy animals sampled in surveillance are sent to disease identification institutes for aquatic organisms or NFQS for laboratory diagnosis under Article 10 (disease identification, etc.) of the Act. As a national aquatic disease control organization, NFQS, under the “Notification on Designation and Operation of Disease Identification Institutes for Aquatic Organisms”, designates local governments, universities, or private institutes as disease identification institutes. NFQS manages and supervises those institutes by providing standardized diagnostic techniques and training, carrying out quality control through national proficiency tests and performing regular facility checks of these institutes (Annex II-Figure 3). If tested positive for infectious aquatic life disease by lab diagnosis, the animals are sent to the Aquatic Disease Control Division of NFQS for a confirmatory diagnosis and determination of the presence and clinical signs of the disease. With a confirmed case, the Korean government implements a systematic collection and analysis of epidemiological information (for understanding the scale of disease outbreak, tracking the source of infection, etc.) under Article 11 (Epidemiological investigations) of the Aquatic Life Disease Control Act. The epidemiological investigations identify the cause of disease and transmission mechanism and help decide on reasonable disease control measures to prevent the reoccurrence of the disease.

If an outbreak of infectious disease is confirmed through confirmatory diagnosis or epidemiological investigation, the equipment, tools, etc. of the affected facility shall be disinfected, incinerated, or buried and affected aquatic organisms shall be subjected to measures like stamping out and isolation/movement restriction, etc. under Articles 13 (Inspection of aquaculture facilities, medication, etc.), 14 (Preparation, preservation, etc. of records of transactions of aquatic organisms), 15 (Isolation, restriction on transportation, etc. of aquatic organisms), 16 (Culling order), 17 (Restrictions, etc. on disposal of carcasses), 18 (Incineration, etc. of contaminated things), and 19 (Prohibition of excavation) of the Aquatic Life Disease Control Act. In addition, the NFQS makes public the current status of domestic and overseas disease outbreaks on its web page under Article 6-2 (Publication of current status of aquatic life disease outbreak) of the Aquatic Life Disease Control Act to prevent and control infectious aquatic animal diseases.

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 ecosystem. 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 of 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 (Annex II -Figure 4).

The country formulated a standard form of health certificate (April 2018), 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.

2.2. Biosecurity Conditions for Infection with Abalone Herpesvirus

Infection with abalone herpesvirus is listed as a nationally notifiable disease in the Republic of Korea under Article 2 of the “Enforcement Rule of the Aquatic Life Disease Control Act”. Therefore, all measures related to surveillance and disease control are specified in the current law to ensure that an appropriate level of biosecurity should be achieved for this disease. The measures include:

1. Any detection of the presence or suspicion of infection with abalone herpesvirus must be reported to the competent authority by law

2. The early warning system of the disease has been in place since 2008. In the case of a disease outbreak, a trained aquatic organism disease inspector or a veterinarian shall conduct a clinical test and technical follow-up measures at the affected farms.

3. Both targeted (twice a year) and general surveillance are carried out to detect the presence of infection with abalone herpesvirus. The surveillance results are all uploaded and maintained in the integrated network for aquatic life infectious diseases.

4. If infection with abalone herpesvirus is confirmed by a confirmatory diagnosis, epidemiological investigations and control measures shall be implemented to prevent the transmission and spread of the disease.

5. To prevent the introduction of infection with abalone herpesvirus into the national territory, conditions specified in Articles 11.1.3. and 11.1.11. of the Aquatic Code apply to imported abalones.

6. To prevent overseas transmission of the disease, conditions specified in Article 5.1. and Chapter 5.6 of the Aquatic Code are applied to exported abalones.

2.3. Diagnosis of Infection with Abalone Herpesvirus

2.3.1. Diagnostic Methods

Clinical and laboratory tests are performed following Chapter 2.4.1. of the Aquatic Manual. The sample size is calculated using FreeCalc. Individuals of Haliotis discus hannai and Haliotis diversicolor subspecies supertexta showing clinical signs specified in Chapter 2.4.1 Point 4.1.1. of the Aquatic Manual should be included among the selected samples. The NFQS or local disease identification institutes carry out both clinical and laboratory tests to diagnose the disease. In the clinical test, samples are examined for the presence of the following clinical signs: irregular peripheral concave elevation of the foot; minimal movement of the pedal muscle; shrunk and hard foot; reduced pedal adhesion to the substrate; swollen and protruding mouth parts; and eversion of the radula.

Molecular techniques (PCR) are used for detection of abalone herpesvirus. DNA is extracted from live or fixed samples (in 80-100% ethanol). AbHV1617 PCR was performed to generate amplicons of lengths of 522-588 bp using the specific primers (AbHV-16, 5'–GGC-TCG-TTC-GGT-CGT-AGA-ATG-3' and AbHV-17, 5'-TCA-GCG-TGT-ACA-GAT-CCA-TGT-C-3').
Samples that have tested positive for the AbHV are sent to the Aquatic Disease Control Division of NFQS for a confirmatory diagnosis.

### 2.3.2. Confirmatory Diagnosis

Confirmatory diagnosis of infection with abalone herpesvirus is conducted at the Aquatic Disease Control Division of NFQS, the national reference laboratory for aquatic organisms in the Republic of Korea. The national reference laboratory attends two kinds of international proficiency tests every year: the KHV PCR proficiency test organized by VETQAS in the U.K. (semiannually) and the proficiency test for KHV, ISAV, VHSV, IHNV, EHNV PCR and cell culture organized by DTU in Demark (annually). The reference laboratory also obtained the ISO 17025 accreditation.

PCR-positive results should be confirmed through sequencing of PCR products and additional histopathology according to the *Aquatic Manual* (Annex Ⅲ-Table 1). If the confirmatory diagnosis is positive, the disease control measures and epidemiological investigations prescribed in Articles 11-19 of the Aquatic Life Disease Control Act shall be implemented.

### 2.4. Control and Management of Infection with Abalone Herpesvirus in the Republic of Korea

#### 2.4.1. Susceptible Abalone Specifies to Infection with Abalone Herpesvirus in the Country

Korea produces both wild and farmed abalone. There are three cultured abalone species in the country: *Haliotis discus hannai*, *Haliotis discus discus*, and *Haliotis diversicolor* subspecies *supertexta*. As of 2020, the aquaculture production is 20,059 tons for *Haliotis discus hannai* and *Haliotis discus discus* combined and 4 tons for *Haliotis diversicolor* subspecies *supertexta*. Captured species include *Haliotis discus discus*, *Haliotis discus hannai*, *Haliotis madaka*, and *Haliotis diversicolor* subspecies *supertexta*, and the total capture production is 103 tons representing a negligible share in the total abalone production of the country (Annex Ⅲ-Table 2).

Farms on the southern and western coast of Korea mostly use cages to culture *Haliotis discus hannai* (Annex Ⅱ-Figure 5), whereas in Jeju, farmers use land-based aquaculture system to culture *Haliotis discus discus* and small amounts of *Haliotis discus hannai* and *Haliotis diversicolor* subspecies *supertexta* (Annex Ⅱ-Figure 6). The different culture methods and species are deeply related to water temperatures in the cold season. With water temperatures below 12°C in winter, the southern and western coasts are suitable for cold-water species (*Haliotis discus hannai*). In Jeju, water temperatures are kept above 15°C in winter enabling the culture of warm water species (*Haliotis discus discus* and *Haliotis diversicolor* subspecies *supertexta*).

Article 11.1.2. of the *Aquatic Code* lists *Haliotis diversicolor* (subspecies: aquatillis and *supertexta*), *Haliotis laevegata*, *Haliotis rubra*, and the hybrid (*Haliotis laevegata × Haliotis rubra*) as susceptible host species to infection with abalone herpesvirus. Gu *et al.* (2019)\(^1\) reported that abalone herpesvirus was also detected in *Haliotis discus hannai*. Therefore, the susceptible species in Korea are *Haliotis discus hannai* and *Haliotis diversicolor* subspecies *supertexta*, and these two species are monitored through surveillance.

As of 2021, there are 660 aquaculture farms that culture *Haliotis discus hannai*. Among them, 652 farms culture *Haliotis discus hannai* using sea cages on the southern and western coasts of Korea, mostly being distributed in South Jeolla Province. The other 8 farms are located in Jeju Island (Table 1; Annex Ⅱ-Figure 7). *Haliotis diversicolor* subspecies *supertexta* is only cultured by five farms in Jeju Island (Table 1; Annex Ⅱ-Figure 8).

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<th>North Gyeongsang</th>
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<th>South Jeolla</th>
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* Both Haliotis diversicolor subspecies supertexta and Haliotis discus hannai are simultaneously cultured in three abalone farms, Jeju.

Most of the abalone farms in Korea consist of land-based nursery tanks and grow-out sea cages. They are under similar environmental conditions regardless of location and species, and are continuously monitored for infection with abalone herpesvirus under the same surveillance and biosecurity conditions.

### 2.4.2. General surveillance Activities of Infection with Abalone Herpesvirus and the Results

Infection with abalone herpesvirus has been listed as a notifiable disease since 2008 in the Republic of Korea and the year-round routine surveillance system has been established to carry out surveillance inspection of the disease. General surveillance is implemented for persons that own, manage and operate aquaculture premises subject to surveillance through field visits or telephone surveys. During the surveys, inspectors carry out interviews and questionnaire surveys to obtain information on the history and the current status of disease occurrences, mortalities, etc. The general surveillance activities enable early detection of the disease in the farms. The general surveillance has been implemented for abalone farms since 2010 (Table 2). Since 2014, inspectors have made at least one visit every year to each farm to perform inspections on disease occurrence (Table 2).

### 2.4.3. Targeted Surveillance Activities of Infection with Abalone Herpesvirus and the Results

To demonstrate the country freedom from infection with abalone herpesvirus, the targeted surveillance program was designed and implemented according to the OIE Aquatic Code. The sample size required to demonstrate the country freedom from the disease was calculated by FreeCalc and the one-stage sampling method was applied for the targeted surveillance for 11 years from 2010 to 2020. Parameters of the one-stage sampling for *Haliotis discus hannai* were set as follows: 1% design prevalence, 95% sensitivity, 100% specificity, and 99% of confidence. From 2010 to 2020, the targeted surveillance program sampled more than the required sample size of 483 animals (over 966 annually) across the country (Table 3). For *Haliotis diversicolor* subspecies *supertexta*, parameters of the one-stage sampling were set as 15% design prevalence (the disease causes high mortalities in these species within a short time; OIE), 95% sensitivity, 100% specificity, and 95% of confidence. The sample size required to demonstrate the country freedom from the disease in *H. diversicolor* subspecies *supertexta* was calculated as 20 animals/farm household (over 40 annually). The targeted surveillance program sampled more than the required sample size from 2018 to 2020 (Table 3).
In the 1st half of 2021, the two-stage sampling was designed to calculate the sample size required to demonstrate the country freedom from infection with abalone herpesvirus. The required sample size was calculated from the 662 farms of *H. discus hannai* and *H. diversicolor* subspecies *supertexta* using the two-stage sampling method. For *H. discus hannai*, the first stage of farm sampling employed parameters of 2% farm-level design prevalence, 30% individual-level design prevalence, 95% test sensitivity, 95% target cluster sensitivity, 95% target system sensitivity, and a population of 662 farms and calculated the required sample size as 135 farms (Table 4). The number of samples was divided by administrative units as shown in Table 4. For *H. diversicolor* subspecies *supertexta*, all the farms (5 farms in 2021) in Jeju were sampled in the first stage (Table 4). In the second stage, the animal sample size per farm was calculated by applying the following parameters: 95% test sensitivity, 5% type I error, 5% type II error, and a population of 30,000 animals. As a result, the required animal sample size was 22 animals with the cut-point of 3 animals. Based on the two-stage sampling, 2,970 samples and 110 samples are required for *H. discus hannai* and *H. diversicolor* subspecies *supertexta*, respectively, to demonstrate the country freedom in the 1st half of 2021 (Table 4). In the 1st half of 2021, 4,140 samples were randomly selected from 138 farms of *H. discus hannai* and 250 samples from 5 farms of *H. diversicolor* subspecies *supertexta* and tested for infection with abalone herpesvirus. The test results were all negative.
Table 4. Required and tested sample size in the targeted surveillance program of *H. discus hannai* and *H. diversicolor* subspecies *supertexta* by administrative unit in the 1st half of 2021 (two-stage sampling) (Source: NFQS)

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<td>Required sample size</td>
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<td></td>
<td>Animal sample</td>
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<td></td>
<td>Tested sample size</td>
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<td></td>
<td></td>
<td>Animal sample</td>
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<tr>
<td><em>H. diversicolor</em></td>
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<td>subspecies <em>supertexta</em></td>
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<td>No. of farms (2021)</td>
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</table>

* 2 farm samples in Jeju were selected from those culturing both *H. discus hannai* and *H. diversicolor* subspecies *supertexta*. *H. diversicolor* subspecies *supertexta* was sampled from these two selected farms.

**For *H. diversicolor* subspecies *supertexta*, the complete survey of all the 5 farms was carried out.

Summarizing the sampling method for the targeted surveillance program to demonstrate the country freedom from infection with abalone herpesvirus, the surveillance program from 2010 to 2020 applied one-stage sampling and the surveillance in the 1st half of 2021 applied two-stage sampling. The targeted surveillance activities were carried out at the selected farms, resulting in negative results from all tested abalone samples (32,720 animals). This result indicates that the country has been free for the last 12 years from infection with abalone herpesvirus at a confidence level of 95%.

To demonstrate the disease freedom in wild abalone populations, samples of wild *H. discus discus*, *H. discus hannai*, and *H. madaka* were collected from 5 administrative units (South Chungcheong, South Jeolla, North Gyeongsang, Jeju, and Gangwon) and samples of wild *H. diversicolor* subspecies *supertexta* were collected at 2 locations in Jeju. All the samples showed negative test results (Annex II-Figure 13, Annex III-Table3).
2.5. Quarantine of Infection with Abalone Herpesvirus

2.5.1. Import Quarantine

During the period between 2014 to 2021, the country had no imports of abalone for transplant but imported *H. discus hannai*, *H. laevigata*, and *H. rubra* for human consumption (Annex III-Table 4). To import abalone, Korea requests the exporting country to issue the health certificate demonstrating the freedom of *infection with abalone herpesvirus* in the exporting country (Annex III-Table 5). On arrival in Korea, the imported abalone should undergo clinical or laboratory examinations of *infection with abalone herpesvirus* according to the methods described in the *Aquatic Manual*, and those that pass the examinations are only allowed for the domestic entry. When an aquatic organism quarantine officer finds that an imported abalone is confirmed or suspected to be infected or contaminated with abalone herpesvirus, Authorities shall order the consignee to return, incinerate, or bury, etc. it under Article 34 of the Aquatic Life Disease Control Act. The quarantine officer may discard it, if the consignee fails to comply with the order. The quarantine procedure for importing susceptible species to *infection with abalone herpesvirus* will be maintained even if the self-declaration of the country freedom from the disease is published by the OIE.

2.5.2. Export Quarantine

The Republic of Korea exports the single species, *H. discus hannai* (Annex III-Table 6). For each export consignment, laboratory tests of infection with abalone herpesvirus were carried out from 2016 to the 1st half of 2021 without any detection of the disease.

3. Measures implemented to maintain freedom

To maintain its status of country freedom from infection with abalone herpesvirus, the Republic of Korea will maintain its general/targeted surveillance activities and basic biosecurity conditions following the provisions of Article 11.1.6. of the *Aquatic Code* and maintain quarantine following the provisions of Articles 11.1.7 to 11.1.11. of the *Aquatic Code*.

4. Conclusion

Considering that:

1. Fish, shellfish and crustacean farms located in nearshore waters or land in Korea do not share zones or water bodies with any other countries, and are more than 50 km away from neighboring countries (Annex II-Figure 14);

2. The basic biosecurity conditions have been continuously met;

3. Targeted surveillance program to demonstrate the country freedom from infection with abalone herpesvirus, as described in Chapter 1.4. of the *Aquatic Code*, has been in place for the last 12 years for *Haliotis discus hannai* and for the last 4 years for *Haliotis diversicolor* subspecies *supertexta* without any detection of the disease in the Republic of Korea;

4. The Republic of Korea will maintain its general/targeted surveillance activities and basic biosecurity conditions following the provisions of Article 11.1.6. of the *Aquatic Code* and maintain quarantine following the provisions of Articles 11.1.7 to 11.1.11. of the *Aquatic Code*;

The OIE Delegate of the Republic of Korea declares that the country complies with the requirements of a ‘country free from infection with abalone herpesvirus’ as of 9 September 2021, in compliance with the provisions of Chapter 1.4., Article 11.1.4. Point 3 of the *Aquatic Code* (2021) and Chapter 2.4.1. of the *Aquatic Manual*, and is consistent with the information provided in OIE-WAHIS.
Statement to be included in the self-declaration document.  
I, the undersigned, Dr Dongsik Lee  
Delegate of KOREA(REP. OF)  
to the World Organisation for Animal Health (OIE), takes responsibility for the self-declaration of freedom  
from infection with abalone herpesvirus

DISCLAIMER

The OIE, after performing an administrative and technical screening of a self-declaration concerning the animal health status of a country, a zone or compartment ("self-declaration"), as described in the standard operating procedures for self-declarations, reserves the right to publish or not the self-declaration on its website. There shall be no right of appeal from this decision or any recourse of any kind.  
The publication by the OIE of self-declaration on its website does not reflect the official opinion of the OIE. Responsibility for the information contained in a self-declaration lies entirely with the OIE Delegate of the Member concerned.
Neither the OIE nor any person acting on its behalf may be held responsible for:
(i) Any errors, inaccuracies or omissions in the content of a self-declaration,
(ii) The use which may be made of the information contained in a self-declaration;
(iii) Any direct or indirect consequences of any nature arising from or relating to the use of the information contained in a self-declaration.

Drawn up on 9/9/2021

Signature of the Delegate: 

署名

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### Basic concepts (Article 2)
- Recognizing aquatic organisms as an essential source for animal protein supply
- Establishing a routine monitoring and control system for rapidly spreading infectious diseases
- Exploring measures for preventing outbreaks and the spread of infectious disease for sustainable development of the aquaculture industry

### Purpose (Article 1)
- To establish a comprehensive control system to prevent outbreaks and the spread of contagious aquatic organism diseases, to strengthen the quarantine of imported aquatic organisms, etc.
- To contribute to the stable production and supply of aquatic organisms
- To enhance citizens’ health

### Responsibilities and duties of the State, etc. (Articles 3 and 5)
- To establish and implement comprehensive control measures to prevent outbreaks and the spread of a contagious aquatic organism disease
- To establish and implement a comprehensive plan for developing medicines to be used for prevention, diagnosis, and treatment of an aquatic organism disease and technologies to improve the sanitation environment for aquatic organisms

### 3 pillars of aquatic organism disease control

#### Control of contagious aquatic organism diseases (chapter 2)
- Reporting on dead or diseased aquatic organisms
- Implementing disease identification and epidemiological investigation
- Inspecting aquaculture facilities, medication, etc.
- Culling order and restriction on disposal of carcasses
- Incineration, etc. of contaminated things
- Inspection, etc. of aquatic organisms for stocking (Articles 7-21)

#### Quarantine of aquatic organisms (Chapter 3)
- Things designated for a quarantine purpose
- Prohibition of import
- Import quarantine and dispatched quarantine
- Restriction on importing places
- Export quarantine and re-inspection
- Import risk analysis (Articles 22-37)

#### Restrictions etc. on the use of unapproved medicines (Article 40)
- Restriction and ban on the use of medicines for aquatic organisms which are likely to cause a severe hazard
- Restriction and ban on the use of an unapproved medicine, chemical substance, etc.

### Medical treatment of aquatic organisms (Chapter 3(2))
- License of aquatic organism disease inspector
- Prohibition against unlicensed medical treatment
- Medical treatment register and carcass examination register
- Public aquatic organism disease inspector
- Reporting on suspension and closure of business

### Supplementary provisions (Chapter 4)
- Education on control of contagious aquatic organism disease
- Compensation and subsidization to owners of aquatic organisms that have become subject to culling, etc.
- Appointment of an honorary observer for control of aquatic organism disease
- Subsidization, etc. for expenses

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Figure 1. Summaries of the Aquatic Life Disease Control Act
Figure 2. NFQS headquarters and branch offices providing disease control service (right) and the respective service areas (left)
Figure 3. Diagram of the national aquatic life disease control system in the Republic of Korea

Figure 4. Quarantine procedure for aquatic organisms in the Republic of Korea

Figure 5. Farms for *Haliotis discus hannai* in Korea (the species is cultured in cage farms on the western and southern coast)
Figure 6. Farms for *Haliotis diversicolor supertexta* in Jeju (spats are grown in the land-based tanks, and then stocked in the coast for grow-out)

Figure 7. Distribution of *Haliotis discus hannai* farms in Korea in 2021

Figure 8. Distribution of *Haliotis diversicolor supertexta* farms in Korea in 2021

Figure 9. Distribution of farm samples of *H. discus hannai* for targeted surveillance (2010-2020, one-stage surveillance)

Figure 10. Distribution of average sampling sizes of *H. discus hannai* and *H. diversicolor supertexta* for targeted surveillance (2010-2020, one-stage sampling)
Figure 11. Distribution of farm samples of *H. discus hannai* for targeted surveillance (2021, two-stage surveillance)

Figure 12. Distribution of farm samples of *H. diversicolor supertexta* for targeted surveillance (2021, two-stage sampling)

Figure 13. Sampling sites of wild abalones (left) and wild *H. diversicolor supertexta* (right) in 2021
Figure 14. Distance between Korean abalone farms and neighboring countries
Table 1. The procedure of laboratory examination of infection with abalone herpesvirus

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<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>NFQS (Aquatic Disease Control Division)</td>
<td>Determination</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
</tr>
</tbody>
</table>

1) Samples with a positive PCR result are sent to the Aquatic Disease Control Division, NFQS for a confirmatory diagnosis.
2) If negative from second PCR, the sample is confirmed negative and the ongoing histopathology is stopped.
※ Final positive confirmation is only made when both PCR (including sequence analysis of the PCR product) and histopathology show a positive result.
Table 2. Total production of abalone species in the Republic of Korea (unit: MT)

<table>
<thead>
<tr>
<th>Production type</th>
<th>Abalone species</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmed</td>
<td>Abalones</td>
<td>6,779</td>
</tr>
<tr>
<td></td>
<td>Haliotis discus discus</td>
<td>3</td>
</tr>
<tr>
<td>Captured</td>
<td>Abalones</td>
<td>162</td>
</tr>
</tbody>
</table>

*In Korea, there are no abalone farms that culture Haliotis discus discus as a single target species. This species is cultured in Jeju on a minimum scale for stocking in the sea.*

Table 3. Number of tested samples of wild abalones by administrative unit in the 1st half of 2021 (Source: NFQS)

<table>
<thead>
<tr>
<th>Species</th>
<th>Administrative unit</th>
<th>South Chungcheong</th>
<th>South Jeolla</th>
<th>North Gyeongsang</th>
<th>Jeju</th>
<th>Gangwon</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. discus discus</td>
<td></td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>6</td>
<td>13</td>
<td>76</td>
</tr>
<tr>
<td>H. discus hannai</td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>H. madaka</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>H. diversicolor supertexta</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>-</td>
<td>60</td>
</tr>
<tr>
<td>Total tested samples</td>
<td></td>
<td>20</td>
<td>21</td>
<td>21</td>
<td>68</td>
<td>31</td>
<td>161</td>
</tr>
</tbody>
</table>

*all samples tested negative*

Table 4. Imports of abalone for human consumption (unit: import quarantine count; weight (kg)) (Source: NFQS)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>quarantine count</td>
<td>Weight (kg)</td>
<td>quarantine count</td>
<td>Weight (kg)</td>
<td>quarantine count</td>
<td>Weight (kg)</td>
<td>quarantine count</td>
<td>Weight (kg)</td>
</tr>
<tr>
<td>Live Haliotis discus hannai</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>1673</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2000</td>
</tr>
<tr>
<td>Frozen Haliotis discus hannai</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>503</td>
</tr>
<tr>
<td>Live Haliotis laevigata</td>
<td>1</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Live Haliotis rubra</td>
<td>3</td>
<td>80</td>
<td>1</td>
<td>10</td>
<td>3</td>
<td>28</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 5. The authorities of each exporting country issuing health certificate for imported abalone for human consumption to the Republic of Korea from 2014 to 2020 (Source: NFQS)

<table>
<thead>
<tr>
<th>Species</th>
<th>Exporting country (quarantine count)</th>
<th>Authorities issuing health certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live <em>Haliotis discus hannai</em></td>
<td>Japan (8)</td>
<td>The ministry of Agriculture, Forestry and Fisheries(MAFF) or local inspection authorities certified by MAFF</td>
</tr>
<tr>
<td></td>
<td>China (7)</td>
<td>General Administration of Customs of the People’s Republic of China(GACC)</td>
</tr>
<tr>
<td>Frozen <em>Haliotis discus hannai</em></td>
<td>Mexico (1)</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Australia (1)</td>
<td>Department of Agriculture, Water and the Environment</td>
</tr>
<tr>
<td>Live <em>Haliotis laevigata</em></td>
<td>Australia (1)</td>
<td>Department of Agriculture, Water and the Environment</td>
</tr>
<tr>
<td>Live <em>Haliotis rubra</em></td>
<td>Australia (10)</td>
<td>Department of Agriculture, Water and the Environment</td>
</tr>
</tbody>
</table>

* Wild abalones were imported from Mexico in 2017 under quarantine exemption and the imported animals were tested by PCR with negative results. Since no negotiations have been carried out on health certificate with Mexico, abalone imports from the country are currently banned.

Table 6. Exports of live abalone (unit: export quarantine count; weight (MT)) (Source: NFQS)

<table>
<thead>
<tr>
<th>Species</th>
<th>2016 quarantine count</th>
<th>2016 Weight (MT)</th>
<th>2017 quarantine count</th>
<th>2017 Weight (MT)</th>
<th>2018 quarantine count</th>
<th>2018 Weight (MT)</th>
<th>2019 quarantine count</th>
<th>2019 Weight (MT)</th>
<th>2020 quarantine count</th>
<th>2020 Weight (MT)</th>
<th>1st half 2021 quarantine count</th>
<th>1st half 2021 Weight (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live <em>Haliotis discus hannai</em></td>
<td>19</td>
<td>17</td>
<td>4</td>
<td>2</td>
<td>82</td>
<td>43</td>
<td>43</td>
<td>244</td>
<td>195</td>
<td>306</td>
<td>291</td>
<td>155</td>
</tr>
</tbody>
</table>