

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

Somkiat Kanchanakhan

*Disease Control and Diagnosis Research Unit
Inland Aquatic Animal Health Research Institute
Department of Fisheries, Jatuchak, Bangkok 10900
Thailand*

Introduction

Movement of live aquatic animals has been generally recognized as an activity coupled with high risk of transferring diseases and pathogens from one area to another. A review from a scientist indicated that international fish trade has spread diseases to many countries for years (Håstein, 2000). In case of Thailand, an introduction of Chinese carps (*Hypophthalmichys molitrix*, *Ctenopharyngodon idellus*, *Aristichthys nobilis*) for food fish culture in the past also introduced the parasite *Lernaea* into the aquatic ecosystem. Importation of ornamental fishes also introduced many new pathogens such as *Hexamita*, *Tetrahymena*, and Ranavirus. Some pathogens have wide host ranges including food fish and ornamental fish. The susceptible hosts exhibit clinical signs, disease and death. However, resistant hosts or fish that has recovered from the disease will possibly serve as reservoir or carriers of the disease. Awareness of aquatic animal disease spread through international trade has been increasing since the first edition of *Aquatic Animal Health Code* was published by the Office International des Epizooties (OIE) in 1995. As part of the regional effort to control disease in aquatic animals, the “*Thailand National Strategy for Control of Aquatic Animal Diseases*” have been developed after seminars among staff of the Department of Fisheries (DOF), Department of Livestock Development, universities, private sector representatives and farmers were held in Bangkok in May 2001.

The components of the national strategic plan are as follows: (1) law and legislation; (2) import/export regulation; (3) disease surveillance, monitoring and control systems; (4) aquatic animal diseases, research and development; (5) diagnosis units and capability building; (6) technology/knowledge transfer; (7) public awareness; (8) contingency plan to control disease outbreak; and (9) funding support. The strategic plans have been implemented with good progress.

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

I-1. Production of Common Carp and Koi

There are 3 culture systems for common carp: pond, ditch and cage systems. For pond culture system, farmers normally raise the carp with other fish species (poly-culture system) or with other animals (integrated culture system). For paddy-field culture system, farmers culture carp in the rice paddy fields during the rice cropping season. For ditch culture system, carp is cultured in the ditch that supplies water to fruit farms. According to Fishery Statistics Analysis and Research Group (2001), the total number of freshwater aquaculture farms recorded in Thailand is 389,374 (pond culture = 355,624 farms; paddy field culture = 14,829 farms; ditch = 7,165 farms, cage culture 1,207 farms). The total freshwater aquaculture production is 279,696 metric tons (MT) valued at 9,279.8 million Baht. There were approximately 17,465 common carp culture farms (pond culture = 15,693 farms; paddy-field culture = 1,723 farms; ditch culture = 49 farms) recorded in year 2001. Ninety percent of common carp farms used pond culture system and there was no record of common carp cage culture in Thailand in 2001. The common carp production in year 2001 was 4,773 MT (pond culture = 4,026 MT; paddy-field culture = 736 MT, ditch culture = 10 MT) valued at 146,658 Baht.

The common carp can now be found in the wild (canals and rivers). There is no statistical record for wild caught carp since the quantity and value is very low. Generally, fish farmers obtain carp seeds from government or private hatcheries. Thailand introduced common carp from China about 100 years ago. There is no record of common carp exportation out of Thailand. The common carp is popular among the Chinese for consumption. The pituitary glands of common carp are used to artificially induce gonadal maturation and spawning in fish hatcheries. In the past 20 years, the pituitary gland of carp is in high demand in fish hatcheries. However, since the supply of synthetic hormones became common and gave similar stimulation on gonad maturation, the demand for pituitary gland of carp reduced.

Koi production in Thailand increased in the past 3-5 years. Since Thailand is located in the tropics and the average water temperature is warm throughout the year, Koi rapidly grow and have relatively lower risk against cold-water diseases such as spring viraemia of carp virus (SVCV) and koi herpesvirus (KHV). Koi are cultured in earthen ponds, concrete ponds and cages. The koi brooders are from local sources as well as imported from Japan. Thailand exports koi to many countries. Since the outbreak of SVCV in China, and KHV in Indonesia and Japan, koi exportation from Thailand to other countries is getting higher.

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

Thailand started its KHVD monitoring program since August 2002 and is still free from KHVD up to now. The DOF also developed a rapid response team and gave high priority to investigate any disease cases reported by the

fish farmers or by the fishery officers related to mass mortality or unusual death of koi. At the moment, KHVD survey is being conducted using virus isolation in KF-1 and BF2 cell lines, and through PCR detection.

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

II-1. Production of Shrimps

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

Tiger shrimp culture can be classified as extensive, semi-intensive and intensive culture systems. The number of farms and the amount of productions are shown in the Tables 1-2.

Tiger shrimp brooders are collected from the wild in the Andaman Sea, Gulf of Thailand and South China Sea. Live exportations of marketable-size shrimps were mainly to Hong Kong for human consumption.

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

The Pacific white shrimp was introduced between March 1, 2002 and February 28, 2003. The Pacific white shrimp farms are mainly of intensive culture type. The most recent fishery statistics of the DOF covers up to year 2001 only. However, during the year 2002-2003, white shrimp production is estimated to reach 40% of the total culture shrimp production of the country or 120,000 MT. Pacific white shrimp brooders imported from the USA were specific-pathogen-free (SPF). Some illegal importation of brooders and various stages of white shrimp have been recorded as originating from Taiwan and Malaysia.

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

According to the Fishery Statistics Analysis and Research Group (2001), there were 2,627 giant freshwater prawn culture farms in year 2001. The giant prawn production during year 2001 was 13,310 MT valued at 1,587 million Baht. The prawn brooders were mainly collected from the wild and culture ponds within the country. Both government and private hatcheries

Table 1. Number of shrimp farms by type of culture from 1997-2001

Number of shrimp farms by type of culture					
Type of culture	1997	1998	1999	2000	2001
Extensive	2,837	2,984	2,509	2,689	1,524
Semi-intensive	8,941	1,069	832	1,036	976
Intensive	19,992	21,924	24,671	31,254	19,339
Total	23,723	25,977	28,012	34,979	31,839

(Fishery Statistics Analysis and Research Group, 2001)

Table 2. Production of shrimp farms by type of culture from 1997-2001

Number of shrimp farms by type of culture					
Type of culture	1997	1998	1999	2000	2001
Extensive	3,867	4,487	3,305	3,845	3,829
Semi-intensive	1,941	2,477	2,363	2,434	3,009
Intensive	221,752	245,767	269,876	303,593	273,169
Total	227,560	252,731	275,544	309,862	280,007

(Fishery Statistics Analysis and Research Group, 2001)

supply the prawn postlarvae to farmers. There is no record of giant freshwater prawn importation into Thailand.

II-2. White Spot Syndrome Virus (WSSV)

An outbreak of WSSV first occurred in Thailand in 1993 and caused losses of over US\$500 million. WSSV usually causes problem in shrimp farms during the dry season in Thailand (November to February). Normally during the dry period, the water salinity is high and induces stress to cultured shrimps resulting in severe infection with WSSV. Viruses may come from different sources such as infected postlarvae, carriers and contaminated water. The extreme environmental changes in pH, temperature and salinity can trigger the virulence of the WSSV infection. The DOF has 11 laboratory facilities with the capability to detect viruses using polymerase chain reaction (PCR) to service to the shrimp farmers and screen shrimp postlarvae prior to stocking in the ponds. Of a total 22,235 samples that had been tested, 513 samples were recorded as PCR positive or about 2.5%. The positive samples were recommended for destruction by using disinfectants.

II-3. Taura Syndrome Virus (TSV)

TSV was first reported in Central America and Latin America in 1991 with losses reaching over 1,000 million US\$. Pacific white shrimp with sizes between 0.1 - 5 g are most susceptible to the disease. TSV also infects many species of shrimp including *P. stylirostris*, *P. aztecus*, and *P. setiferus*. Affected areas recorded in the Americas are Ecuador, Peru, Columbia, El Salvador, Guatemala, Brazil, Nicaragua, Hawaii, Florida and Mexico. In 1999, TSV appeared and caused severe mortality to Pacific white shrimp cultured in Taiwan. For Thailand, the DOF had given temporary import permit of Pacific white shrimp for one year (March 2002 – February 2003). During that time, 97,752 SPF shrimp brooders were imported into the registered hatcheries. Since Thailand has over 2,000 km of shoreline and is connected by land to nearby countries, there were some illegal importations of Pacific white shrimp. Because of un-controlled shipments, Thailand experienced TSV outbreak for the first time in year 2003. The TSV diagnosis had been confirmed at the Inland Aquatic Animal Health Research Institute

(AAHRI) using RT-PCR and gene sequencing. Since then, TSV has established in the shrimp farms and hatcheries. The TSV survey during January – March 2004 showed that 21 of 561 (3.7%) shrimp samples from hatcheries and grow-out farms were tested positive for the virus. The positive batches of postlarvae were not allowed for stocking in grow-out farms. The contingency plan to eradicate TSV infected shrimp or disease carrier shrimp in the ponds or grow-out farms has been drafted and intensively discussed in the DOF.

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

There is no record of viral disease in giant freshwater prawn in Thailand. One viral research project is being planned to re-investigate the white muscle syndrome of the giant freshwater prawn in Thailand.

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

III-1. Responsible Facility and Personnel

Two main research institutes, the Inland Aquatic Animal Health Research Institute (AAHRI) and the Coastal Aquatic Animal Health Research Institute, are designated as Central Laboratories of the DOF. The DOF also has another 11 PCR-capable laboratories that are based in 11 Coastal Fishery Research and Development Centers. These two main research institutes and 11 PCR laboratories are responsible for diagnosis and inspection services. Below is the complete contact information for the two main institutes:

- Inland Aquatic Animal Health Research Institute (AAHRI)
Bureau of Inland Fishery Research and Development
Department of Fisheries
Paholyothin Rd., Jatuchak, Bangkok 10900, Thailand
e-mail: aahri@fisheries.go.th
- Coastal Aquatic Animal Health Research Institute
Bureau of Coastal Fishery Research and Development
Pawong, Muang District
Songkhla Province, 90100, Thailand

Fishery Biologists conduct diagnosis and inspection services under supervision of the Directors of Inland and Coastal Aquatic Animal Health Research Institutes, and the Directors of 11 Coastal Fishery Research and Development Centers where PCR laboratories are located. Surveillance and monitoring for diseases of aquatic animals are conducted regularly.

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

Laboratories of the DOF have capabilities for Level II and III diagnosis. University-based laboratories can also diagnose diseases at Levels II and III. Specifically, they are based at the following universities:

- Faculty of Science, Mahidol University, Bangkok
- Faculty of Veterinary Medicine, Chulalongkorn University, Bangkok
- Faculty of Veterinary Science, Kasetsart University, Kamphaeng Campus, Nakornpathom Province
- Faculty of Agricultural Science, Prince of Songkhla University, Songkhla Province

Many private laboratories and shrimp farms have PCR laboratory to detect viral diseases in shrimp. Feed manufacturers and dealers also offer PCR diagnostic services to shrimp farmers.

Table 3. List of economically important diseases of aquatic animals

Name of disease	Affected animals	Level	Note
Epizootic haematopoietic necrosis	Fish and frog	III	Not found
Spring viraemia of carp	Carp	III	Not found
Viral encephalopathy and retinopathy	Grouper	III	
Epizootic ulcerative syndrome (EUS)	About 40 fish species	II	
Epitheliocystis	Cichlids	II	
Grouper iridoviral disease	Grouper	III	
Infection with koi herpesvirus	Common carp and koi	III	Not found
Taura syndrome	Pacific white shrimp	III	
White spot disease	Tiger shrimp, Pacific white shrimp	III	
Yellowhead disease (YH virus, gill-associated virus)	Tiger shrimp	III	
Spherical baculovirus (<i>Penaeus monodon</i> -type baculovirus)	Tiger shrimp	II	
Infectious hypodermal and haematopoietic necrosis virus	Pacific white shrimp	III	

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

IV-1. Responsible Facility, Agency and Personnel

The DOF is responsible for quarantine of aquatic animals. When live aquatic animals arrive in the country, they will be quarantined at the importing company's facilities that passed the quarantine standard. A Fish Health Inspector will inspect the animals at the quarantine zone. Fish samples will be taken and sent to the laboratory for pathogen detection.

The Fish Quarantine Inspector conducts quarantine and inspection services at the port of entry, while a Fish Health Inspector conducts inspection at the quarantine zone of the importing company. The Fish Health Inspectors

are Fishery Biologists or Fish Pathologists working at the Inland or Coastal Aquatic Animal Health Research Institutes, and the Coastal Fishery Research and Development Centers. Level III diagnosis is used on fish for shipment at the quarantine zone of the importing premises.

IV-2. Procedures and Requirements for Importation

Steps for live aquatic animal importation into Thailand:

1. Pre-arrival of the aquatic animals. The importer must have a certificate indicating that the quarantine facilities have been inspected and passed the standard biosecure requirements.
2. Animal arrival at the port of entry. Fish shipment must be accompanied by a health certificate. Fish will be inspected and examined for any possible pathogens. The quarantine officer will check all documents and check fish health using Level I diagnosis. The quarantine officer will order the fish to be quarantined at the certified quarantine zone and notify the fish health inspector to checking the fish at the importing company.
3. Post-arrival of the aquatic animals. The inspector at the port will order the fish to be quarantined at any of the following places: at the quarantine area of the port of entry, at the quarantine area of the importer's premises, or at the place where the Head of the port is assigned.

During 2-3 weeks of quarantine, a Fish Health Inspector will visit and take fish samples back to the laboratory for disease diagnosis. If the fish are free from listed diseases, the importation procedures are completed. If diseases are found, fish will be destroyed or sent back to the country of origin. The DOF uses Animal Epidemic Act and Fisheries Act to regulate the importation. The box contains requirements for importation of aquatic animals into Thailand (completed draft).

IV-3. List of Quarantinable Diseases of Aquatic Animals

- a. Viral diseases: Epizootic haematopoietic necrosis, Spring viraemia of carp, Viral encephalopathy and retinopathy, Grouper iridoviral disease, koi herpesvirus, Taura syndrome, White spot disease, Yellowhead disease, and Infectious hypodermal and haematopoietic necrosis virus
- b. Bacterial diseases: none
- c. Fungal diseases: none
- d. Parasitic diseases: none

Requirements for Importation of Aquatic Animals into Thailand for Culture Purpose

The Department of Fisheries (DOF) has set up a new regulation to prevent and control aquatic animal diseases through importation. The imported aquatic animals are subject to quarantine at the approved quarantine zone of the importing companies for at least of 15 days. Health inspectors will inspect the animals in the quarantine zone and will take samples for laboratory tests.

A health certificate must be presented at the port of entry together with the aquatic animal shipment. The health certificate must be issued by competent authority, signed by veterinarian or authorized officer, and must contain information as follows;

1. Name and address of consignee
2. Name and number (scientific and common name) of aquatic animals
3. Origin of the aquatic animals exported.
4. The aquatic animals must come from a country, a zone or a farm establishment where they are submitted to a health supervision set up to operate according to the procedures described in the *Diagnostic Manual for Aquatic Animal Diseases* from Office International Des Epizooties (OIE) and that this country, zone, or farm establishment is recognized officially unaffected by the OIE listed diseases. If the test methods of any diseases are not designated in most recent edition of the OIE Diagnostic Manual, test methods of the disease which having been published in international science journals shall be used and must be state in the certificate.
5. The exported animals must not come from the sources that had an unusual mortality during the previous 3 months, which the causation could not be explained.
6. Before exportation, the animals must be quarantined for 7-10 days and treated with chemicals to remove all external parasites.
7. The exported animals must be certified as indicated in the following table:

Type of aquatic animals and their gametes to be exported.	Type of diseases or pathogens
Freshwater fish	Epizootic haematopoietic necrosis virus or EHNV Iridovirus disease or Ranavirus disease Viral haemorrhagic septicaemia or VHS Spring viraemia of carp virus or SVCV Koi herpesvirus disease
Marine and estuarine fish	Red sea bream iridovirus disease or RSIV Viral encephalopathy and retinopathy or VER
Mollusks	Bonamiosis MSX disease Marteliosis Mikrocytosis Perkinsosis
Crustaceans	Taura syndrome virus White spot syndrome virus Yellowhead virus Infectious hypodermal and haematopoietic necrosis virus Crayfish plague disease
Amphibians	Iridovirus disease or Ranavirus disease Epizootic haematopoietic necrosis virus
Reptiles	Iridovirus disease or Ranavirus disease Poxvirus

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

AAHRI has trained 2 groups of DOF staff on topics related to surveillance, monitoring and diagnosis of fish diseases. Group one was composed of Fishery Biologists based at the Fisheries Research and Development Centers and they received Level II training course program. Group two was composed of Provincial Fishery Officers based at the Provincial Offices and they received Level I training course program.

References

- Fishery Statistics Analysis and Research Group 2001. *Freshwater Fishfarm Production 2001*. Fishery Information Technology Center, Technical Paper No. 10/2003, Department of Fisheries, Bangkok. 65 p.
- Håstein, T. 2000. Principles of prevention and control of aquatic animal diseases. 68th General Session of the International Committee, May 22-26, 2000, Paris. Office International Des Epizooties, Paris. 31 p.