

Current Status of Transboundary Fish Diseases in Indonesia: Occurrence, Surveillance, Research and Training

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Introduction

Aquaculture industry in Indonesia has been growing rapidly in the past decade. It plays an important role in rural development, a source for export earning, and has been a leading sector in economic growth. This development is supported by a great potential of resources. The total potential area for aquaculture industry development is estimated at 27,671,778 ha, consisting of about 24,528,178 ha for marine, 913,000 ha for brackishwater ponds and 2,230,600 ha for freshwater culture (Table 1).

However, concurrent with aquaculture potential, substantial problems are being faced because they hamper the development of aquaculture. The main problem encountered along with aquaculture production in Indonesia has always been associated with disease outbreaks and environmental pollution. Substantial economic losses in Indonesian aquaculture have been mainly due to serious disease outbreaks. Recently, the National Fish Health

Table 1. Potential and utilization of aquaculture resources in Indonesia

No.	Type of Aquaculture	Potential Area (ha)	Utilization	
			(ha)	%
1	Marine	24,528,178	753	0.0000003
2	Brackishwater	913,000	438,010	48
3	Freshwater			
	Pond	526,400	85,900	16
	Cage culture	158,200	1,516	1
	Paddy field	1,546,000	150,680	10
	Total	27,671,778	676,959	2.5

Commission (NFHC) declared 4 major economically-important diseases of aquatic animals in Indonesian aquaculture: white spot syndrome virus (WSSV) in tiger shrimp (*Penaeus monodon*), Taura syndrome virus (TSV) in Pacific white shrimp (*Litopenaeus vannamei*), viral nervous necrosis (VNN) in grouper (*Cromileptes altivelis* and *Epinephelus* spp.) and seabass (*Lates calcarifer*), and koi herpesvirus (KHV) in koi and common carp (*Cyprinus carpio*). All of the diseases are associated with transboundary introduction or movement of aquatic species (Table 2).

Table 2. Chronological introduction of transboundary aquatic animal pathogens into Indonesia

No.	Transboundary aquatic animal pathogens	References
1	<i>Ichthyophthirius multifiliis</i>	Sachlan 1952
2	<i>Thelohanellus pyriformis</i>	Sachlan 1952
3	<i>Lernaea cyprinacea</i>	Djajadiredja <i>et al.</i> 1983
4	<i>Myxobolus koi</i>	Djajadiredja <i>et al.</i> 1983
5	<i>Myxosoma</i> sp.	Djajadiredja <i>et al.</i> 1983
6	<i>Aphanomyces invadans</i>	Djajadiredja <i>et al.</i> 1983
7	Yellow head virus (YHV)	Rukyani 1994
8	Iridovirus	Owens 1994
9	White spot syndrome virus (WSSV)	Sunarto 1995
10	Viral nervous necrosis (VNN)	Zafran and Yuasa 1999
11	Koi herpesvirus (KHV)	Sunarto <i>et al.</i> 2002
12	Taura syndrome virus (TSV)	Lightner 2002

I. Current Status of Koi Herpesvirus Disease (KHVD) in the Production of Common Carp and Koi

I-1. Production of Common Carp and Koi

a. Production of Common Carp

Common carp (*Cyprinus carpio*) is the main freshwater fish cultured in Indonesia. Annual production of cultured common carp in the last five years follows 56,546 metric tons (MT)(1998), 57,278 MT (1999), 75,322 MT

(2000), 76,475 MT (2001), and 83,885 MT (2002)(DGA, 2003). Fifty percent of this annual production is contributed in West Java. In addition to the cultured common carp, the fish are also found in wild habitats such as rivers, lakes and reservoirs. However, there are no available data of carp production in the wild.

There are 13 local strains of common carp in Indonesia: namely Majalaya, Rajadanu, Sutisna Kuningan, Sianjur Wildan, Aki Ending Cianjur, Cangkringan, Samin Sumbar, Kancra Domas, Karper Kaca, Sinyonya, Punten, Merah Sumbar and Bali. Spawners, broodstock or fingerlings are locally available. Indonesia does not import or export common carp. The broodstock are usually kept in earthen ponds or concrete tanks and the seeds are produced either by provincial breeding centres (Balai Benih Ikan, BBI) or by farmers. The eggs and juveniles are produced using combination of hatchery and outdoor pond facilities. Hatched larvae obtained through egg stripping are kept inside the hatchery until they start swimming few days after hatching. The major food for the larvae are *Daphnia* or *Moina*, rotifers, and artificial diet. The larvae are then raised into fingerlings in nursery ponds, prior to stocking into growout ponds or cages. The annual production of common carp seeds is around 10 billion/year.

There are three types of common carp culture systems: floating netcage culture in lakes or reservoirs, running water system (raceway) in rivers or streams, and in earthen ponds. The floating net-cages apply a double cage culture system whereby the upper cage measures 7 × 7 m with 2.5 m water depth and used for common carp, and the lower layer is for Nile tilapia. Running water culture systems are situated in the bank of a river and measures 7 × 2.5 m with 1.5 m water depth. Earthen pond extensive culture system has low stocking density and located in a shallow water pond. This system has less water exchange, and poor quality of feed and other management measures.

The production of common carp in Indonesia is hampered by the shortage of good quality broodstocks and seeds, and, recently, by mass mortality due to koi herpesvirus (KHV). The government promotes selective breeding program to ensure the quality of broodstock and seeds. However, there are no effective management measures to control the KHV outbreak.

b. Production of Koi

Koi (*Cyprinus carpio*) is an important freshwater ornamental fish cultured in Indonesia. However, there is lack of information on its annual production. Koi is cultured in various systems as shown in Table 3.

Indonesia mainly imports high quality koi broodstock from China, Japan and Singapore. The quality of color of koi mostly depends on its genetic make-up (70%), water quality (20%) and other factors (10%). The optimum water quality for cultured koi includes pH of 7.2-7.4, low level of iron, chlorine and sulfur, high dissolved oxygen and temperature range of 25-30°C.

Table 3. Stocking density of koi based on size of fish and water depth

Age of koi (year)	Length of koi (cm)	Pond water depth (m)	Number of koi per m ²
1	15	20-30	40
2	30	30	10
3-5	40	30-45	2-5

I-2. Koi Herpesvirus Disease (KHVD) of Common Carp and Koi

a. History, Geographic Distribution and Clinical Signs

The first episode of mass mortalities of cultured koi was recorded in March 2002 in Blitar, East Java. It occurred after heavy rains among fishes newly introduced from Surabaya, the capital city of East Java. The fish were imported from China through Hong Kong in December 2001 and January 2002. The outbreak occurred in koi of all ages causing mortality of up to 80-95%. The diseased fish showed a blister-like lesion on the skin, called 'penyakit melepuh' in Indonesian language. Although gill damage was also observed in the diseased fish, not much attention was given to that clinical sign. Blitar is well known as the centre for koi production in the country. The koi, including the infected fish batch, were distributed all over the country, with Central Java, West Java and Jakarta as the main market (Sunarto *et al.*, 2002).

The second disease outbreak occurred in cultured common carp at the end of April of 2002 in Subang regency, West Java. Due to immediate harvest, there was an over supply of fish in the region. Therefore, farmers sold the infected fish at very low price (Rp 3,000/kg; normal price Rp 7,000/kg). After this, the outbreaks spread to neighboring provinces mainly through fish movements. The third episode of the outbreak occurred in May to early June 2002 in cultured common carp in floating net-cages in the Citarum river system. The system is composed of the Saguling reservoir in the upper reaches, Cirata in the middle, and Jatiluhur down stream. There are 4,425, 33,000, and 2,000 units of floating net-cages, mostly with common carp, in Saguling, Cirata and Jatiluhur reservoirs, respectively. Weeks before the outbreak, farmers introduced common carp from the Subang region to this system due to the low price of fish.

The fourth episode of the outbreak occurred in cultured common carp during in February 2003 in Lubuk Lingau regency, South Sumatera. The gross signs of the diseased common carp were extremely similar with that observed previously in koi and common carp in Java islands. Common carp farms at Lubuk Lingau were infected with the disease coming from Cirata reservoir, West Java through fish transfer by traders. The outbreak then spread to neighbouring districts and provinces including Bengkulu in the south and Jambi in the west.

b. Species Affected

Although the disease was observed as being highly contagious and extremely virulent, morbidity and mortality were restricted to koi and common carp populations. Several other species stocked within the same ponds or cages remained completely asymptomatic to the disease. However, it is not known

yet whether these fish harbor the virus and act as carriers. Screening of other cultured and wild fishes collected from the same cage, pond or canal of surrounding farm showed PCR negative results against KHV. The fish include Nile tilapia, giant gouramy, native catfish and Siam catfish.

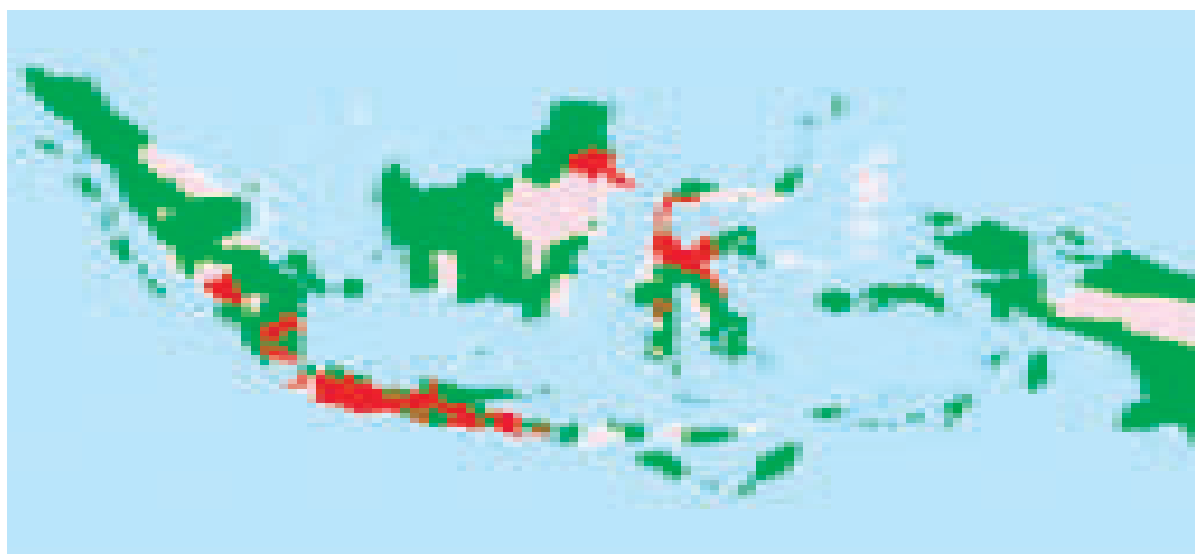


Fig. 1. Geographical distribution of reported KHV in Indonesia. Pink areas indicate no data. Green areas indicate no reported KHV, red areas have reported KHV in either common carp or koi (Cameron, 2003)

c. Diagnosis

A case definition was established as an important step in the disease investigation in order to determine whether an individual fish, pond or tank is suffering from KHV disease or not. The case definition was used to minimize mis-diagnosis. The case definition included high mortality in koi or common carp, in which the fish shows gill damage, with or without other skin lesions. The only consistent clinical sign found during the outbreak was severe gill necrosis. Therefore, this pathognomonic clinical signs was used to establish a presumptive diagnosis against KHV (Level I diagnosis). Although KHV histopathological changes (Level II diagnosis) were not obviously observed in most of the diseased fish, some of diseased fish showed consistent findings with various lesions. These include intranuclear amphophilic inclusion bodies with peripheral chromatin margination within the gill epithelium. Similar inclusions were also observed within the kidney tubular epithelium accompanied by nephrocalcinosis. PCR detection (Level III diagnosis) of KHV was carried out using specific primers set developed by Gray *et al.* (2002) and Gilad *et al.* (2002).

d. Socio-economic Impact

The first report regarding the economic losses due to the outbreak was made by the head of the Association of Ornamental Fish Culture of Blitar regency, East Java. They reported that in Blitar alone, the outbreak destroyed high quality koi belonging to 5,000 fish farmers with economic losses of more than Rp5 billion (US\$ 0.5 millions) within the first 3-months of the outbreak.

As of July 2002, the Task Force estimated that the loss of revenue in the sector and the socio-economic impact to the rural farming communities was in the region of US\$5 million. As the outbreaks continued to spread to new areas, the socio-economic impact due to the diseases escalated. The Directorate of Fish Health and Environment (DFHE) estimated that as of December 2002 and 2003, losses due to the outbreak were US\$10 million and US\$15 million, respectively.

II. Current Status of Viral Diseases in the Production of Shrimps

II-1. Production of Shrimps

a. Production of Tiger Shrimp (*Penaeus monodon*)

Culture of black tiger shrimp (*P. monodon*) is the most important aquaculture industry in Indonesia. It is notable that Indonesia has a large potential area of approximately 4 million ha of mangrove tidal swamps for shrimp culture, plus generations of experience in shrimp pond aquaculture. The government has given high priority to shrimp aquaculture. Since the government launched the programme on shrimp pond intensification in 1984, referred to as 'program intensifikasi tambak' in the Indonesian language, shrimp pond culture has rapidly expanded. This programme has been successful in increasing shrimp production from 15,400 MT in 1986 to 159,597 MT in 2002 (DGA, 2004) (Table 4).

Table 4. Production of shrimp from Indonesian aquaculture

No.	Species	Production				
		1998	1999	2000	2001	2002
1	Giant tiger shrimp (<i>Penaeus monodon</i>)	78,824	92,726	93,756	103,603	112,840
2	Banana shrimp (<i>Penaeus merguensis</i>)	22,589	28,872	28,965	25,862	24,708
3	Metapenaeus shrimp (<i>Metapenaeus ensis</i>)	20,434	19,255	20,453	19,093	21,634
4	Mysids	264	93	544	610	415

Source: DGA (2004)

b. Production of Pacific White Shrimp (*Litopenaeus vannamei*)

The Government of Indonesia released a permit that allowed importation of Pacific white shrimp (*L. vannamei*) on 10 October 2000 for research purposes only. The exotic shrimp was imported from Taiwan, Hawaii and America (Table 5). Based on Ministerial Decree No. 4/2001 dated 14 July 2001, the government allowed importation of Pacific white shrimp for culture purpose. Since then, the shrimp has been cultured in 15 out of 30 provinces in Indonesia, namely North Sumatera, West Sumatera, South Sumatera, Riau, Bengkulu, Lampung, Banten, West Java, Central Java, Jogjakarta, East Java, Bali, West Nusa Tenggara, South Kalimantan and West Kalimantan. Up to July 2002, the production of the shrimp was 27,000 MT (Sugama, 2002). The broodstocks were imported from Taiwan, Hawaii and USA. The seeds are either imported or produced by local hatcheries.

Local hatcheries in Lampung, West Java, Central Java, East Java and Bali produced 5-30 million seeds/cycle.

Table 5. Records of first importation of *Litopenaeus vannamei* into Indonesia

No.	Species	Country of Origin	No. of Shrimp	Permit/ Recommendation Letter
1	<i>Litopenaeus vannamei</i>	Taiwan & Hawaii	5,000,000 seeds 2,000 spawners	Degree of DGA No. IK.530/D3.9389/X/00K dated 10 October 2000
2	<i>Litopenaeus vannamei</i>	USA	300,000 seeds	Degree of DGA No. IK.530/D3.9390/X/00K dated 10 October 2000

c. Production of Freshwater Prawn (*Macrobrachium rosenbergii*)

Freshwater prawn (*M. rosenbergii*) was mainly cultured in Java and Bali. The average annual production of freshwater prawn is 400 MT per year. The seeds are produced by either private or governmental breeding units (Table 6).

Table 6. Seed production of freshwater prawn

No.	Province	Number of breeding units	Production per year
1	West Java	1	300,000
2	Central Java	7	11,809,000
3	East Java	3	Not operated
4	Bali	9	7,786,000
	Total	20	19,995,000

Source: Hadie *et al.*, 2001

Freshwater prawn is cultured in earthen ponds or rice fields. The minimum size of the pond is 1000 m². There are at least four types of freshwater pond culture systems; monoculture, polyculture with freshwater finfish, integrated with paddy field, and integrated with poultry culture. No importation of freshwater prawn has been recorded.

II-2. White Spot Syndrome Virus (WSSV)

The disease occurred in on-growing juvenile shrimp of all ages and sizes. Moribund shrimp displayed red discoloration and white spots on the inside surface of carapace, body shell and appendages. The spots ranged from 0.5 to 3.0 mm in diameter. The lymphoid organ of the diseased shrimp was swollen and shrunken.

a. Species Affected

The disease affected both cultured and wild penaeid shrimps. The major cultured shrimp species in Indonesia are black tiger shrimp (*Penaeus monodon*) and white shrimp (*P. merguensis*). Infection with WSSV was also found in wild shrimp, *Metapenaeus ensis*. Recently, Pacific white shrimp (*L. vannamei*) was also affected by the disease, but WSSV infection has not yet been reported in *L. stylirostris*.

b. Epidemiology

Since the middle of 1994, a disease that caused cumulative mortality of up to 100% was reported in numerous shrimp farms in northern coast of East, Central and West Java, Indonesia. The new disease, in which the pathognomonic characteristic sign was the presence of white spots on the cuticle, referred to as white spot syndrome ('penyakit bercak putih' in the Indonesian language), was the most threatening disease that had ever occurred in Indonesian shrimp farms. The two earlier viral diseases of shrimp, i.e. monodon baculovirus (MBV) and yellow head virus (YHV) were less pathogenic than the newly emerged white spot syndrome virus (WSSV), the causative agent of white spot syndrome (WSS).

The economic impact of WSSV in Indonesian shrimp industry is difficult to determine. It is estimated that in 1999 only 20% of shrimp ponds were in operation. Many of the ponds remained un-operated, with some being converted to milkfish ponds. This phenomenon may be associated with environment deterioration and disease outbreaks, particularly WSSV.

c. Geographic Distribution and Transmission Issues

Outbreak of WSSV was first reported to occur in black tiger shrimp in Probolinggo, East Java and later in Tangerang, Serang and Karawang, West Java. The disease, causing severe losses, has spread to Bali, Nusa Tenggara, Sulawesi, Kalimantan and Sumatera. Virtually, the disease has spread throughout the country. The disease is vertically transmitted from infected broodstock to its offspring and horizontally transmitted from infected carriers and contaminated environment.

d. Availability of Diagnostics (Levels I, II and III)

At the farmer-level and district laboratories, WSSV may be diagnosed based on its pathognomonic clinical signs, i.e. the appearance of white spots in the carapace and body surface (diagnostic Level I). Histopathological changes (diagnostic Level II) and molecular-based methods (diagnostic Level III) are also used as a confirmative diagnosis for the disease. Almost all major fish disease laboratories are equipped with PCR units and capable for detection of WSSV.

e. Preventive and Control Methods

Managing WSSV should be done in all levels of shrimp production starting from shrimp hatchery up to the grow-out ponds. In hatcheries, PCR technique is used for screening broodstock before spawning. Only broodstocks that are free from WSSV are used as spawners. The postlarvae (PLs) should also be

screened for WSSV. If infected, the whole tank should be disinfected with 20 ppm chlorine and then discarded.

The combination of PCR technique and formalin treatment has been proven as the best strategy for managing WSSV in grow-out ponds. The benefit of PCR screening combined with formalin treatment is to maintain low-intensity of WSSV infections in shrimp, hence significantly reducing the disease outbreak in ponds. We adopted the technique developed by Chanratchakool and Limsuwan (1994). WSSV-free PLs are bathed in 150 ppm formalin for 30 minutes to separate the weak and unhealthy individuals. Only the healthy PLs, which actively swimming against the water current, are then stocked into the ponds. WSSV status during the rearing periods is monitored through regular PCR checking at day 25 and day 55. Semi-quantitative PCR technique allows us to distinguished light and severe infection of WSSV. If the WSSV infection is light, the culture may be continued with improvement of culture condition. However, when the WSSV infection is severe, immediate harvest is the only way to reduce more economic losses on the part of the farmer.

To maintain low level of WSSV infection, bio-security concept should be applied. Closed system with zero or minimum water exchange might be the best solution to have consistent and environmentally sound shrimp production. The key component of closed system is the application of bioremediator (probiotic) and vigorous aeration.

Managing WSSV outbreak in grow-out shrimp may also be achieved through enhancement of shrimp defence mechanism using immunostimulants such as fucoidan, peptidoglycan, and lipopolysaccharide. Combination of prophylactic measures such as screening of PLs using PCR, use of specific-pathogen-free broodstock and PLs, application of immunostimulants, and good management practices will be helpful in controlling WSSV outbreak in Indonesian shrimp farms.

II-3. Taura Syndrome Virus (TSV)

The Government of Indonesia officially released a permit that allowed importation of Pacific white shrimp (*Litopenaeus vannamei*) in 1999. The exotic shrimps should only be imported from Taura syndrome-free country. However, since November 2002, Taura Syndrome caused by Taura syndrome virus (TSV), an RNA virus, has been reported in *L. vannamei* in East Java.

a. Clinical Signs

TSV mostly caused mortality in 1-2 months old *L. vannamei* reared in intensive culture systems at the stocking density of 120 PLs/m². Affected shrimp show reddish discoloration on the tail and multifocal necrosis shown as black spots on the body.

b. Economic Losses

The disease caused up to 75% mortality, but there are no data on the economic impact of TSV to the Indonesian shrimp industry. It is suspected that the disease came to Indonesia due to illegal importation of broodstock and PL from sources with unreliable health status.

c. Epidemiology and Geographic Distribution

In response to Dr. Lightner's letter dated 4 November 2002 to the OIE pertaining to the 'confirmation of TSV in Indonesia', the Government of Indonesia conducted active surveillance in the islands of Java (East, Central and West Java) and Sumatera (Lampung province). TSV was first reported to occur in *L. vannamei* in 2002. Despite active surveillance in *L. vannamei*, TSV infection was not found in West Java and Banten provinces. However, most *L. vannamei* originating from East Java (Banyuwangi, Situbondo, Pasuruan, Bangil, Sidoarjo, Malang) were TSV positive. It is suspected that TSV first occurred in Banyuwangi and Situbondo before it spread to other districts in East Java through movement of infected post larvae. Banyuwangi and Situbondo are important production centers for *P. monodon* and *L. vannamei*, producing both PLs and marketable shrimps. Samples of *P. monodon* originating from Brebes (Central Java), Situbondo (East Java) and Bali islands were also PCR positive for TSV. The virus has also been found in *L. vannamei* from Maros (Sulawesi Islands) and Sumbawa Islands.

d. Diagnostic Methods

Capability to diagnose shrimp viruses at all levels of diagnosis (Level I, II or III) is available in the country. However, PCR technique using both commercial kits and primers based on the OIE Manual were used as confirmatory diagnosis for the disease.

e. Prevention and Control Methods

To prevent the introduction of TSV to their farms, most of shrimp farmers use specific-pathogen-free (SPF) and specific-pathogen-resistant (SPR) postlarvae, which are imported from Hawaii and Florida. The shrimp are then cultured in ponds that strictly apply bio-secure concepts similar with those for prevention of WSSV.

II-4. Significant and Emerging Viral Diseases of *Macrobrachium rosenbergii*

No significant emerging viral disease of freshwater prawn has been recorded. This may be due to lack of intensive research on diseases affecting freshwater prawn.

III. Surveillance, Monitoring and Diagnosis of Diseases of Aquatic Animals

III-1. Responsible Facility and Personnel

Since the Directorate General of Fisheries was promoted to become the Ministry of Marine Affairs and Fisheries in 2001, three principal institutions have been created with mandates related to fish health management including surveillance, monitoring and diagnosis. These institutions are the **Directorate for Fish Health and the Environment (DFHE)** under the Directorate General

for Aquaculture, the **Center for Fish Quarantine (CFQ)** under the Secretariat General, and the **Central Research Institute for Aquaculture (CRIA)** under the Agency for Marine and Fisheries Research (AMFR) (Appendix 1). Arthur (2003) advised that coordination and cooperation between the three principal government agencies involved in fish health management should be further developed and strengthened through interagency consultative and working groups (Appendix 2). There are also various commissions and committees, universities, professional associations, private sector representatives and other stakeholders who are concerned with the status of fish health management in the country.

III-2. Diagnostic Capabilities and Major Diseases of Aquatic Animals

a. Fish Health Laboratories

Although Indonesia has a long history of work on fish diseases, there is very limited expertise and laboratory facilities within the country (Appendix 3). Most laboratories in Indonesia fall under Level I and Level II categories, capable of conducting fish disease diagnosis based on clinical signs and observation of environmental changes (Level I), and microbiology and histopathology (Level II). Viral diseases are becoming increasingly important to Indonesian aquaculture, and the country currently has little expertise or facilities to conduct research in this area. Specifically, there is lack of laboratory facilities and expertise for fish virology. A national laboratory for fish virology is being set up. However, staff expertise needs to be further developed. Despite the constraints, research activities related to virology have been initiated at the Fish Health Research Laboratory in Jakarta, Gondol Research Station for Coastal Fisheries in Bali, and Brackishwater Aquaculture Development Centre in Jepara.

b. Economically-Important Diseases of Aquatic Animals

The 4 major economically-important diseases of aquatic animals in Indonesian aquaculture declared by the National Fish Health Commission (NFHC) are shown in Table 7.

Table 7. Four major economically-important diseases of aquatic animals in Indonesia

No.	Name of Disease	Affected animals	Level of Diagnosis
1	White spot syndrome virus (WSSV)	Penaeid shrimp	III (PCR)
2	Taura syndrome virus (TSV)	Mainly Pacific white shrimp (<i>Litopenaeus vannamei</i>)	III (PCR)
3	Koi herpesvirus disease (KHVD)	Koi and common carp (<i>Cyprinus carpio</i>)	III (PCR)
4	Viral nervous necrosis (VNN)	Groupers (<i>Cromileptes altivelis</i> and <i>Epinephelus</i> spp.) and seabass (<i>Lates calcarifer</i>)	III (PCR)

IV. Quarantine Services to Prevent Entry of Diseases of Aquatic Animals

IV-1. Responsible Agency and Personnel

The Center for Fish Quarantine (CFQ) of the Ministry of Marine Affairs and Fisheries (MMAF) located in Jakarta manages fish quarantine in Indonesia. The Director of the Centre is under the supervision of the Secretary General of MMAF. The Director of the center supervises 41 Fish Quarantine Implementing Units consisting of 2 Fish Quarantine Regional Offices, 12 Fish Quarantine Stations and 27 Fish Quarantine Sub-Stations that are located all over the country.

IV-2. Procedure/Requirements for Imported/Arriving Live Fish/ Crustaceans at Port of Entry

According to the regulations on importation of fish, all importation of live fish, dead fish, and fish product is subject to the following conditions:

- a. Importation must be made through designated points of entry;
- b. It should be accompanied by a Fish Health Certificate; and
- c. It should be notified and submitted to a Fish Quarantine Inspector upon arrival of the consignment.

In addition to the conditions mentioned above, importation of live fish must be covered by an Import Permit, which may require additional conditions for the said importation. The additional conditions will be determined on case-by-case basis by the Director General of Fish Culture depending on the risk involved.

a. Import Permit

The application for import permit shall be made in writing to the Director General of Fish Culture prior to importation of the fish. Copies of the application shall be sent to the Center for Fish Quarantine. Any applicant who has obtained a fish import permit shall contact the Center for Fish Quarantine so that technical requirements for proper handling of the imported fish during the quarantine period can be prepared.

b. Quarantine Actions

1. Inspection

- a) Inspection of documents
Inspection of documents is performed to determine the presence of required documents, such as import permit and Fish Health Certificate. If the required documents are present, the consignment is subjected to health inspection.
- b) Inspection of consignment
When the required documents are fulfilled, the inspection of consignment is performed to detect the presence of quarantinable diseases. Inspection of consignment may be done on board or after it has been unloaded from the means of conveyance.

2. Detention

If after inspection it becomes evident that required documents have been fully complied with, carriers of pest and diseases may be detained for observation at a fish quarantine establishment.

3. Isolation and Observation

For further detection of certain quarantinable pests and diseases, which due to their nature, requires a definitely long period, special facilities, and controlled environmental conditions, carriers of pest and diseases that have been inspected may be isolated for observation. According to the MOA Decree No. 265 of 1990, isolation and observation in certain cases can be conducted at an approved private fish quarantine establishment.

4. Treatment

Treatment shall be performed if after observation it becomes evident that:

- a) The carrier is infested or infected, or suspected being infested by quarantinable pest and diseases, or
- b) The carrier is not free or suspected of being not free from quarantinable pest and diseases.

5. Refusal of Entry

Carriers of quarantinable pest and diseases shall be refused entry if it becomes evident that:

- a) After inspection on board, the carrier is infested by certain quarantinable pest and diseases designated by the Government, or in a decaying condition or damage, or belong to species prohibited to be imported.
- b) The required quarantine documents have not yet been complied with, or
- c) After treatment on board, the carrier cannot be freed from inspection of quarantine pest and diseases.

6. Destruction

Carriers of quarantinable pest and diseases shall be destroyed if it become evident that:

- a) After discharge from conveyance and subsequent inspection, the carrier is infested by quarantinable pest and diseases, or is in decaying condition, damage, or belong to those species prohibited to be imported.
- b) After refusal of entry, the carrier is not moved out (re-export) of the territory of the Republic of Indonesia by its owner within the stipulated period of time, or
- c) After observation in isolation, the carrier is not free from quarantinable pest and diseases, or
- d) After discharge from the conveyance and subsequent treatment, the carrier cannot be freed from quarantine pest and diseases.

7. Release

Carrier of quarantine pest and diseases shall be released if it becomes evident that:

- a) After inspection, the carrier is free from quarantinable pest and diseases, or
- b) After observation in isolation, the carrier is free from quarantinable pest and diseases, or
- c) After treatment, the carrier can be freed from quarantine pest and diseases, or
- d) After detention, the required documents have been fully complied with.

c. Rules and Regulations

Basic and fundamental to fish quarantine measures in Indonesia is Law No. 16 of 1992 concerning Animal, Fish and Plant Quarantine, which was published and came into effect on 8 June 1992. In general, with the issuance of this law, all regulations issued before it became invalid. However, all existing executive regulations, as long as they are not in contradiction with this law, remain in force pending the issuance of new executive regulations under this law. Furthermore, by the enactment of Government Regulation No. 15 of 2002 concerning Fish Quarantine, basic legal conditions required for the implementation of fish quarantine actions became stronger. Law No. 16 of 1992 and Government Regulation No. 15 of 2002 put into order, among others, basic provision on quarantine requirement, quarantine actions, quarantine area, kinds of pests and their carrier, places of entry and export, development of quarantine mindedness, investigation and penalty. As already mentioned earlier, existing executive regulations remain in force as long as they are not in contradiction with Law No. 16 of 1992. A comprehensive list of legislations related to fish quarantine and legislation, and on the restriction of movement of certain fish species are in Appendix 4 and 5, respectively.

d. Facilities, Standard Methods and Manpower

Diagnostic methods for aquatic animal diseases that have already been set up and recommended by the OIE will be adopted. By using that method, accurate results will be achieved and the risk on the introduction of dangerous pathogens can be mitigated or eliminated. Most developed countries have already set up complex conditions and requirements that should be met by their trading partners. To fulfill those requirements, countries need to develop capability to adopt the standard and code recommended by the OIE, such as setting up of facilities and laboratories for fish disease diagnosis. On the other hand, there is also a need to improve fish health status by upgrading culture methods and sanitation system in fish production facilities.

As already mentioned, standards and codes on aquatic animal health recommended by the OIE have to be adopted by WTO member countries. The Government of Indonesia is aware that technical capability of quarantine inspectors on virus detection is very limited. It is, therefore, recommended that ASEAN will organize a training in order to strengthen capability in protecting the region from introduced viral diseases of common concern. Recognizing this situation, Indonesia recently conducted trainings on disease diagnostics using histopathology and PCR technology. These trainings were conducted in collaboration with universities and research institutes. Standardized training on

aquatic animal diseases organized by the ASEAN will be more effective to properly improve technical capability of fish quarantine inspectors in the region.

IV-3. List of Quarantinable/Notifiable Fish/Crustacean Diseases in Indonesia

Based on Ministerial Decree No. 17/2003, there are 51 quarantinable fish diseases in Indonesia. Of these, 18 are viral, 11 bacterial, 5 mycotic and 17 are parasitic diseases.

A. Viral Diseases

1. Channel catfish virus disease (CCVD)
2. Spring viraemia of carp (SVC) & Swimbladder inflammation (SBI)
3. Infectious pancreatic necrosis (IPN)
4. Infectious haematopoietic necrosis (IHN)
5. Lymphocystis
6. Infectious hypodermal and haematopoietic necrosis virus (IHHNV)
7. Baculovirus penaei (BP)
8. Monodon baculovirus (MBV)
9. Baculovirus midgut gland necrosis (BMGN)
10. Yellow head disease (YHD)
11. Hepatopancreatic parvovirus (HPV)
12. Taura syndrome virus (TSV)
13. White spot syndrome virus (WSSV)
14. Golden eye disease (GED) or Sleepy grouper disease (SGD)
15. Lymphoid parvovirus
16. Type C baculovirus (TCBV)
17. Viral nervous necrosis (VNN)
18. Epithelioma papillosum (*Herpesvirus cyprini*)

B. Bacterial Diseases

1. Furunculosis (*Aeromonas salmonicida*)
2. Bacterial kidney disease (BKD) (*Renibacterium salmoninarum*)
3. Fish mycobacteriosis (*Mycobacterium marinum*, *M. fortuitum*, *M. chelonae*)
4. Nocardiosis (*Nocardia* sp.)
5. Edwarsiellosis (*Edwardsiella tarda*)
6. Enteric septicaemia of catfish (*Edwardsiella ictaluri*)
7. Streptococcosis (*Streptococcus* sp.)
8. Pasteurellosis (*Pasteurella piscicida*)
9. Enteritic red mouth disease (*Yersinia ruckeri*)
10. Gaffkemia (*Aeromonas invadans* var. *homari*)
11. Red spot disease (*Pseudomonas anguilliseptica*)

C. Mycotic Diseases

1. Sand paper disease/Swinging disease/Ichthyoporosis (*Ichthyophonus hoferi*)

2. Branchiomycosis (*Branchiomyces sanguinis*)
3. Branchiomycosis (*Branchiomyces demigrane*)
4. Aphanomycosis (*Aphanomyces astaci*)
5. Epizootic ulcerative syndrome (*Aphanomyces invadans*)

D. Parasitic Diseases

1. Whirling disease (*Myxobolus/Myxosoma cerebralis*)
2. Pleistophorosis (*Pleisthopora hyphessobrycon*)
3. Pleistophorosis (*Pleisthopora anguillarum*)
4. Ceratomyxosis (*Ceratomyxa shasta*)
5. Henneguyan disease (*Henneguya exiilis*)
6. Cotton shrimp disease (*Thelohania duorara*)
7. Cotton shrimp disease (*Thelohania penaei*)
8. Bonamiosis (*Bonamia ostreae*)
9. Haplosporidiosis (*Haplosporidium nelsonii*)
10. Haplosporidiosis (*Haplosporidium costale*)
11. Marteiosis (*Marteilia refrigens*)
12. Marteiosis (*Marteilia sydneyii*)
13. Perkinsiosis (*Perkinsus marinus*)
14. Ergasiliosis (*Ergasilus sieboldi*)
15. White tumor in siam catfish (*Nosema* sp.)
16. Lytoceatosis (*Lytoceatus parvulus*)
17. Paragonimiasis (*Paragonimus pulmonalis*)

V. Research and Training of Fish Health Staff for Quarantine, Diagnosis, and Surveillance of Diseases of Aquatic Animals

Current research activities are mainly focused on the four major fish diseases: WSSV, TSV, VNN and KHV and conducted at the Fish Health Research Laboratory, Research Institute for Freshwater Fisheries in Bogor, West Java. Research is also going on at the Research Institute for Brackishwater Fisheries in Maros, South Sulawesi and at the Research Institute for Coastal Fisheries in Gondol, Bali.

There are also various implementing units under Directorate General of Aquaculture where research is conducted to some extent. These are the:

1. Brackishwater Aquaculture Development Centre (BBBAP, Jepara)
2. Brackishwater Aquaculture Development Centre (BBAP, Situbondo)
3. Marine Aquaculture Development Centre (BBL, Lampung)
4. Freshwater Aquaculture Development Centre (BBAT, Sukabumi)
5. Freshwater Aquaculture Development Centre (BBAT, Jambi)
6. Brackishwater Aquaculture Development Centre (BBAP, Takalar)
7. Marine Aquaculture Development Centre (LBL, Batam)
8. Marine Aquaculture Development Centre (LBL, Ujung Bate)
9. Marine Aquaculture Development Centre (LBL, Lombok)
10. Freshwater Aquaculture Development Centre (LBAT, Mandiangin)
11. Marine Aquaculture Development Centre (LBL, Ambon)
12. Freshwater Aquaculture Development Centre (LBAT, Tatelu)

In addition, there are other implementing units under the Provincial Fisheries Service:

13. Marine and Brackishwater Aquaculture Development Centre (UPBAPL Karawang, West Java)
14. Brackishwater Aquaculture Development Centre (UPBAP Bangil, East Java)
15. Brackishwater Aquaculture Development Centre (BBAP Pangkep, South Sulawesi)

University-based research is being conducted at:

16. Faculty of Veterinary Medicine, Bogor Agricultural University, West Java
17. Faculty of Fisheries, Bogor Agricultural University, West Java
18. Faculty of Fisheries, Diponegoro University, Central Java
19. Faculty of Fisheries, Gajah Mada University, Jogjakarta
20. Faculty of Fisheries, Airlangga University, East Java
21. Faculty of Fisheries, Brawijaya University, East Java

As for training, the courses that provide necessary skills to conduct quarantine, diagnosis and inspection of aquatic animals include the following:

1. Basic training on fish health management
2. Advanced training on fish health management, including parasitology, mycology, bacteriology, histopathology, immunology and molecular biology
3. Use of rapid diagnostic techniques
4. PCR methodology
5. Fish medicine

For surveillance activities, the skills required are more advanced since the activity entails more expertise and training in the following aspects are necessary:

1. Histopathology (long term training)
2. Epidemiology (short and long term training)
3. Virology (short and long term training)
4. Rapid diagnostics
5. Developing program on surveillance and monitoring

References

- Arthur JR. 2003. Fish Health Management for Indonesia. A consultancy report of Project TCP/INS/2905 (A): Health Management in Freshwater Aquaculture. FAO, Rome, 25 p.
- Bastiawan D, Taukhid, Rukyani A. 1997. Culture and specimen preservation techniques of mycotic disease group. Paper presented in a Seminar on Evaluation of Fish Quarantine Diseases, Cipanas, West Java. 9 p.

- Callinan RB, Paclibare JO, Reantaso MB, Lumanlan-Mayo SC, Fraser GC, Sammut J. 1995. EUS outbreaks in estuarine fish in Australia and the Philippines: Association with acid sulfate soils, rainfall, and *Aphanomyces*, p. 291-298. *In*: Shariff M, Arthur JR and Subasinghe RP (eds). Diseases in Asian Aquaculture II. Fish Health Section, Asian Fisheries Society, Manila, Philippines.
- Cameron A. 2003. Report of International Consultant in Epidemiology. Health Management in Freshwater Aquaculture. TCP/INS/2905(A). FAO, Rome, 25 p.
- Chanratchakool P, Limsuwan C. 1998. Application of PCR and formalin treatment to prevent white spot disease in shrimp, p. 287-290. *In*: Flegel TW (ed) Advances in Shrimp Biotechnology. National Centre for Genetic Engineering and Biotechnology, Bangkok.
- Directorate General for Aquaculture (DGA). 2003. Indonesian Aquaculture Statistics. Directorate General for Aquaculture. Jakarta. 127 p.
- Djajadiredja R, Panjaitan TH, Rukyani A, Saron A, Satyani D, Supriyadi H. 1983. Country Report. Indonesia, p. 19-30. *In*: FB Davy and A Chouinard (eds.) Fish Quarantine and Fish Diseases in Southeast Asia. Report of a Workshop held in Jakarta, Indonesia, 7-10 December 1982. International Development Research Centre of Canada (IDRC-210e) Ottawa, Canada, 72 p.
- Gilad SO, Yun S, Andree KB, Adkison MA, Zlotkin A, Bercovier H, Eldar A, Hedrick RP. 2002. Initial characteristics of koi herpesvirus and development of a polymerase chain reaction assay to detect the virus in koi, *Cyprinus carpio koi*. *Dis. Aquat. Org.* 48: 101-108.
- Gray WL, Mullis L, LaPatra SE, Groff JM, Goodwin A. 2002. Detection of koi herpesvirus DNA in tissues of infected fish. *J. Fish Dis.* 25: 171-178.
- Hadie LE, Hadie W, Hikmayani Y, Gunadi B, Wakhid A. 2001. Opportunity and prospect of freshwater shrimp (*Macrobrachium rosenbergii*) culture. Paper presented in 'Release of new strain and business meeting of freshwater shrimp', 24 July 2002, West Java, Indonesia. 20 p. (in Indonesian).
- Mangunwiryo H. 1997. Country Paper: Indonesia, p. 51-64. *In*: Humphrey J, Arthur JR, Subasinghe RP and Phillips MJ (eds). Aquatic Animal Quarantine and Health Certification in Asia, FAO Fisheries Technical Paper No. 373.
- Owens L. 1994. Sleepy grouper disease in Indonesia. A report prepared by the Department of Biomedical and Tropical Veterinary Sciences, James Cook University of North Queensland, Townsville, Australia.
- Rukyani A. 2001. Control strategy of viral diseases in grouper culture, p. 27-34. *In*: Sudradjat A, Heruwati ES, Poernomo A, Rukyani A, Widodo J, Danakusumah E (eds). Proceedings of the Marine Culture Technology and Development of Sea Farming in Indonesia (in Indonesian).

- Rukyani A. 1993. The status of aquaculture and fish disease problems in Indonesia. Paper presented at the International Workshop and Training Course on Quick Diagnostic Methods and Bio-ecological Control of Fish and Shrimp Diseases. 29 July-7 August 1993, Vietnam.
- Rukyani A. 1994. Yellow head disease in shrimp. *Trubus*, March, 1994. p. 293 (in Indonesian).
- Rukyani A. 2002. Koi Herpesvirus in Indonesia. Report of KHV epidemic to OIE by the Directorate of Fish Health and Environment, DGA, Jakarta.
- Rukyani A, Sunarto A. 1998. Non-specific pathogen resistant (NsPR) *Penaeus monodon*: a complementary SPF broodstock development. Paper presented in the Workshop on the Development of *Penaeus monodon* Disease Free Broodstock in ASEAN Country held on 23-24 March, Jakarta, Indonesia. 15 p.
- Sachlan M. 1952. Notes on parasites of freshwater fishes in Indonesia. *Central Inland Fisheries Research Station* 2:1-59.
- Sugama K. 2003. Culture status of introduced shrimp and the prospects for its development in freshwater ponds. *Warta Perikanan* p.19-22 (in Indonesian).
- Sunarto A. 1995. Watch out for white spot disease in shrimp. *INFOVET*, April 1995, p.30-31 (in Indonesian with abstract in English).
- Sunarto A, Taukhid, Rukyani A, Koesharyani I, Supriyadi H, Huminto H, Agungpriyono DR, Pasaribu FH, Widodo, Herdikiawan D, Rukmono D. 2002. Field investigations on a serious disease outbreak among koi and common carp (*Cyprinus carpio*) in Indonesia. Paper presented in the 5th Symposium on Diseases in Asian Aquaculture, 24-28 November 2002, Gold Cost, Australia.
- Surahmat and Suparno. 1995. What is Pest Risk Analysis (PRA). Paper presented at the Seminar on Fish Quarantine held on 24-26 January 1995 at the Center for Agricultural Quarantine, Jakarta, Indonesia.
- Sutanto H. 2003. Koi. *PT Penebar Swadaya*. p.78.
- Zafran and Yuasa K. 1999. History of VNN disease in Indonesia. *Lolitkanta News Letter*, 15: 3-4 (in Indonesian).

Appendix 1. Summary of Current Mandates of Governmental Departments and other Agencies Concerned with Fish Health Management (Arthur, 2003)

Ministry of Marine Affairs and Fisheries (MMAF)

Directorate General for Aquaculture

Directorate for Fish Health and the Environment

- Develops policy and legislation related to fish quarantine (shared)
- Responsible for disease control and prevention in aquaculture
- Responsible for conducting import risk analysis (IRA)
- Controls introduction of fish into inland waters
- Responsible for disease monitoring and surveillance activities
- Submits reports on national disease status to FAO/NACA
- Responsible for extension activities for fish disease

National Commission on Introductions and Transfers (Proposed)

- Reports to the Director General for Aquaculture

Universities

- Provide ad hoc diagnostic expertise and advice
- Training
- Applied research

Ministry of Trade

- Concerned with fees for quarantine services

Ministry of Health

- Concerns related to zoonotic diseases (i.e., those transmitted from aquatic animals and their products to man)

Ministry of Forestry

- Enforces CITES
- Concerns about impacts of exotic diseases on biodiversity

National Commission on Fish Health (and other committees)

- Reports to the Director General for Aquaculture
- Provides advice on fish health issues

Other Agencies with Related Concerns

Research Agency for Marine Affairs and Fisheries

Central Research Institute for Aquaculture

- Conducts research on diseases of fish

Secretariat General

Center for Fish Quarantine

- Develops regulations, technical guidance and standards for fish quarantine
- Implements quarantine for both international and domestic movements of live fish, including: issuance of health certificates, border inspections, laboratory diagnostics, quarantine of shipments
- Develops technical cooperation with other institutions, both nationally and internationally

Bureau of Law

- Evaluation of laws
- Stakeholder consultation process

Ministry of Agriculture

Chief Veterinary Officer

- Official reporting to OIE (However, fish disease reporting is done by MMAF via FAO/NACA)

Appendix 2. Interrelationships for Governmental Department and other Agencies Concerned with Fish Health Management (Arthur, 2003)

Ministry of Marine Affairs and Fisheries

Secretariat General

(6 agencies including quarantine)

Research Agency for Marine Affairs and Fisheries

Directorate General of Aquaculture

Center for Fish Quarantine

National Fish Health Committee

National Committee on Introductions & Transfers (Proposed)

Five Sub-Directorates

- Fish Disease Monitoring & Evaluation
- Fish Disease Control & Eradication
- Quality Control & Fish Medicine Certification
- Environmental Monitoring & Evaluation
- Aquaculture Environmental Protection

Three Sub-Directorates

- Technical Services
- Administration
- Program for Overseas Collaboration

Directorate for Fish Health & Environment

Others with Potential Involvement

- Universities (4 with fish health expertise)
- Private aquaculturists (farmer's organizations)
- Ornamental fish importers
- Sportsfishermen
- International agencies
- International experts/universities

Fish Quarantine Offices, Stations and Checkpoints

- Fish Quarantine Regional Offices (2)
- Class I Fish Quarantine Stations (7)
- Class II Fish Quarantine Stations (5)
- Fish Quarantine Substations (27)
- Domestic Checkpoints (more than 300)

Research Centers

- Research Center for Aquaculture, Fish Health Research Laboratory
- Four other centers with no activities related to fish health (Marine Technology; Capture Fisheries; Marine Territory and Non-biotic Resources; Fish Processing; and Social Economics of Marine Affairs and Fisheries)

Other Agencies with Related Concerns (Liaison Required) :

Ministry of Health

- Concerns related to zoonotic disease

Ministry of Trade

- Liaison concerning fees for quarantine services

Ministry of Health

- Concerns related to zoonotic diseases

Ministry of Forestry

- Protection of endangered species (CITES)

Ministry of Agriculture

- Chief Veterinary Officer (OIE reporting)

Appendix 3. List of fish health laboratories in Indonesia

No.	Province	Name of Laboratory or Institution	Contact Person	Diagnostic Capability	Address	Diagnostic Level
1	Nangro Aceh Darussalam	Loka BAP Ujung Batee, Banda Aceh	Endah Sutanti	Clinical signs, parasitology, bacteriology	JL. Krueng Raya KM 16 PO BOX 46 Banda Aceh Telp/ Fax (0651) 24686	Level 1 + PCR
		Pos Karantina Ikan ST Iskandar Muda, Banda Aceh	Dra. Erita	Clinical signs, parasitology, bacteriology	JL. Cendana Utama No.7 Jeulingke. Banda Aceh. Telp.(0651) 53705	Level 1
2.	R i a u	Loka Budidaya Laut Batam	Sri Agustati, S. Pi	Clinical signs, parasitology, bacteriology	Jl. KHA. Dahlan Sekupang PO BOX 60 Batam Telp. (0778) 381042	Level 1 + PCR
		BBI Sentral Sei Tibun	Haerudin, A. Md	Clinical signs	Jl. Bangkinang Km.43 Kab. Kampar Telp.(0761) 22921-34685 Fax. (0761) 23191	Level 1
		Pos Karantina Ikan Sultan Syarif Kasim II, Pekanbaru	Tatang	Clinical signs	Gedung Terminal Sultan Syarif Kasim II Telp. (0761) 674626	Level 1
		Pos Karantina Ikan Tanjung Pinang	Ir. Elfahmi	Clinical signs, parasitology, bacteriology	d/a Pos K. Tumbuhan Pinang, Jl. Sumatera No. 163 Tanjung Pinang Telp. (0771) 313316	Level 1
		Pos Karantina Ikan Pangkal Pinang (Bandara Depati amir)	Ir. Hendri Novianto	Clinical signs, parasitology, bacteriology	Jl. Koba Pangkal Baru Telp. (0717) 434756	Level 1
		Universitas Riau Fakultas Perikanan, Pekanbaru.	Ir. Teten Suparmi, M.Sc	Clinical signs, parasitology, bacteriology	Jl. Raya Bangkinang, Pekanbaru Telp. (0761) 63266	Level 1
		Satuan Kerja Karantina Ikan Pelabuhan Dumai	Jhon Edward Reski Paningotan, S.Pi	Clinical signs, parasitology, bacteriology	Jl. Datuk Laksamana, Telp. (0765) 438906	Level 1
3.	Sumatera Utara	Stasiun Karantina Ikan Bandara Polonia, Medan.	Barita Sriwaty Aritonang	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Padang Golf Polonia Medan Telp/Fax (061) 4572181 Email : Fish-Quarantine@Yahoo.com	Level 1 + PCR
		Dinas Perikanan Propinsi	Ir. Erna Dewi	Clinical signs	Jl. Sel Batu Gingging 6 Medan Telp. (061) 552881, 568819 Fax.21508	Level 1
		PT. Central Windu Sejati, Medan.	Edi	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Desa Karang Gading, Secanggang, Kab Langkat, Telp. (061) 7867678	Level 1
4.	Sumatera Barat	Stasiun Karantina Ikan Tabing, Padang.	Ir. Nuraini Umrainita	Clinical signs	Jl. Prof. Hamka Gd. Terminal Bandara Tabing Padang Telp. (0751) 57561	Level 1
5	Jambi	BBAT Seigelam, Jambi	Edi Barkat Kholidin, S.Pi	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Jen.Sudirman No.16 C The Tok, Kab. Muaro Jambi Telp.(0741) 33508	Level 2 + PCR
		BBI Sentral Kerinci	Sukirman, A.Md	Clinical signs	Jl. Desa Pendung Hilir, Kec. Air Hangat Kab. Kerinci, Telp (0748) 353038	Level 1

Appendix 3 (continuation)

No.	Province	Name of Laboratory or Institution	Contact Person	Diagnostic Capability	Address	Diagnostic Level
6	Bengkulu	Pos Karantina Ikan ST Thaha, Jambi	Guntur K Darmanto	Clinical signs	Jl. Sersan UD Syawal Palmerah Baru, Jambi 36139 Telp.(0741) 572474	Level 1
		Pos Karantina Ikan Bengkulu	MW. Giri P,S.Pi	Clinical signs	Jl. Ir. Rustandi Sugianto Km.13,8 Kandang Telp.(0736) 53017	Level 1
		UPTD - BPBAT	Ir. Sri Hartati, M.MA	Clinical signs	Desa Marga Sakti Kec. Lais Kab. Bengkulu Utara Telp.(0736) 21477	Level 1
7	Sumatera Selatan	BBI Sentral Air Satran	Ir. Teti Hutapea	Clinical signs	Desa Air Satran Kec. Muara Beliti Kab. Musi Rawas,Telp. (0711) 352528, Fax.351394	Level 1
		Stasiun Karantina Ikan Sultan Mahmud Badaruddin II Palembang	Leonard Tambunan, S.Pi	Clinical signs	Jl. Adi Sucipta Telp/Fax. (0741) 414184	Level 1
8	Lampung	BBL Lampung	Drs. Philipus Hartono	Clinical signs, parasitology, bacteriology	Desa Hanura Kec. Padang Cermin Kec. Lampung Selatan Telp. (0721) 471379 - 471380, Fax. (0721) 471379	Level 2 + PCR
		PT. Biru Laut Khatulistiwa, Lampung.	Hery Saria	Clinical signs, parasitology,	Jl. Raya Trans Sumatera PO Box.1, Desa Merak Belantung, Lampung SelatanTelp (0721) 351310	Level 1
		Pos Karantina Ikan Pel Laut Panjang	Suharyanto, A.Pi	Clinical signs, parasitology, bacteriology	Jl. Jawa No.5 Pelabuhan Panjang Bandar Lampung Telp (0721) 32487	Level 1
		PT. Prospek Karyatama	Alfian	Clinical signs, parasitology, bacteriology, rapid test for virus	Jl. Ir. Sutami Km 15, Tanjung Bintang - Lampung, Telp. (0721) 351310	Level 1
		PT. Charoen Pokphan Bahari/Bratasena	Januar	Pathology, clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Desa Teladas, Kec. Menggala Kab Tulang Bawang, Lampung, Telp. (0725) 556222	Level 1
9	DKI Jakarta	Laboratorium Riset Kesehatan Ikan, Pasar Minggu - Jakarta	Ir. Taukhid, MSc	Pathology, parasitology, mycology, bacteriology, histopathology, imunology, virology (PCR),	Jl. Ragunan No 20 PO Box 7220, Pasar Minggu. Telp. (021) 7805052 Fax 7815101	Level 2 + PCR
		PT. Charoen Pokphand Jaya Farm, Aquatic Animal Health Laboratory, Jakarta.	Ir.Heni Budi Utari, MS	Pathology, clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jln. Parang TritisV No. 6 Ancol, Jakarta Utara Telp. (021) 6922646, Fax (021) 6914462	Level 2 + PCR
		Pos Karantina Ikan Tanjung Priok, Jakarta	Hary Maryadi	Clinical signs, parasitology	d/a Raya Pelabuhan 6-8 Tanjung Priok, Jakarta.Telp. (021) 491549	Level 1

Appendix 3 (continuation)

No.	Province	Name of Laboratory or Institution	Contact Person	Diagnostic Capability	Address	Diagnostic Level
10	Banten	Balai Karantina Ikan Soekarno Hatta, Cengkareng	Ir. Rini Widoyati	Clinical signs, parasitology, mycology, bacteriology,	Gedung Karantina Pertanian Bandara Soekarno Hatta Telp. (021) 5507932 Fax. 5506738	Level 2
11	Jawa Barat	BBAT Sukabumi	Ir. Endang Mujiutami	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Selabintana No.17 Sukabumi Telp. (0266) 225211-225240 Fax.221762	Level 2 + PCR
		Fakultas Perikanan, Institut Pertanian Bogor (IPB), Bogor	Drs. Alifuddin, MS	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Fakultas Perikanan dan Ilmu Kelautan Jl.Rasamala Dermaga Bogor. Telp.(0251) 628755 Fax. 622941	Level 2 + PCR
		Universitas Padjadjaran, Bandung	Ike Rustikawati	Clinical signs, parasitology, mycology, bacteriology,	Jl. Dipati ukur No. 35 Bandung Telp. (022) 7797763	Level 1
		Balai Pengembangan Budidaya Perikanan Laut, Tawar dan Payau, Kerawang	Sam Prihata, A.Md	Clinical signs, parasitology, mycology, bacteriology,	Jl. Pusaka Jaya Utara Kec. Pedas Kerawang Telp. (0267) 409887	Level 1
		Dinas Perikanan Kabupaten Indramayu	Sri Supriatinah, S.Pi	Clinical sign, virology (PCR)	Jl. Pabean Udik No.1 Indramayu Telp. (0234) 272767	Level 1 + PCR
12	Jawa Tengah	Balai Besar Pengembangan Budidaya Air Payau Jepara	Drs. Arief Taslihan, M.Si	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Pemandian Kartini PO BOX No1 Jepara Telp.(0291)591125, Fax. 591724	Level 2 + PCR
		Universitas Diponegoro, Semarang.	Ir. Desrina, MSc	Clinical signs, parasitology, mycology, bacteriology,	Fak. Perikanan Jl. Prof. Sudarto Tembalang Telp.(0291) 7474698	Level 2
		Balai Pengembangan Budidaya Air Payau Tegal	Ir. Pratiwi	Clinical signs, parasitology, mycology, bacteriology,	Jl. Raya Beringin Maribaya Tegal.Telp. (0283) 323230	Level 1
		Pos Karantina Ikan Tanjung Emas, Semarang.	Ir. Eka Perdana	Clinical signs, parasitology,	Jl. Ampena No.4 Semarang Telp. (024) 541769	Level 1
		PT. Charoen Pokphan Prima Lab, Tegal.	Ir. Nurhabana	Clinical signs, parasitology, mycology, bacteriology,	Jl. Cimanuk 1A Tegal, Telp. (0283) 351375	Level 1
		Satker Karantina Ikan Adi Sumarno, Solo	Ir. Woro Nur Endang Satriati	Clinical signs, parasitology	Jl. Amarta Gedong Baru Ngabean Kartosuro PO Box.800 Suarakarta. Telp.(0271) 790715 Pes 232 Fax (0271) 780058	Level 1
13	Jawa Timur	BBAP Situbondo	Ir. Yani Lestari Nuraini	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Pecaron PO BOX. 5 Panarukan Situbondo Telp.(338) 0673328	Level 2 + PCR

Appendix 3 (continuation)

No.	Province	Name of Laboratory or Institution	Contact Person	Diagnostic Capability	Address	Diagnostic Level
		PT.Tirta Mutiara Makmur	Rubyanto, MBA	Clinical signs, parasitology, virology (PCR)	Jl. Raya Tampora Km.5 PO.Box 14 Telp, (0338) 891286, Fax.(0338) 891679	Level 1 +PCR
		Univ. Airlangga, Surabaya.	Drh.Usni Anwar	Clinical signs, parasitology, mycology, bacteriology,	Jl. Airlangga No.4 Surabaya Telp. (031) 5020348	Level 2 + PCR
		Univ. Brawijaya, Malang.	Ir. Syamsudin Dalimunte	Clinical signs, parasitology, mycology, bacteriology,	Jl. Mayjen Haryono No.161 Malang Telp/Fax (0341) 553512	Level 2
		Stasiun Karantina Ikan Bandara Juanda, Surabaya.	Sri Diyah Purnamasar, A.Pi	Clinical signs, parasitology, mycology, bacteriology,	Jl. Pangesongan II/58 A Jambangan Surabaya. Telp. (031) 8286357 - 8678471	Level 2
		Balai Pengembangan Budidaya Air Payau Bangil	Dra. Ninik	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Perikanan Kalianyar PO Box.6 746 Bangil. Telp. (0343) 741654	Lever 1 + PCR
		Akademi Perikanan Sidoarjo	Ir. Insani Gunawati	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Raya Buncitan PO BOX 1 Sidoarjo Telp. (0318) 911380	Level 1 + PCR
		PT. Suryawindu Pertiwi, Probolinggo.	Yulianto	Clinical signs, parasitology, E45bacteriology	Desa Jabungsisir, Paiton - Probolinggo, Telp. (0335) 771193	Level 1
		Pos Karantina Ikan Tanjung Perak, Surabaya.	Ir. Dwi raharjo, S.Pi	Clinical signs, parasitology, mycology, bacteriology	Jl. Kalimas Baru No.86 Surabaya. (031) 3283886	Level 1
		Petani	Ahmad Munajad	Clinical signs, parasitology	Jl. KS Tubun No.24 Bantarsoka Purwokerto Barat. Telp. (0281) 631468	Level 1
14	DIY Yogyakarta	Univ. Gajah Mada, Yogyakarta.	Dr. Ir. Trianto, M.Sc	Clinical signs, parasitology, mycology, bacteriology	Fak. Perikanan Jl. Bulak Sumur Telp. (0274) 551218	Level 2
		Pos Karantina Ikan Adi Sucipto, Yogyakarta	Drs. Sumargono	Clinical signs, parasitology, mycology, bacteriology	Bandara Adi SuciptoTelp. (0274) 583632	Level 2
15	Bali	Balai Besar Riset Perikanan Laut Gondol	Ir. Zafran	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Desa Penyambungan Kec. Gerokjak Kab. Buleleng PO BOX 140 Singaraja. Telp (0362) 92278 - 92272	Level 2 + PCR
		Stasiun Karantina Ikan Ngurah Rai	Gatot Perdana A.Pi	Clinical signs, parasitology, bacteriology	Jl. I Gusti Ngurah Rai Tuban Denpasar Telp. (0361) 75695 Fax.756951	Level 2
		Wilayah Kerja Karantina Ikan Gilimanuk	Slamet Eko Priyono, A.Pi HP. 08118432312	Clinical signs, parasitology	Jl. Pel Penyebangan Gilimanuk, Jembrana.	Level 1

Appendix 3 (continuation)

No.	Province	Name of Laboratory or Institution	Contact Person	Diagnostic Capability	Address	Diagnostic Level
16	Nusa Tenggara Barat	Loka Budidaya Laut Lombok	Ir. IBM. Made Suastika, MS	Clinical signs, parasitology	Jl. Jend. Sudirman No.21 PO BOX 128 Praya Lombok Tengah Telp./Fax. (0370) 653795-654898	Level 1
		Stasiun Karantina Ikan Selaparang, Mataram	Drs. Nurhaidin, S.Pi	Clinical signs, parasitology	Jl. Adi Sucipto Bandara Salaparang Mataram Telp. (0370) 635425	Level 1
		Pos Karantina Ikan Bandara M. Salahuddin, Bima	M. Farchan, S.Pi	Clinical signs, parasitology	Jl. St. Salahuddin Polibelo Bima Telp. (0374) 6472562	Level 1
		Satker Karantina Ikan Pelabuhan Laut Lembar	I Putu Panca Yasa, S.Pi HP.08123782820	Clinical signs, parasitology	Jl. Raya Pel Laut Lembar, Lombok Barat	Level 1
17	Nusa Tenggara Timur	Pos Karantina Ikan Bandara El Tari, Kupang	Ir. Putu Sumardiana	Clinical signs, parasitology	Jl. Terminal Bandara El Tari, Kupang. Telp. (0380) 832600	Level 1
18	Kalimantan Selatan	Loka Budidaya Air Tawar Mandiangin	Ir. Sarifin	Clinical signs, parasitology, bacteriology	Jln. Tahura Sultan Adam Km 14 Banjar Baru Telp/ Fax. (0511) 780758	Level 1
		Fak. Perikanan, Univ. Lambung Mangkurat, Banjarmasin.	Ir. Ririn Kartika	Clinical signs, parasitology, mycology, bacteriology	Jl. Hasan Basri Ahmad Yani KM. 36 Banjarmasin, Telp. (0511) 777897- 772124	Level 1
19	Kalimantan Barat	Balai Benih Ikan Sentral Anjungan	Ir. Anang Napiri	Clinical signs, parasitology	Desa Kepayang, Kec. Sei Pinyuh, Kab. Pontianak, Telp.(0561) 227926	Level 1
		Stasiun Karantina Ikan Bandara Supadio, Pontianak.	Ir. Suhermanto	Clinical signs, parasitology	Bandara Supadio, Pontianak. Telp/Fax. (0561) 691126	Level 1
		PT. Charoen Pokphan Prima Mempawah, Pontianak.	Diana	Clinical signs, parasitology	Bandara Supadio, Pontianak. Telp/Fax. (0561) 691126	Level 1
20	Kalimantan Timur	Stasiun Karantina Ikan Sepinggan, Balikpapan.	Nafi Mubarak, S.Pi	Clinical signs	Jl. Kol. Syarifuddin Yoes, Balikpapan. Telp/Fax. (0542) 876348	Level 1
		Dinas Perikanan Propinsi, Samarinda	Ir. Esti Wahyuni	Clinical signs	Jl. Kesuma Bangsa No. 1 Samarinda Telp. (0541) 206938	Level 1
		Satker Karantina Ikan Juata, Tarakan	Sachrurozi, S.Pi	Clinical signs, parasitology,	d/a Bandara Juata, Tarakan, Telp. (0551) 35803	Level 1
21	Sulawesi Utara	Loka Balai Air Tawar, Tatelu	Ir. Frederik Lantang	Clinical signs, parasitology, bacteriology	Jl. Penilih, Kec. Dimembe, Kab. Minahasa Telp. (0431) 823697	Level 1
		Stasiun Karantina Ikan Bandara Sam Ratulangi, Manado.	Ir. Sunarti Ahmad	Clinical signs, parasitology	Jl. Bandara Samratulangi, Manado Telp. (0431) 64688, Fax. 811688	Level 1
		Wilayah Kerja Karantina Ikan Bitung	I Nyoman Suardana, S.Pi	Clinical signs, parasitology	Komp. Pelabuhan Laut Bitung Jl. Ir Soekarno No.23 Telp. (0438) 34386	Level 1

Appendix 3 (continuation)

No.	Province	Name of Laboratory or Institution	Contact Person	Diagnostic Capability	Address	Diagnostic Level
22	Sulawesi Tengah	Pos Karantina Ikan Muitiara, Palu	Suardi, S.Pi	Clinical signs, parasitology	Jl. AR. Rahman Saleh No.15 Birobuli - Palu, Telp.(0451) 482131	Level 1
23	Sulawesi Tenggara	Stasiun Karantina Ikan Wolter Mongonsidi, Kendari.	Ir. St. Narwiyani	Clinical signs, parasitology	Jl. Balai Kota No. 4 Kendari Telp. (0401) 3244848	Level 1
		Satker Karantina Ikan Kolaka	Hamzah, S.Pi	Clinical signs, parasitology	Jl. Banteng No. 76, Komp Pelabukan Kolaka	Level 1
24	Sulawesi Selatan	Balai Riset Perikanan Pantai Maros	Ir. Munimah	Clinical signs, parasitology, mycology, bacteriology	Jl. Makmur. DG Sitaka, Maros. Sulawesi selatan Telp. (0416) 371544. Fax 371545	Level 2
		Balai Karantina Ikan Hasanuddin, Makassar.	Ir. Siti Chadijah	Clinical signs, parasitology, mycology, bacteriology	Jl. Landak Baru No. 47 Telp. (0411) 874793. Fax 855766	Level 2
		Univ. Hasanuddin, Makassar.	Ir. Alex Rantetondok	Clinical signs, parasitology, mycology, bacteriology	Jl. Perintis Kemerdekaan Km.10, Makassar Telp. (0411) 586200	Level 1
		Balai Budidaya Air Payau Takala	Drs. Habson	Clinical signs, parasitology, mycology, bacteriology	Desa Bontole, Kec. Galesong, Kab. Takalar Telp. (0411) 320730. Fax 866936	Level 1
		Unit Pembinaan Budidaya Air Payau Pangkep/Barru	Ir.Andi Farida HP. 08124239707	Clinical signs, parasitology, mycology, bacteriology, virology (PCR)	Jl. Poros Pangkep Baru, Kec. Mandale Kab. Pangkep Telp. (0411) 864720	Level 1+ PCR
		PT. Charoen Pokphand Prima, Makassar.	Nathalia	Clinical signs, parasitology, bacteriology	Jl. Gatot Subroto 23 Makassar, Telp. (0411) 438189	Level 1
25	Maluku	Loka Budidaya Laut Ambon	Evri Nurbeti	Clinical signs, parasitology, bacteriology	Jl. Laksda Leo Wattimena, Weiheru Telp (0911) 361616	Level 1
		Pos Karantina Ikan Ambon	Komaruddin, S.Pi	Clinical signs, parasitology	Jl. Laksda Leo Wattimena, Weiheru.Ambon, Telp/Fax (0911) 362047	Level 1
		Pos Karantina Ikan Ternate	Ramli, S.Pi	Clinical signs, parasitology	Komp. Bandar Sultan Babullah, Ternate	Level 1
26	Papua	Stasiun Karantina Ikan Sentani, Jayapura.	Muchlin, S.Pi	Clinical signs, parasitology	Komp. Bandara Sentani PO BOX 234 Jayapura Telp. (0967) 592203	Level 1
		Pos Kerja Karantina Ikan Bandara Mopah, Merauke	Ashari Syarief, S.Pi	Clinical signs, parasitology	Jl. Peternakan Mopah Lama PO BOX 263, Telp (0971) 323749	Level 1
		Pos Karantina Ikan Bandara Jefman, Sorong	Rd. Ferry Ichwan Priatna, A.Pi	Clinical signs, parasitology	Jl.Jend A. Yani No.2 Sorong Telp/Fax (0951) 32671	Level 1
		Satker Karantina Ikan Bandara Timika	Dede Rosmana, A.pi	Clinical signs, parasitology	Jl. Yos sudarso, Timika,Telp. (0901) 322709	Level 1
		Satker Karantina Ikan Bandara Frans Kaisiepo, Biak.	Yesse Danny Huwae, A.Pi	Clinical signs, parasitology	Jl. Prof. Muh. Yamin No. 73 Biak, Papua, Telp. (0981) 23054	Level 1

Appendix 4. List of legislations related to fish quarantine

No.	Decree Number	Level and Effective Date	Note
1.	Act. No. 16/1992	Law of the Republic of Indonesia Effective date (ED): 8 June 1992	This is the main legislation for Quarantine in Indonesia. It includes animal, plant and fish quarantine. This act explains about the health certification, requirement for domestic and international fish movement.
2.	Decree no. 15/2002	The Ministry of Marine Affairs and Fisheries (MMAF) ED: 23 April 2002	Further explanation of the Fish Quarantine act. No. 16/1992. It contents definition, requirement for fish quarantine, quarantine action, quarantine zone, quarantine pest and disease categories, entry and exit point, quarantine personals, retribution and collaboration among the countries.
3.	Decree no. 819/1980	The Ministry of Agriculture ED: 15 Nov 1980 <i>Not valid</i>	Importation procedure of live fish into Republic of Indonesia Permit issued by Directorate General of Fisheries, entry point only Jakarta International Airport
4.	Decree no. 265/1986	The Ministry of Agriculture ED: 6 May 1986 <i>Not valid</i>	The requirements (procedure, document, and criteria) for importation of live fish
5.	Decree no. 245/1990	The Ministry of Agriculture Effective date: April 1990A. <i>Not valid</i>	Quarantine measures, and actions against live fish intended for exportation. Annex. List of exporting points
6.	Decree no. 169/1990	The Ministry of Agriculture ED: March 1990B. <i>Not valid</i>	Specifies ports of entry for live fish airport of Sukarno hatta (Jakarta), regional quarantine service, Polonia Airport (Medan, FQS), Ngurah Rai Airport (Bali, FQS), and Biak Airport (Papua, FQS)
7.	Decree No.405/1996	The Ministry of Agriculture ED: 27 May 1996C. <i>Not valid</i>	Renewal of the Decree no. 88/1994 Revision on entry and exit points for carriers of quarantine pests and diseases of fish
8.	Decree no. 213/2001	The Ministry of Agriculture ED: April 2001D. <i>Not valid</i>	Renewal of the decree no. 245/1990 and 405/1996. Updates the list of entry, exit and domestic checkpoints for live fish transport.
9.	Decree no. 470/2002	The Ministry of Agriculture ED: 31 August 2002	Renewal of the decree no. 213/2001. Updates the list at the appendix.
10.	Decree no. 16/2003	MMAF ED: 9 June 2003	Renewal of the decree no. 470/2002. Updates the list of entry, exit and domestics checkpoints at the appendix.
11.	Decree no. 809/1990	The Ministry of Agriculture ED: 30 October 1990	Fish Quarantine fees for importation, exportation, and inter-island movement of live fish
12.	Decree no. 18/2003	MMAF ED: 9 June 2003	Renewal of the decree no. 405/ Update list of international, and domestic exit and entry points for live fish (airports, seaports, river ports, inland ports, and other intra-national checkpoints)
13.	Instruction letter no. 429/1998	The Center for Fish Quarantine ED: 1 April 1998	Technical guidance on the standard diagnosis and monitoring of quarantine fish pest and disease, as well as the trial for vaccine, disinfections, and medicine.
14.	Decree no. 520/1993	The Ministry of Agriculture ED: 5 August 1993	List of quarantine pest and diseases of fish and their carriers.
15.	Decree no. 841/1999	The Ministry of Agriculture ED: 22 July 1999	Updates of the decree no. 520/1993 concerning list of quarantine fish disease.
16.	Decree no. 17/2003	MMAF ED: 9 June 2003	Updates of the decree no. 841/1993 concerning list quarantine fish disease.(detailed list is enclosed)
17.	Decree no. 363/1990 Decree no. 248/1990 Decree no. 143/1990	Agriculture The Ministry of Health The Ministry of Trade ED: May 1990	Collaboration ministerial decree on the quality control technical guidance for the exported fresh and frozen fish. A simplification procedure <i>Not directly related to fish quarantine</i>
18.	Decree No.34/2003	MMAF ED: 17 Sept 2003	Legal documents required for fish quarantine with standard form examples
19.	Decree no.15/2003	MMAF ED: 9 June 2003	Requirement and procedures for neither individual nor government institution to qualify as a Quarantine unit.

Appendix 5. Legislations on the restriction of movement of certain fish species

1.	Decree no. 214/1973	The Ministry of Agriculture ED: 7 May 1973	Prohibition of exporting live fish (<i>Anguilla</i> , milkfish fry, <i>Botia</i> broodstock, and freshwater shrimp)
2.	Decree no. 179/1982	The Ministry of Agriculture ED: 22 March 1982	Importation prohibition of some high-risk fish to Indonesia. The species prohibited was: Piranha, Vampire catfish, Aligator, <i>Silurus alanis</i> , <i>Esex masoinongy</i> , <i>Electronhorus electricus</i> , <i>Tetraodon spp.</i>
3.	Decree no. 382/1987	The Ministry of Agriculture ED: 20 June 1987	Prohibition of exporting wild milkfish fry from sea around Java, Madura, Lampung, South Kalimantan, East Kalimantan, South Sulawesi, and Southeast Sulawesi.
4.	Decree no. 700/1989	The Ministry of Agriculture ED: 6 October 1989	Agreement for exporting Penaeid shrimp from Indonesia except brood stock and their candidates. Quarantine was not necessarily applied unless stated by the destination country
5.	Decree no. 94/1995	The Ministry of Trade ED: May 1995	Prohibition of exporting Napoleon wrasse (<i>Cheilinus undulatus</i>)
6.	Decree no. 375/1995	The Ministry of Agriculture ED: 24 May 1995	Prohibition for Napoleon wrasse fishing activities, except for traditional fish farmers at certain size, location and number.
7.	Decree no. 34/1996	The Directorate General of Forest Protection and Sustainable Natural Resources ED: June 1996	Prohibition of trading wild Arowana. Permits of Trading of Arowana (<i>Scleropages formosus</i>) only from registered culture farm with certificate of origin and microchip number.
8.	Decree no. 28/2002	MMAFED: June 2002	The decree officially declared that Java Island as an isolated area of the disease and moving carp and koi from Java Island to other islands are strictly prohibited. In addition, importation of common carp and koi into this country was temporarily not permitted.
9.	Decree no. 40/2002	MMAFED: October 2002	Three months after the Ministerial Decree no 28/2002, through Ministerial Decree No.40/2002 Java and Bali is pronounced as infected area and movement of live-fish from the Islands to another within the country should follow quarantine check for KHV. Importing koi and common carp is permitted only from free KHV country.
10.	Circulation letter No. 4999/2002	The Directorate General of Aquaculture ED: 15 Nov 2002	Technical guidance and procedure transporting common carp out the Java island.