Status of Aquatic Animal Health in Indonesia

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Abstract

Fish disease is one of the main obstacles in the success of aquaculture production because of the loss caused by it. The outbreak of diseases has resulted to a substantial economic loss which was reported to have reached almost USD 400 million. To minimize the impact of losses caused by fish diseases, the Indonesian government through the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries has a fish disease monitoring and surveillance program. The program aims to monitor the occurrence of fish diseases in Indonesia, especially in the fish and shrimp farming centers and to educate on how to control them. In 2018, the monitoring and surveillance program have 34 provinces with 100 districts/cities location targets targeting fish and shrimp diseases. Based on the results of the monitoring and surveillance activities in 2018, the fish and shrimp are affected by the following diseases: White Spot Syndrome Virus (WSSV), Infectious Hypodermal and Haemotopoietic Necrosis Virus (IHHNV), Infectious Myonecrosis Virus (IMNV), Iridovirus, *Aeromonas hydrophila*, *Streptococcus iniae*, *Streptococcus agalactiae*, *Edwardsiella ictaluri* and Ichthyophthiriasis. The program to control fish diseases in order to minimize the losses has also been carried out by the government including trainings on the application of biosecurity, the use of vaccines, probiotics, immunostimulants and herbal medicines.

Introduction

Indonesia is an archipelago with 17,504 islands and 99,093 km coastline as a large asset to develop aquaculture. Aquaculture in the fisheries subsector has been growing rapidly lately, due to efforts to increase production which has led to intensive aquaculture. In intensive aquaculture, success in production is largely determined by several factors, including seeds, water quality, and aquaculture management. However, obstacle become one of the determinants of failure in aquaculture. The obstacles that can be found in the field such as availability of inadequate seedlings and fish diseases which can inhibit the increase of national fisheries production and detrimental fish and shrimp farmers in Indonesia.

Disease is one of the main obstacles in the success of aquaculture production because of the loss caused by it. The emergence of disease is a dynamic process and interaction between the host, pathogen, and the environment. In nature, the three factors are balanced, so there is no disease. Diseases that are often found in fish and shrimp farming in Indonesia are infectious and non-infectious diseases. Infectious disease is a disease caused by

microorganisms, such as bacteria, fungi, parasites, and viruses. On the other hand, non-infectious diseases that can be found in fish farming, are those related to the environment or nutrition. Infectious diseases can cause death and the rates are reaching 90–100 %, causing huge losses to fish and shrimp farmers.

The outbreak of diseases has resulted to a substantial economic loss which was reported to have reached almost USD 400 million (Lusiastuti *et al*., 2020). To minimize the impact of losses caused by fish diseases, the Indonesian government through the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries has a fish disease monitoring and surveillance program. The program aims to monitor the occurrence of fish diseases in Indonesia, especially in fish and shrimp farming centers and to educate on how to control them. In 2018, the monitoring and surveillance program targeting fish and shrimp diseases included 34 provinces and 100 districts/cities. Based on the results of monitoring and surveillance activities in 2018, shrimp are affected by the following diseases: White Spot Syndrome Virus (WSSV), Infectious Hypodermal and Haemotopoietic Necrosis Virus (IHHNV), Infectious Myonecrosis Virus (IMNV); fish with Iridovirus, *Aeromonas hydrophila*, *Streptococcus iniae*, *Streptococcus agalactiae*, *Edwardsiella ictaluri* and Ichthyophthiriasis.

In addition, a program to control fish diseases in order to minimize the losses has also been carried out by the government. Among these are trainings on the application of biosecurity measures, the use of vaccines, probiotics, immunostimulants and herbal medicines. Biosecurity is one of the key factors in preventing the entry and spread of fish and shrimp diseases. The use of vaccines, probiotics and immunostimulants are useful to improve the immune system of fish and shrimp making them more resistant to diseases. Natural herbal medicines have been used to replace antibiotics as antibacterial. The following provides details on the current condition of fish and shrimp diseases in Indonesia.

Shrimp diseases

One of the factors causing failure in shrimp farming in ponds is diseases. The most dangerous and detrimental disease for farmers are viral infections (WSSV, TSV, YHD, IMNV, and IHHNV). Based on the results of monitoring and surveillance activities in 2018, diseases affecting shrimps are: White Spot Syndrome Virus (WSSV), Infectious Hypodermal and Haemotopoietic Necrosis Virus (IHHNV), and Infectious Myonecrosis Virus (IMNV).

White spot syndrome virus (WSSV)

In 2018, WSSV disease was found in several shrimp pond centers, the areas affected by this disease includes: Aceh, West Java, Central Java, East Java, Yogyakarta, Bali, South Sulawesi and West Nusa Tenggara. The average mortality rate reached 60–100 %, causing high economic losses. Economic losses in 2016 due to WSSV outbreak were approximately 300 million USD (Shinn *et al*., 2018). White Spot Syndrome (WSS) is a viral disease in penaeid shrimp farming, especially tiger shrimp (*Penaeus monodon*), kuruma shrimp (*P. japonicus*), *P. chinensis*, *P. indicus*, and white leg shrimp (*Litopenaeus vannamei*). This disease, caused by a Baculovirus, is very virulent with mortality reaching 100% in just few days after infection. Some fresh and seawater crustaceans, as well as shrimp that survive after being infected with this disease, usually have the potential to be carriers of white spot disease (OIE, 2019). The attack of white spot disease in Indonesia was first reported in areas of tiger shrimp farms in Tangerang, Serang, and Karawang in mid 1994 (Mahardika *et al*., 2004). At present, WSSV was believed to have spread to various shrimp ponds throughout Indonesia.

Transmission usually occurs horizontally through cannibalism in shrimp. Water and wild crustaceans, such as crabs, can also be a factor in the spread of disease. The WSS disease agent can survive in the environment for 3–4 days (OIE, 2019). In acute cases, feed consumption was significantly decreased. Infected shrimps are weak, swimming near the surface and undirected. In addition, white spots are usually found on the carapace and rostrum of shrimp when entering the sub-acute and chronic phases. Dying shrimp had brownish red colour (Bondad-Reantaso *et al*., 2001).

Polymerase Chain Reaction (PCR) was used to detect White Spot Syndrome (WSS), in addition to observing the clinical signs.

Infectious hypodermal and haemotopoietic necrosis virus (IHHNV)

In 2018, shrimp infected with IHHNV was found in West Java, Banten and South Sulawesi with an average mortality rate of 30-60%. IHHNV is a disease in penaeid shrimp caused by Parvovirus. Transmission of IHHNV can occur both vertically, through the female reproductive organs, or horizontally, through cannibalism or cohabitation in water (OIE, 2019). IHHNV was first discovered infecting *P. vannamei* postlarvae in the hatchery and broodstock on Situbondo, East Java in 2003. IHHNV infection in shrimp can cause retardation of shrimp growth. Observed clinical signs are decrease in feed consumption, slow growth, swim on the surface, and abnormal swimming behavior. Further observation includes: white patches found between the exoskeleton and carapace segments. In addition, white leg shrimp are non-uniform in size, have bent rostrum, and rough cuticles (Bondad-Reantaso *et al*., 2001).

Diagnosis of IHHNV can be done by observation of clinical signs and molecular laboratory testing via PCR.

Infectious myonecrosis virus (IMNV)

In 2018, IMNV disease was found in several shrimp pond centers. Areas affected by this disease includes Central Java, East Java, Banten, South Sulawesi, Bali and West Nusa Tenggara with an average mortality rate of 30–60 %. Data on economic losses in 2016 due to IMNV disease amounted to USD 95.6 million (Shinn *et al*., 2018). This IMNV disease is caused by a Toti-like virus from the Totiviridae family, with both vertical and horizontal transmission. The pattern of disease attacks can either be acute or chronic. The acute attack marked by clinical signs and mortality reaching 60–85 %, while chronic marked by low mortality but persistent (OIE, 2019). IMNV was first discovered in the white leg shrimp ponds at Situbondo, East Java, Indonesia in 2006 (Tang *et al*., 2019). Specific clinical signs of Infectious Myonecrosis Virus (IMNV) disease are white (necrotic) areas in the muscles that resemble strokes, especially in the last 1/3 of shrimp body parts. In addition, muscle necrosis is also sometimes observed as a red discoloration (looks like boiled or cooked) of the tail uscle with a firm boundary (OIE, 2019).

Observation of specific clinical signs and testing using the PCR method are used to diagnose Infectious Myonecrosis Virus (IMNV).

Fish diseases

Based on the results of monitoring and surveillance activities in 2018, diseases affecting the cultured fishes are: Iridovirus, *Aeromonas hydrophila*, *Streptococcus iniae*, *Streptococcus agalactiae*, *Edwardsiella ictaluri* and Ichthyophthiriasis.

Iridovirus

In 2018, spread of iridovirus are in the islands of Riau and West Nusa Tenggara, infecting large grouper and snapper fish with a mortality rate of 30 %. The first case of Iridovirus infection in grouper was reported in North Sumatra by Rukyani *et al*. (1993) In 2001, the viral infection spread to Bali and infect grouper seeds (Mahardika *et al*., 2001). Data on economic losses in 2014 due to the attack of iridovirus is USD 12.5 million. Iridovirus in brackish or sea water fish was caused by a virus from the genus Ranavirus which has a diameter approximately 160–200 nm. Viral replication occurs in the cytoplasm of infected cells and can grow well *in vitro* in tissue culture derived from groupers.

Fish that are very susceptible to iridovirus which includes snapper and grouper. Transmission of this virus can occur through direct contact or contaminated water. The target organs of this disease are the kidneys and lymph which can lead to systematic infection that can can infect other organs, such as the liver, heart, thymus, stomach, and intestines. The mortality rates of this disease ranges between 0 % and 100 % depending on factors such as host fish species, fish size, fish age, water temperature, and other culture conditions (OIE, 2019).

Common clinical signs found in fish infected with iridovirus are decreased appetite, weak swimming movements and coordination, and fish lying on one side of the body found at the bottom of the pond. The dark body color of the fish, anemia (pale gill color), and swelling of the spleen organs are the specific clinical signs of this disease (OIE, 2019).

Recognition of clinical signs with the help of molecular testing, such as PCR, is one of the most effective ways in diagnosing this disease.

Aeromonas hydrophila

Motile Aeromonas Septicemia (MAS) is a disease caused by *Aeromonas hydrophila* bacteria which has spread in several regions of Indonesia including West Java, Central Java, Banten, Jambi and South Kalimantan. This disease has been reported to have infected dumbo catfish seeds with a mortality rate between 80–100 % (Kusdarwati *et al*., 2018). MAS was first plagued Indonesia in 1980 in carp (Djajadiredja *et al*., 1983). *Aeromonas hydrophila* is a gram-negative bacteria that are native inhabitants of aquatic environments. They are often found in waters with high levels of organic matter and sewage (Scullion, 2008).

Aeromonas hydrophila has been linked to several diseases in fish, including tail rot, fin rot, and haemorrhagic septicemia. Haemorrhagic septicemia is characterized by a small surface wound, often leading to flaking of the scales, bleeding in the gills and rectum, ulcers, exophthalmia (swollen eyes), and swelling of the stomach. On the inside, it is possible to have ascitic fluid in the peritoneal cavity, lack of red blood cells, and swelling of the kidneys and liver (Stratev and Odeyemi, 2016).

The detection method used was isolation and identification of bacteria through biochemical testing or molecular methods through PCR technique.

Streptococcosis

Streptococcosis disease in 2018 spread in the South Kalimantan region that infect tilapia aquaculture commodities with an average mortality rate of 30–60 %. Based on 2014 reports, economic losses due to Streptococcosis disease reached USD 1.2 million. Supriyadi *et al*., (2002) reported that Streptococciasis disease first became an epidemic in tilapia cultivation centers

throughout Java in 2002. Streptococcosis is caused by *Streptococcus agalactiae* and *S. iniae. S. iniae* infection often occurs in sea water aquaculture; whereas *S. agalactiae* was more commonly found in freshwater aquaculture. This bacterium is one type of bacteria that causes quite serious diseases in several types of fish, including tilapia. Fish infected with this bacterium generally die (survival of less than 50 %) within 3–7 days (Yanong and Francis-Floyd, 2002). Clinical signs of fish with streptococcus infection includes hemorrhage, exopthalmia, melanosis, ulcers, or sores on the surface of the body, loss of orientation, damage to the structure of the spine, anorexia, and damage to the brain (Mishra *et al*., 2018).

The detection method used was isolation and identification of bacteria through biochemical testing or using molecular methods through the PCR technique.

Edwardsiella ictaluri

Edwardsiella ictaluri bacteria in 2018 was known to infect catfish farming centers in the South Kalimantan region with a mortality rate reaching 30–60 %. *E. ictaluri* is a bacterium that causes systemic bacterial disease called enteric septicemia of catfish (ESC). This bacterium was initially known to infect cannel catfish, but was later known to infect other types of fish such as other species of catfish and eel. Based on experiments, some types of fish such as trout, tilapia, salmon and ornamental fish can also be infected with this type of bacteria. *E. ictaluri* was first discovered in Indonesia in 2002 (Sakai *et al*., 2009), infecting catfish in the Jambi region and also caused significant economic losses. In South Kalimantan and Central Kalimantan was also reported that in 2012 it had infected catfish farming and caused more than 50 % mortality. Clinical signs of fish infected with *E. ictaluri* includes: appearance of red spots on the body of the fish, swelling of the abdomen and fish swimming without direction/ whirling (Hawke *et al*., 2013).

The detection method used was isolation and identification of bacteria through biochemical testing or using molecular methods through PCR technique.

Ichthyophthiriasis

In 2018, Ichthyophthiriasis spread almost in all regions of Indonesia. The affected areas include Jambi, Bengkulu, Jakarta, West Java, Central Java, East Java, South Kalimantan and Yogyakarta. This disease attacks the centers of freshwater aquaculture with a mortality rate of 30–60 %. This disease was caused by the parasitic *Ichtyophtyrius multifilis. I. multifilis* belongs to the parasitic ecto group, a shaggy-haired protozoan, an obligate parasite in freshwater that must find a new host within 48 hours (at 25–27 °C). The parasite has hairy structures (cilia) and horseshoe-like core. This parasite measures 30 µm × 50 µm covered with cilia. This parasite infests the skin, fins, and gills. Clinically, infected fish become hyperactive and irritably swim while rubbing their bodies against rocks or aquarium walls, epidermal hyperplasia, and has white spots on the skin or gills (Klinger and Francis-Floyd, 2009).

An infected fish lose appetite and becomes weak or has a decreased activity. In severe infections, especially if the attack is on the gills, the gills become pale and swollen. This interferes with oxygen absorption, resulting in respiratory distress and eventually to death. This parasite is known as white spot disease or ich and is very common in domesticated fish in aquariums or in hatcheries. Ichthyophthiriasis or ich is very contagious and spreads rapidly (Francis-Floyd and Reed, 2009).

Figure 1. Fish and shrimp deaths due to disease attacks

Handling of fish and shrimp disease in Indonesia

In terms of efforts to control fish diseases, the government continues to conduct trainings related to the application of biosecurity measures in aquaculture. The concept of biosecurity is the most appropriate step to reduce the entry of pathogens in aquaculture environment and prevent its spread to other places. The principle of applying biosecurity includes knowledge of the disease, list of diseases, availability of tools/methods for detection of pathogens, control of the pathogen, management of the environment, application of Best Management Practices (BMP), disease eradication programs, and disinfection of pathogens. The application of biosecurity measures thoroughly and strictly in the aquculture environment is one of the effective efforts that can be done during the production process. The Indonesian government also promotes the use of vaccines, probiotics, immunostimulants and natural medicines in the context of preventing and treating fish diseases. In addition, zoning of free and infected areas is based on monitoring and surveillance of fish diseases carried out by the government and limiting the entry and exit of shrimp to and from the free zone (quarantine).

In an effort to detect the presence of fish diseases, the Indonesian government under the Ministry of Marine Affairs and Fisheries has 91 fish disease testing laboratories spread throughout Indonesia. Efforts to control fish diseases in the aquaculture area are inseparable from the important role of the laboratory which can have significant benefits and have an extraordinary impact on the community through laboratory testing services at the aquaculture center. The fish disease testing laboratory supports the success of the program to increase aquaculture production through water quality monitoring and surveillance activities, inspection of fish diseases, as well as providing recommendations for the prevention of fish diseases and sustainability of the environment. Through these activities, it is expected to improve the ability of the early warning system and early response, so that the possibility of outbreaks of fish diseases and pollution of the aquaculture environment can be immediately handle.

Emergency response of exotic fish disease in Indonesia

The problem of fish and shrimp diseases in aquaculture businesses is increasing which is caused by several problems. This includes an increase in the area of aquaculture, a large number of live fish trade, intensive aquaculture, less intensive monitoring and surveillance efforts, and the entry of new fish commodities that are not accompanied by Import Risk Analysis (IRA) studies. In addition, quarantine acts are not supported by adequate equipment and limited information of the farmers in the effort to control the disease. Moreover, the problem of pollution in the aquaculture environment contributes to the susceptibility of the cultured organism. Alongside the widespread of diseases in the area of aquaculture, it is necessary to immediately implement policies and strategies for fish health management so that fish are kept protected from diseases.

Indonesia continues the efforts to prevent the entry of diseases in shrimp that have potential risk and can reduce the quality and quantity of shrimp aquaculture production in Indonesia. One of the concerns is acute hepatopancreatic necrosis disease (AHPND). AHPND has now spread to several countries such as China, Thailand, Vietnam, Malaysia, Mexico and the Philippines. So, the Indonesian government continues to make efforts to disseminate to all shrimp farming communities related to the prevention of AHPND disease. In addition, the Indonesian government made regulations regarding the prevention of new diseases that had not yet entered Indonesian territory and had become epidemic in several countries. This enables the government to form a task force for AHPND disease prevention consisting of government elements, stakeholders, and academic experts.

Figure 2. Training on the application of biosecurity measures and the use of vaccines, probiotics, and immunostimulants

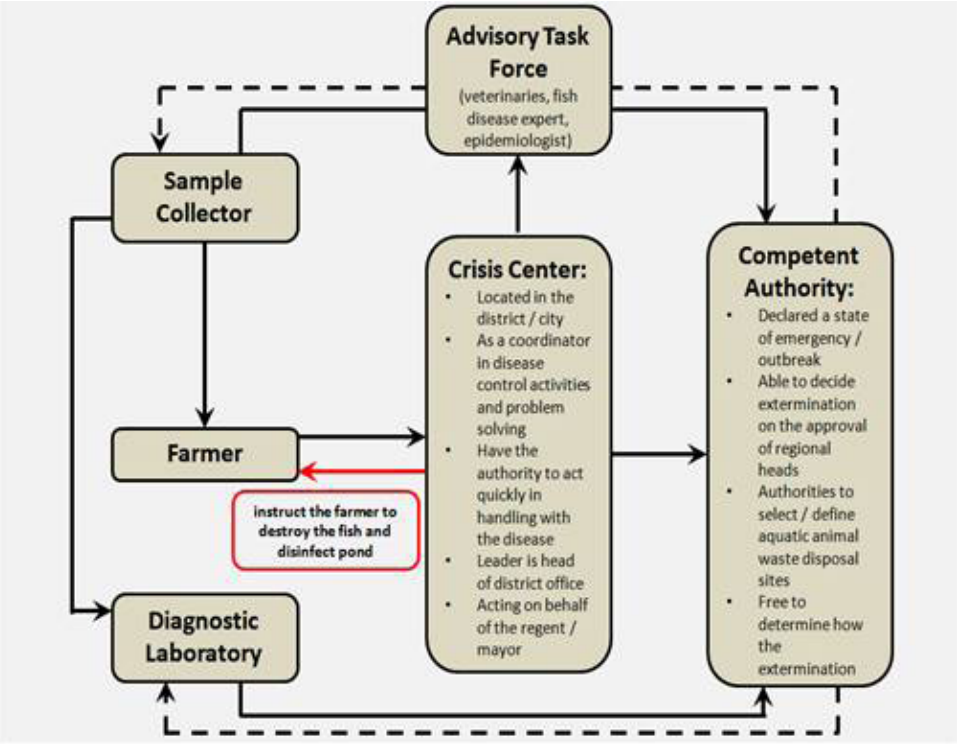

Figure 3. Task Force Institution in Emergency Response of Fish Disease

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