

# Emergency Preparedness and Response Systems for Aquatic Animal Diseases in Malaysia

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## Abstract

The Department of Fisheries (DoF) Malaysia is the custodian of the Fisheries Act 1985, which serves as the main legislative source for subsidiary regulations, including aquaculture and fish health management. It has established Emergency Disease Task Force Committee for any emergency related to disease outbreak as well as standard operating procedures for massive fish kill. This committee consists of taskforce teams from federal and/or state fisheries and oversee the operations of the task force. Fisheries Biosecurity Division under DoF Malaysia holds the primary responsibility for managing the country's emergency preparedness and response system for aquatic animal diseases. As for early detection system, Fisheries Biosecurity Division has established official control and official analysis for targeted diseases listed under OIE and National Listed Diseases. Fish health monitoring programmes are conducted every six months and samples are analyzed by accredited laboratories. Quarterly and half year reports are submitted to representative offices for the health status of targeted disease. Apart from the targeted fish health monitoring program, epidemiology on common and emerging diseases are conducted by National Fish Health Research Division (NaFisH) which is the only research and development arm under DoF. Laboratories under Fisheries Biosecurity Division are responsible for organizing and coordinating surveillance programs for diseases in the OIE list while NaFisH is responsible for conducting research and development on aquatic diseases that cause high losses in industry since 2002. Currently, the DoF has four servicing laboratories under Fisheries Biosecurity Division and one NaFisH laboratory under Fisheries Research Institute for fish health diagnosis in Malaysia.

Keywords: Aquatic Health, Emergency Preparedness, Response Systems, Malaysia

## Introduction

Aquaculture in the Malaysia has grown dramatically and continued to show a rapid growth. The amount of fish demand is expected to increase from 1.3 million tons in 2010 to 1.9 million tons in 2020 with growth of 3.8% per year. Per capita consumption of fish is expected to increase from 20 to 55 kilogram with growth of 1.9% annually. Aquaculture production is projected to increase to 790,000 metric tons, equivalent to 41% of total demand state fish in 2020. Export value of aquaculture, including fish products especially fillet, is expected to increase from RM1.4 billion in 2010 to RM3.2 billion in the year 2020. From 2016 to 2017, fish production from aquaculture grew 5% per year (DoF Malaysia 2016 and 2017). In terms of commodities, seaweeds contributed 47.5% from the total aquaculture production in 2017, followed by Hawaiian white shrimp (8.3%), freshwater catfish (8.2%), sea bass (7.1%), red tilapia (6.0%) and pangasius (4.7%) (Figure 1).

As one of the fast growing industry in Malaysia, aquaculture sector also faced challenges related to various aquatic animal issues, managing or untimely response to disease emergencies such as disease outbreak, mass mortalities, emerging or re-emerging diseases. In order to fulfil the requirements of increased production and to secure food security for long-term sustainability, Department of Fisheries (DoF) Malaysia has been focusing on efforts to improve the quality, efficiency and effectiveness of service delivery and partnerships between the DoF and stakeholders. The DoF is the Competent Authority (CA) for fish

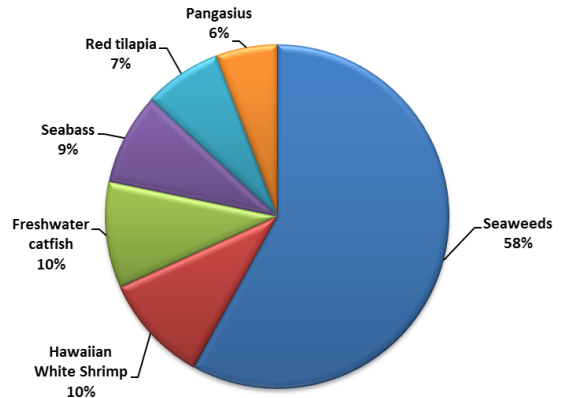


FIGURE 1. Growth of Aquaculture in 2017, Malaysia

health and biosecurity management in Malaysia (Figure 2). The CA manages fish health based on main legislative acts for subsidiary regulations, including aquaculture and fish health management. The relevant legislation implemented in Malaysia are the Fisheries Act 1985, Malaysian Quarantine And Inspection Services Act 2011, Feed Act 2009 and Animal Welfare Act 2015. As for East Malaysia, addition regulation such Inland Fisheries and Aquaculture Enactment 2003 has been implemented by DoF Sabah as well as State Fisheries Ordinance 2003 by Department of Agriculture (DoA) Sarawak (Table 1). The relevant government departments use the legislation as guidelines, and through detailed discussion with stakeholders, to formulate mechanisms that are standardised and suit the needs of industry and international trade. The implementation required rapidity and effectiveness on government to recognise and react to the first report of serious disease through early warning, first detection and responding system.

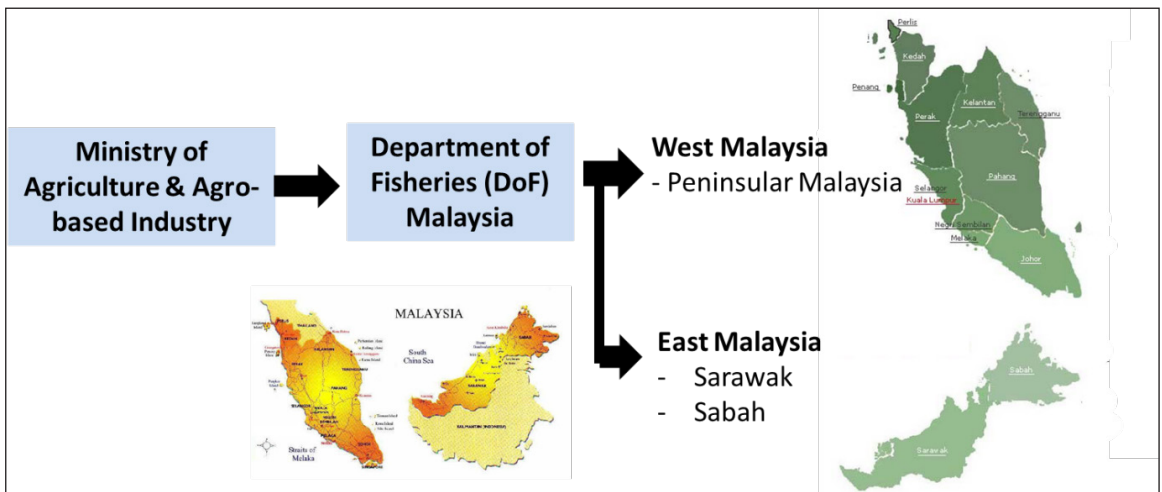


FIGURE 2. National Government Agency (CA) of fish health in Malaysia

**TABLE 1.** Legislative acts on fish health implemented in Malaysia

Act	Regulation
Fisheries Act 1985 (Act 317)	<ul style="list-style-type: none"> <li>• Fisheries Regulation 1990 (Marine Culture System)</li> <li>• Fisheries Regulation 2002 (Cockle Culture and Conservation)</li> <li>• Fisheries Regulation 2009 (Quality of Fish for Export to the European Union)</li> <li>• Fisheries Regulation 2012 (Fish Disease Control Compliance for Exports &amp; Imports)</li> <li>• Fisheries Regulations 2010 (Prohibition of Import, etc., of Fish) (Amendment 2011)</li> <li>• Fisheries (Inland Fisheries Aquaculture) (Federal Territory of Kuala Lumpur and Federal Territory of Labuan) Rules 2017</li> </ul>
Malaysia Quarantine And Inspection Services Act 2011 (Act 728)	<ul style="list-style-type: none"> <li>• Malaysian Quarantine and Inspection Services Regulations 2013 (Quarantine and Inspection)</li> <li>• Malaysian Quarantine and Inspection Services Regulations 2013 (Quarantine Procedures)</li> <li>• Malaysian Quarantine and Inspection Services Regulations 2013 (Issuance of Permit, License and Certificate)</li> <li>• Malaysian Quarantine and Inspection Services Regulations 2013 (Registration of Importers, Exporter and Agents)</li> <li>• Malaysian Quarantine and Inspection Services Regulations 2013 (Fees and Charges)</li> </ul>
Feed Act 2009 (Act 968) Section 53(2) (b), (c), (e), (f), (g) and (h)	<ul style="list-style-type: none"> <li>• Feed (License to Import Feed and / or Feed Additive) Regulations 2011</li> <li>• Feed (Labelling of Feed and Feed Additive) Regulation 2011</li> <li>• Feed (Prohibited Use of Antibiotics, Hormones or Others Chemicals) Regulation 2011</li> <li>• Feed (Manufacture and Sale of Feed and Feed Additive) Regulation 2011</li> <li>• Feed (Methods of Analysis of Feed and the Form of Certificate of Analysis) Regulation 2011</li> </ul>
Inland Fisheries and Aquaculture Enactment 2003 of Sabah State	<ul style="list-style-type: none"> <li>• Part IV - Aquaculture</li> <li>• Part VI - Control of Fish</li> <li>• Part VI - Control of Fish Diseases</li> <li>• Part X - Enforcement</li> </ul>
Law of Sarawak, Chapter 54, State Fisheries Ordinance 2003	<ul style="list-style-type: none"> <li>• Part VI - Control of Fish Diseases</li> <li>• Part VII - Fish Products and Fish Processing</li> <li>• Part VIII - Enforcement</li> </ul>

## Early Warning System

DoF Malaysia has established Emergency Disease Task Force Committee (EDTFC) which acts as national aquatic emergency preparedness and response committee toward any emergency related to disease outbreak as well as standard operating procedures for massive fish kill. This committee led by Fisheries Director General and cover Fishkill Task Force Committee and State Task Force Committee. The main tasks are to monitor, provide guidance, evaluate, oversight of progress and assist in key decisions regarding the implementation of task force.

Information from national aquatic epidemiology, alerts news from DoF Malaysia Corporate Communications Unit (CCU), National Aquatic Animal Health Focal Point (NAAHFP) for OIE and reports from DoF staff serve as early warning system for DoF Malaysia particularly to EDTFC (Table 2). The national authority monitors aquatic animal disease events in other countries through internet, literature search and attending regional consultation meetings, seminar, symposium, conference or workshop. CCU will gather news related to fisheries through social media while NAAHFP will receive latest notification of any new diseases from OIE and NACA website and subsequently will alert DoF. DoF staff participating in the regional consultation meetings, training, seminar, symposium and conference will prepare a

**TABLE 2.** National information sharing networks

Network	Information sharing
Corporate Communications Unit (CCU) under DoF	<b>Social media (Facebook, Twitter, Instagram, Whatsapp)</b> <ul style="list-style-type: none"> <li>• Fisheries related news/issues</li> </ul>
National aquatic animal health focal point (NAAHFP) for OIE - E-network Malaysian Aquatic Animal Health Expert (MAAHE)	<b>E-mail</b> <ul style="list-style-type: none"> <li>• Quarterly Aquatic Animal Disease Report (QAAD)</li> <li>• Aquatic Animal Disease Report (OIE)</li> <li>• The Aquatic Animal Scientific Commission Report (OIE)</li> </ul>
Industry Consultation	<b>Dialogue and meetings</b> <ul style="list-style-type: none"> <li>• Specific issues</li> <li>• New regulation/requirement</li> </ul>
Farmers Day	<b>Seminar and dialogue</b> <ul style="list-style-type: none"> <li>• Annual event organized by state</li> </ul>

detailed report and alert DoF on immediate action if required. If the alert news can cause impact to industry, Fisheries Biosecurity Division will notify the EDTFC to take appropriate action (Figure 3). Currently, DoF Malaysia is developing a specific system regarding fish health information. Under this system, information on Official Control which covers detailed profiles and activities of stakeholders, fish disease notifications, reporting and mapping will be made available. As for Official Analysis, it will include information on the disease surveillance programme and laboratory analysis. This system will be ready for use at DoF headquarter and at the state level in coming year.

DoF Malaysia also conduct risk analysis to identify high priority aquatic disease threats for introduction of alien aquatic species. Import Risk Analysis (IRA) covers list of diseases, biodiversity or genetic threat to national aquatic resources which will be carried out during the application process.

### Early Detection and Response System

DoF Malaysia has developed a Fish Disease Notification Form that has been distributed to registered farms/premises (Figure 4). All registered

farms/premises are obliged to notify DoF in case of the occurrence or suspicion of a listed fish disease or the occurrence of mass mortality. Farmers, state aquaculture or biosecurity fishery officers act as front line and continue to receive training and awareness on fish health management from time to time.

Apart from EDTFC, DoF Malaysia also established national aquatic epidemiology or on-ground aquatic animal disease management through Fisheries Biosecurity Division and National Fish Health Research Division (NaFisH). Fisheries Biosecurity Division is responsible for (1) preparing and drafting policies on fish and public health management, (2) providing laboratory services on fish disease diagnostics and food safety, (3) implementing the development of fish and fisheries product standards at national and international level, (4) coordinating on capacity building of staff and their training on relevant fields, and (5) managing the administration and financial aspect of the Fisheries Biosecurity Division. On their hand, NaFisH responsibilities included (1) conducting and implementing research and development of aquatic animal health specifically on fish, shrimp and mollusc health management, (2) providing laboratory services on

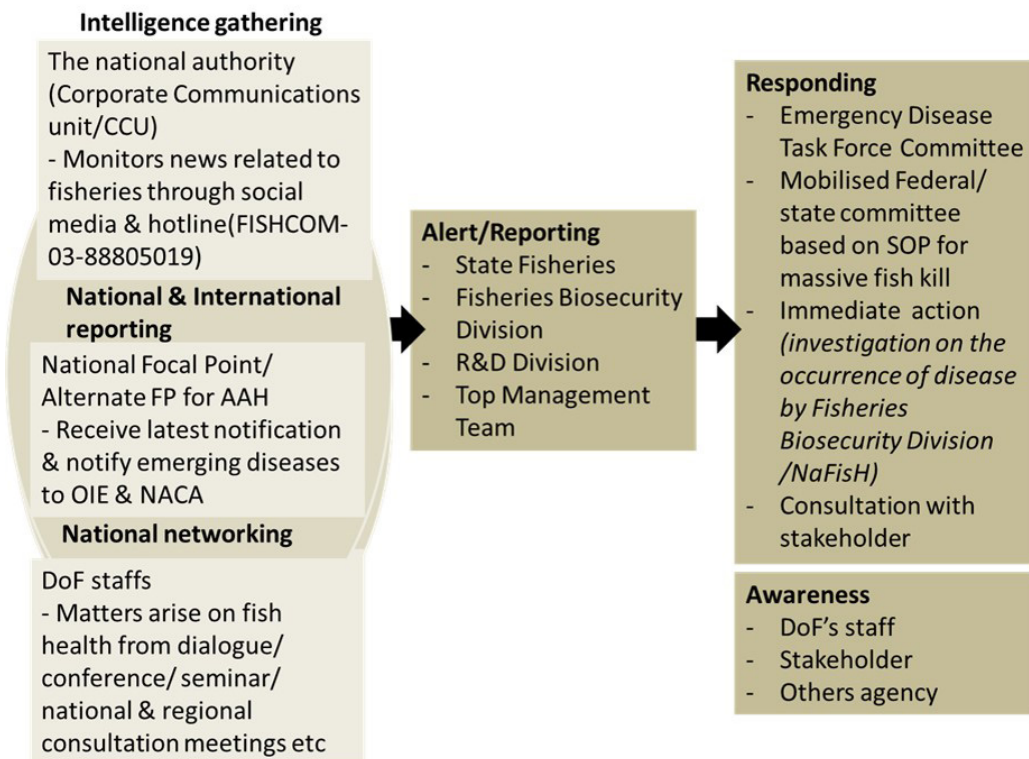


FIGURE 3. Mechanisms on early warning system by national authority on fish health management

Department of Fisheries Malaysia Form FDN01

Department of Fisheries Malaysia Form FDN01

FISH DISEASE/ FISH MORTALITY NOTIFICATION FORM

5 Occurrence Cause :  Disease  Others, please specify : \_\_\_\_\_  
 Pollution

\* If the occurrence cause is due to disease, please proceed to 5.1

5.1 Observation of Clinical Sign :

5.1.1 Gilt	5.1.2 Fin	5.1.3 Body	5.1.4 Eye
<input type="checkbox"/> Normal	<input type="checkbox"/> Normal	<input type="checkbox"/> Normal	<input type="checkbox"/> Normal
<input type="checkbox"/> Pale	<input type="checkbox"/> Reddish discolouration	<input type="checkbox"/> Bleeding	<input type="checkbox"/> Pop eye
<input type="checkbox"/> not	<input type="checkbox"/> not	<input type="checkbox"/> Ulceration	<input type="checkbox"/> Corneal opacity
<input type="checkbox"/> Reddish discolouration	<input type="checkbox"/>	<input type="checkbox"/> Reddish discolouration	<input type="checkbox"/> Sunken
<input type="checkbox"/> High Mucus	<input type="checkbox"/>	<input type="checkbox"/> Dark Body	<input type="checkbox"/> Bleeding
<input type="checkbox"/> Cyst formation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C Receiver Information

1 Name : \_\_\_\_\_ 2 Occupation : \_\_\_\_\_  
3 Office Address : \_\_\_\_\_  
4 Notification mean:  Fax  Telephone

Signature \_\_\_\_\_ Official stamp \_\_\_\_\_ Date \_\_\_\_\_

D Case Status

	Starting date	Finish Date
1 Investigation		
2 Diagnosis		
3 Close case		

FIGURE 4. Fish Disease Notification Form

fish disease diagnostics and technical assistance in fish health management to farmers, (3) providing training on fish health managements to DoF staffs and those concerned and (4) acting as adviser in main committee of National Fish Health Strategy and EDTFC. Both divisions will provide awareness and announcement through dialogs/forum to the target groups on any emerging new cases especially on the disease impact, occurrence of disease in the neighbouring countries as well as the control measures and actions to be taken by target groups (associations, breeders and other traders).

The difficulties in handling and managing the disease problems in aquaculture system are well known and worsen by the uncontrolled movement of aquatic animal species through global trading. Thus, there is a need of the industry to be aware of the current status and issues in aquatic animal health and diseases with regards to local and international requirements. In view of the increasing need of the Aquaculture industry, DoF established Fish Health Research unit under Fisheries Research Institute in 1996 with a focus on development of national personnel level with expertise on aquatic animal health. Since then, the unit grown rapidly and in 2002, the unit was upgraded into a center, carrying out R&D on fish diseases programmes, developing database of epizootics for early warning of diseases

while providing and enhancing the capacity for diagnostics and disease prevention. Through five epidemiology projects focusing on diseases at national level, a database on National Pathogen Lists was established in 2010 and since then, disease surveillance on common and emerging diseases studies are based on those that cause high economic losses in the country.

Since 2010 onward, Fisheries Biosecurity Division has established official control and official analysis for targeted diseases listed under OIE-listed diseases and National Pathogen Lists (Table 3). Surveillance programme for fish, shrimp and mollusc diseases were established (Table 4). Fish health monitoring programme were conducted every six months under accredited laboratories. Currently, DoF has four servicing laboratories under Fisheries Biosecurity Division and one National Fish Health Research Division laboratory under Fisheries Research Institute for fish health control in the whole of Malaysia. These laboratories are responsible for testing of samples from the disease surveillance and investigation of fish mass mortality cases (Figure 5). From time to time, capabilities of DoF are enhanced through training conducted by national and international bodies. In the case of TiLV, two staffs of DoF were sent for TiLV course in Thailand in 2017. At the same time, development of RT



PCR detection method for TiLV was established at NaFisH. The national laboratories of Fisheries Biosecurity Division have knowledge in organising and coordinating surveillance for diseases in the OIE list while laboratories under NaFisH have been organising and coordinating surveillance for diseases that cause high losses in the country. Currently, all DoF personnel had gone through basic training course, Diagnostics Level I, II and III on aquatic animal health according to The Asia Diagnostic Guide (Melba et al., 2001).

Quarterly and half year reports were prepared by Fisheries Biosecurity Division and validation was carried by NAAHFP before submitting to

representative offices for the health status of targeted disease (Figure 6). For emerging diseases, confirmation diagnosis test under national competent authority will be carried and followed by notification to OiE by NAAHFP. DoF Malaysia works hand in hand with others agencies such as (a) Department of Environment Malaysia for reporting, sampling and investigation in mass mortality of fish in open water, (b) Department of Veterinary Services (DVS) for notification/reporting to OIE/NACA, and (c) Department of Chemistry for further laboratory analysis of unexplained mortality in open water. The positive cases were disposed under the supervision of DoF.

**TABLE 3.** Targeted diseases that listed under OIE-listed diseases and National Pathogen Lists

OIE-listed Diseases	National-listed Disease	Importing Country Requirements
<b>Finfish</b> <ul style="list-style-type: none"> <li>• Koi Herpes Virus (KHV)</li> <li>• Spring Viraemia of Carp (SVC)</li> <li>• Red Sea bream Iridovirus (RSIV)</li> <li>• Epizootic Ulcerative Syndrome (EUS)</li> <li>• <i>Gyrodactylus salaris</i></li> </ul>	<ul style="list-style-type: none"> <li>• Viral Nervous Necrosis (VNN)</li> <li>• Iridovirus</li> <li>• <i>Streptococcus</i> sp.</li> <li>• Enteric Septicemia of catfish</li> <li>• Nocardiosis</li> <li>• Flexibacter</li> <li>• Vibriosis</li> <li>• <i>Gyrodactylus</i> sp.</li> <li>• Skin monogenean</li> <li>• Isopod infestation</li> </ul>	<ul style="list-style-type: none"> <li>• Megalocytivirus</li> <li>• <i>Aeromonas salmonicida</i> (AS)</li> <li>• Enteric Redmouth Disease (ERD)</li> </ul>
<b>Shrimp</b> <ul style="list-style-type: none"> <li>• White Spot Syndrome Virus (WSSV)</li> <li>• Infectious Myonecrosis Virus (IMNV)</li> <li>• Infectious Hypodermal and Haemopoietic Necrosis Virus (IHHNV)</li> <li>• Taura Syndrome Virus (TSV)</li> <li>• Yellowhead Virus (YHV)</li> <li>• Macrobrachium Nodavirus (MRNV)</li> <li>• Acute Hepatopancreatic Necrosis Disease (AHPND)</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Enterocytozoon hepatopenaei</i> (EHP)</li> <li>• Hepatopancreatic Parvovirus (HPV)</li> <li>• Spherical Baculovirus</li> </ul>	
<b>Mollusc</b> <ul style="list-style-type: none"> <li>• <i>Perkinsus olseni</i></li> <li>• <i>Perkinsus marinus</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Perkinsus</i> spp.</li> </ul>	

**TABLE 4.** Type of surveillance conducted in Malaysia

Active Surveillance	Passive Surveillance
<b>Shrimp</b> <ul style="list-style-type: none"> <li>• Yellow Head Virus (YHV)</li> <li>• Infectious Hypodermal and Haematopoietic Necrosis Virus (IHHNV)</li> <li>• Infectious Myonecrosis Virus (IMNV)</li> </ul>	<b>Shrimp</b> <ul style="list-style-type: none"> <li>• <i>Enterocytozoon hepatopenaei</i> (EHP)</li> <li>• Hepatopancreatic Parvovirus (HPV)</li> <li>• Acute Hepatopancreatic Necrosis Disease (AHPND)</li> <li>• Spherical baculovirus (<i>P. monodon</i>-type baculovirus)</li> </ul>
<b>Fish</b> <ul style="list-style-type: none"> <li>• Koi Herpesvirus (KHV)</li> <li>• Spring Viraemia of Carp (SVC)</li> <li>• Red Seabream Iridovirus</li> <li>• Epizootic Ulcerative Syndrome</li> <li>• Megalocytivirus</li> <li>• <i>Aeromonas salmonicida</i></li> <li>• Viral Nervous Necrosis</li> </ul>	<b>Fish</b> <ul style="list-style-type: none"> <li>• Streptococcosis</li> <li>• Enteric Septicimia of Catfish</li> <li>• Vibriosis</li> <li>• Capsalid (Skin monogenean) infestation</li> <li>• <i>Gyrodactylus</i> infestation</li> <li>• Mycobacteriosis</li> <li>• Isopod infestation</li> <li>• Tilapia Lake Virus</li> </ul>

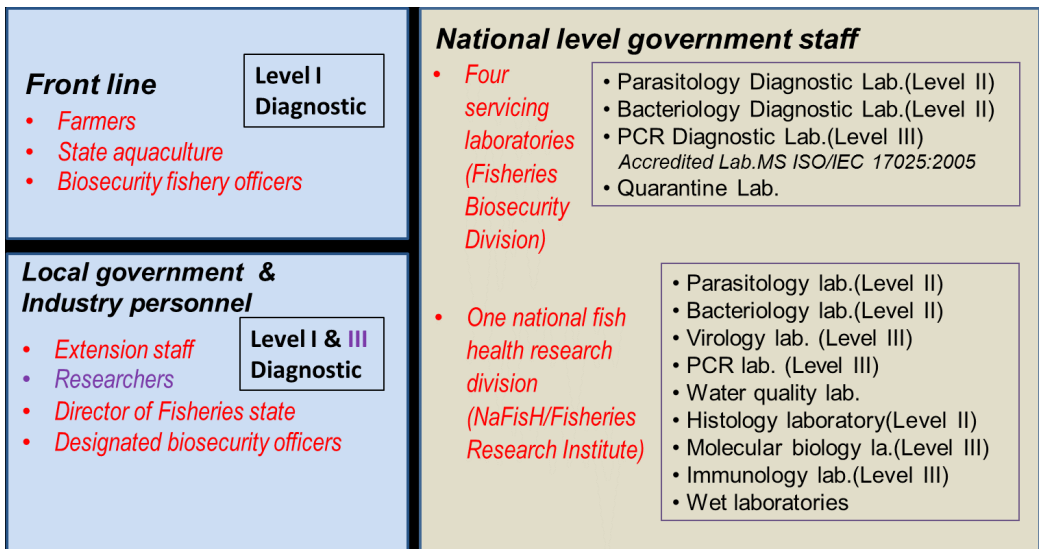


FIGURE 5. Personnel competencies of national competent authority in Malaysia

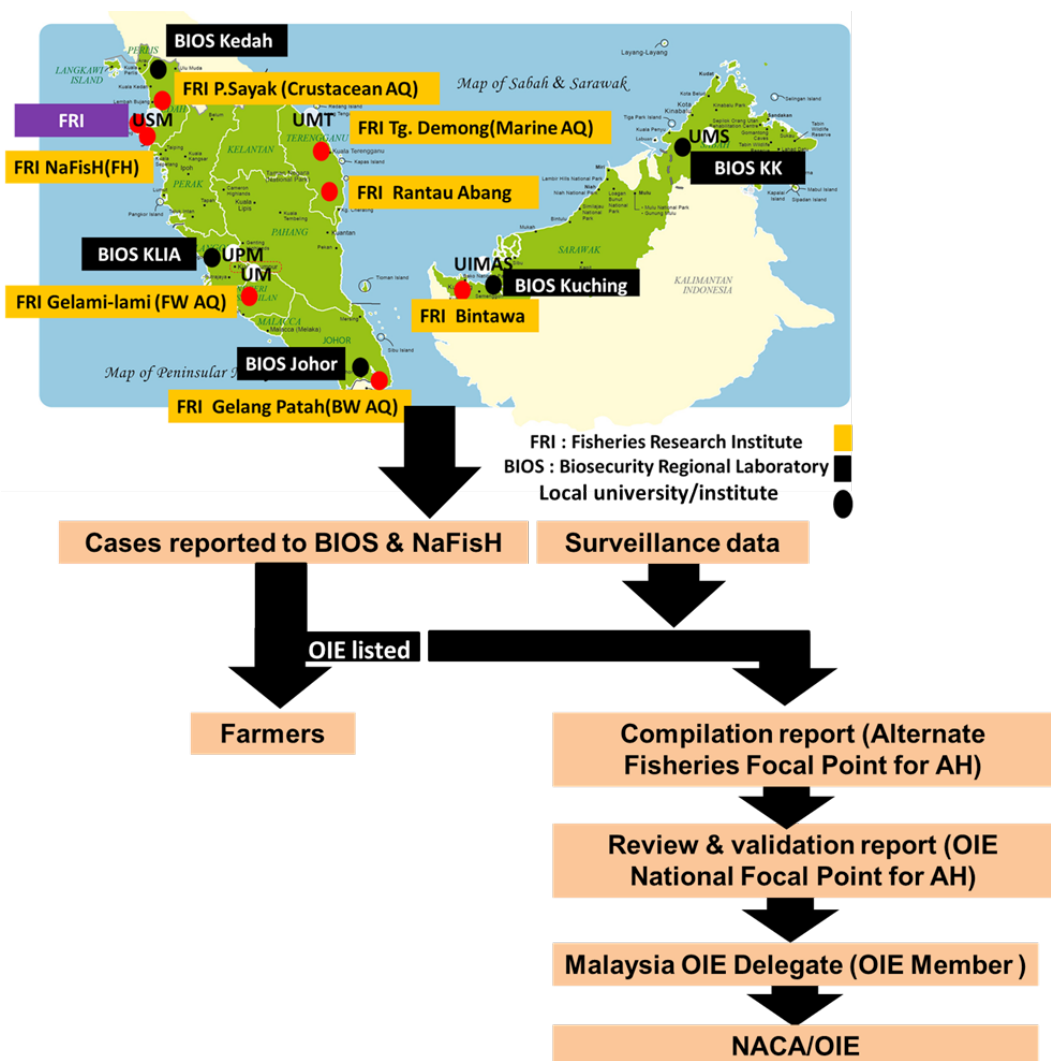
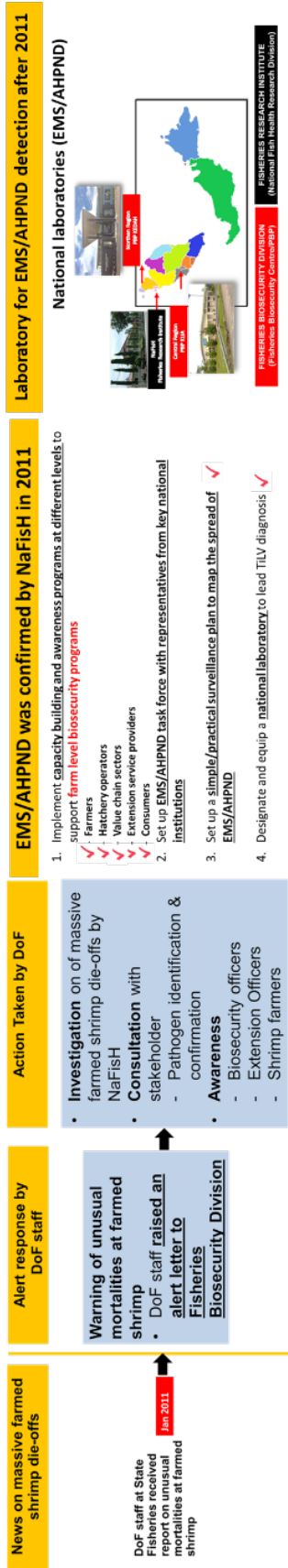


FIGURE 6. Flow chart of aquatic animal health reporting system in Malaysia

## Summary

Fisheries Biosecurity Division is responsible for the implementation of official control, official guarantee and official analysis for fish and fishery products along the supply chain from farm to the exporter premises. These responsibilities cover Peninsular Malaysia, and the states of Sabah and Sarawak on the island of Borneo.

Using current procedure for early warning system, the national competent authority on fish health management was implemented on emerging disease of Acute Hepatopancreatic Necrosis Disease (AHPND) in 2011



(Figure 7) and Tilapia Lake Virus (TILV) in 2017 (Figure 8). Imposing IRA as compulsory for country also prevent the introduction of alien aquatic species which may pose threat to national aquatic resources. Since 2010, DoF had processed and conducted 51 IRA applications for bringing in non-indigenous species to Malaysia and only 21 applications were approved (Figure 9). Through early detection and response system, an average of 15 active surveillances were performed on average of 465.4 registered farms (Figure 10). Between 2012 and 2016, the status of targeted diseases were identified (Figure 11) and the information obtained helps the competent authority to establish new guidelines for improving better fish health management.

FIGURE 7. National news mechanisms for emergency preparedness and response system for emerging disease of AHPND in 2011

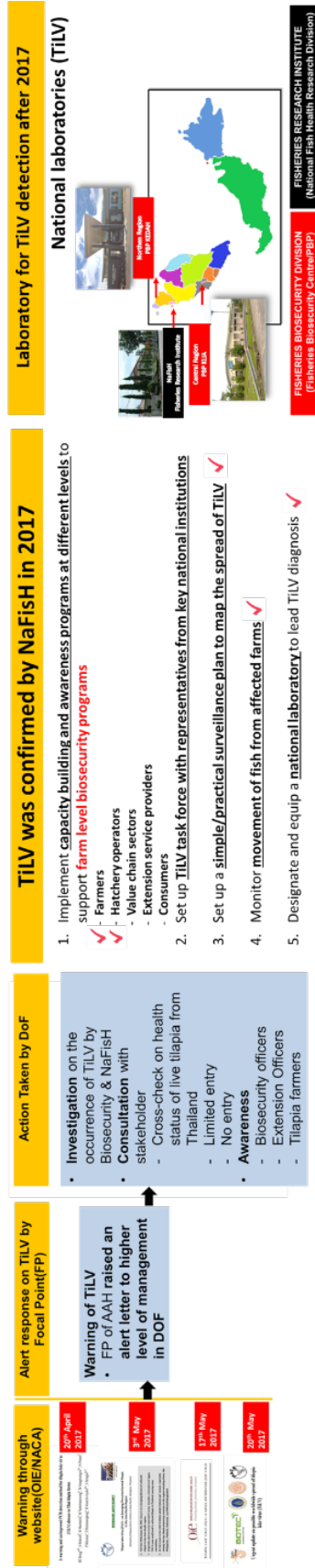


FIGURE 8. National/International reporting for emergency preparedness and response system for emerging disease of Tilapia Lake Virus (TILV) in 2017



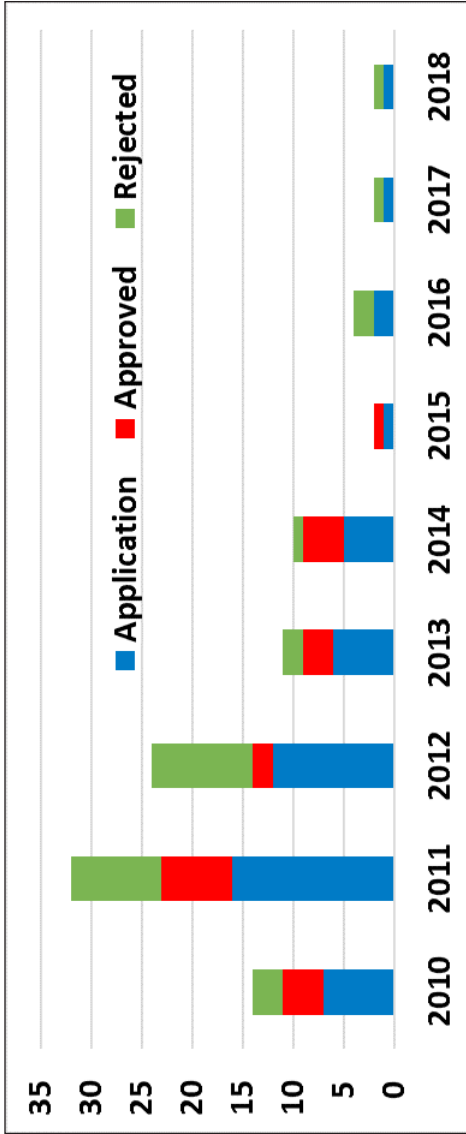
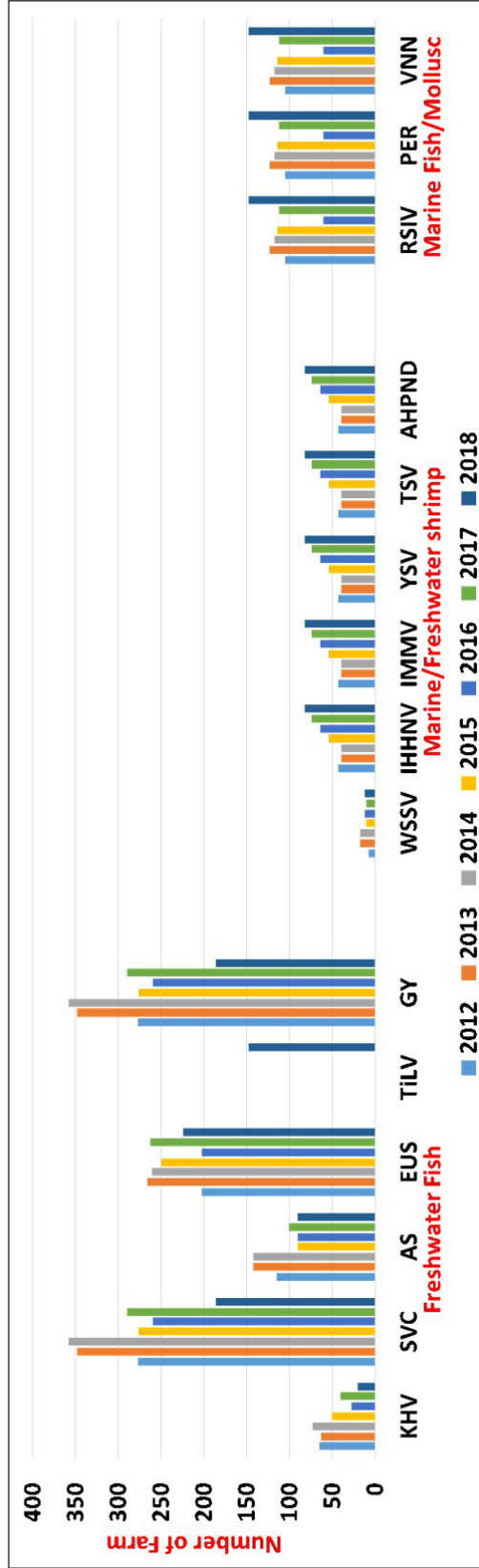


FIGURE 9. Status of application for bringing in non-indigenous species to Malaysia after IRA



Legend:  
 KHV - Koi Herpesvirus, SVC - Spring Viraemia of Carp, AS - Aeromonas salmonicida, EUS - Epizootic Ulcerative Syndrome, TILV - Tilapia Lake Virus,  
 GY - Gyrodactylus salaris, WSSV - White Spot Syndrome Virus, IHHNV - Infectious Hypodermal & Hematopoietic Necrosis Virus, IMMV - Infectious Myonecrosis Virus,  
 YHV - Yellow Head Virus, TSV - Taura Syndrome Virus, AHPND - Acute Hepatopancreatic Necrosis Disease, RSIV - Red Sea Bream Iridovirus, PER - Perfringens olsenii, and VNN - Viral Nervous Necrosis

FIGURE 10. Fish Disease Surveillance Programmes from 2012 until 2018

# Summary of Program Fish Health Surveillance (2012-2016)

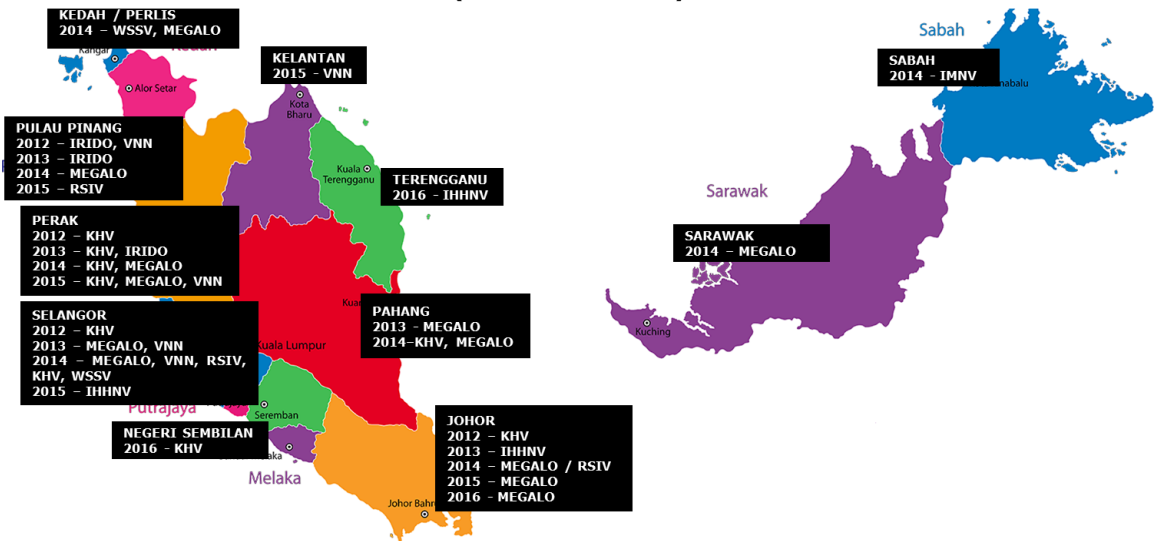


FIGURE 11. The summary of fish health programme between 2012 and 2016

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