The Status of Aquatic Animal Health in Cambodia

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Abstract

Human population in Cambodia keeps increasing from year to year and the demand for food consumption also increases. Food products in Cambodia come from two main sources: terrestrial and aquatic. In this sense, aquaculture has been playing very important roles to produce aquatic food products in order to provide the sustainability of national food security, economy and also minimize the pressure on Cambodia's capture fisheries. Aquaculture production in Cambodia has grown by an average of 20 % per year over the past decade, increasing from less than 50,000 metric tons in 2008 to 207,443 metric tons in 2017. However, disease is considered as the most serious problem that can limit the aquaculture production in many countries in the world including Cambodia. Previous reports showed that in 1999 intensive shrimp farming systems in Cambodia were severely affected by White Spot Syndrome Virus (WSSV), Monodon Baculovirus (MBV) and Yellow Head Virus (YHV). Hence, shrimp farming areas dropped from 1,000 hectares to 850 hectares in the year 2000 and gradually decreased each year. WSSV is the most serious threat faced by the shrimp farmers in Cambodia and is probably the major cause of direct losses of up to $ 14.5 million per year. During 2011–2013, white leg shrimp (*Litopenaeus vannamei*) was seriously infected by Early Mortality Syndrome (EMS) in Koh Kong Province. To date, extensive and semi-intensive shrimp farming have started mainly in Kampot, Kep and Preah Sihanouk and Koh Kong. Only one super intensive RAS Indoor white leg shrimp farm in Kampot operated in 2019.

Recently, fish health monitoring of freshwater fish farms in 10 provinces and sea bass farms in three coastal provinces were conducted by the cooperation of central officers, officers from Marine Aquaculture Research and Development Center (MARDeC) and provincial officers. Fish samples were diagnosed and analyzed in Aquatic Animal Health Laboratory of MARDeC. The results showed that several of fish pathogens were identified such as fish parasites: *Trichodina* sp., *Ichthyophthirius multifiliis*, *Epistylis*, *Apisoma*, *Dactylogyrus* sp., *Gyrodactylus* sp., *Argulus* sp., *Acanthocephalan*, *Henneguya* sp., *Cryptocaryon irritans*, *Caligus* sp., *Lernaea* sp., *Benedinia* sp., *Ancyrocephalidae* sp., *Amyloodinium* sp. and *Myxozoa* sp. Pathogenic bacteria: *Aeromonas* spp., *Edwardsiella ictaluri*. Fungi: *Aphanomyces invadans* and *Saprolegnia* sp. Diagnostic laboratories can perform level I and II but not for all species of aquatic animals and diseases; level III is not yet effectively performed due to the lack of facilities, skills and knowledge.

Keywords: aquatic animal health, diseases outbreak, aquaculture, Cambodia

Introduction

Cambodia, located in the continent of Asia, covers 176,515 square kilometers of land and 4,520 of water, making it the 90th largest nation in the world with total area of 181,035 square kilometers. Bordered by Thailand and Laos to the northwest, Viet Nam to the east and the Gulf of Thailand to the Southwest. Cambodia has a population of over 16 million. There are many natural water sources in Cambodia like the Tonle Sap or Tonle Sap Lake, the biggest lake in the country and situated in the central part of the country. The lake's size varies considerably over the year from an area of around 2,500 square kilometers at the end of dry season in late April to an area of up to 16,000 square kilometers during the rainy season in September to early October. The lake was one of the most abundant inland waters in the world where floodplains and shrubs provide the habitat and breeding grounds for fish and other aquatic animals. It was reported that more than 500 freshwater fish species (Rainboth, 1996) inhabit the lake. On the other hand, more than 562 marine fish species were identified (Try, 2003; Hortle, 2007) in Cambodia's coastal zone located on the Southwest of the country extending 435 km in the gulf of Thailand (Hav and Leap, 2005). Cambodians consume 52 kg of fish per person per year which was recorded as one of the highest level of fish consumption in the world. Remarkably, people who lived around Tonle Sap Lake consumed fish between 67–80 kg per capita per year (Lang, 2015).

Human population in Cambodia keeps growing every year and the demand for food also increases (Joffre *et al*., 2019). Moreover, abrupt climate changes, destruction of floodplain for agricultural lands, hydropower dam constructions in upstream Mekong River, and some illegal fishing are considered as the major challenges causing the fluctuation of Cambodia's capture fisheries (Khan *et al*., 2019). Aquaculture is an alternative way to minimize the pressure on Cambodia's capture fisheries and has potentially contributed to national food security, economic sustainability and promote poverty alleviation (SPF, 2015).

Seed production rapidly increased from less than 20 million in early 2000s to approximately 180 million in 2015. Fifty-five percent (55 %) of the seeds are imported from adjacent countries, 13 % derived from the wild and 32 % from Cambodian state and private hatcheries. Freshwater cage culture has been practiced for many centuries in Great Lake, Tonle Sap and the Upper Mekong river. Cage culture contributed about 50 % to total aquaculture production with several main species including giant snakehead (*Channa micropeltes*, 47 %), pangasius (*Pangasianodon hypophthalmus*, 27 %), and hybrid catfish (*Clarias*, 27 %) and other species (3 %). Marine and brackish water aquaculture are relatively under developed. Marine cage culture began in the late 80s and early 90s in Kampot and Koh Kong provinces (NSPAD, 2017). It was mostly practiced in small scale farms in Preah Sihanouk, Kampot, Kep, and Koh Kong provinces located along the Cambodian coastal line. Farming was mainly based on seeds of sea bass, grouper, cobia, and pompano that were produced either from governmental hatcheries, from the wild, or were imported (Sorphea *et al*., 2018). According to official statistics of Fisheries Administration, aquaculture production increases by an average of 20 % per year over the past decade, increasing from less than 50,000 metric tons in 2008 to 207,443 metric tons in 2017. Aquaculture accounts for 20 % of the total fish production in the country and

the majority of aquaculture production is from inland aquaculture that accounts for nearly 90 % (Joffre *et al*., 2019). Aquaculture in Cambodia has been quickly increasing year by year as mentioned, but disease outbreaks are the main constraint in developing aquaculture in the country leading to serious economic loss to both inland and marine aquaculture.

Shrimp farming and disease outbreaks

Shrimp cultivation in Cambodia started in the early 1990s and had increased tremendously since 1991. Black tiger shrimp (*Penaeus monodon*) and whiteleg shrimp (*Litopenaeus vannamei*) are the common species cultured in intensive and extensive systems in coastal provinces. Extensive shrimp culture system was mostly carried out by farmers in Kampot and Preah Sihanouk. Shrimp ponds are normally constructed close to the mangrove areas, some with mangroves planted inside the ponds; stocking density range from 5,000 to 20,000 postlarvae/ha. Generally, these extensive shrimp farms depend mainly on natural food propagated in the ponds for feed, and on tidal water for water change. It required low cost investment for pond construction, preparation and farm operation, without feeding, water pond aeration, and predator control for a whole cycle of shrimp cultivation or until harvesting. However, the productivity remained lower than 100 kg/ha/year. In contrast, intensive culture has stocking densities ranging from 300,000 to 500,000 postlarvae/ha. While intensive shrimp culture system was practiced predominantly by farmers in Koh Kong province located near Thailand. Intensive shrimp farming system was first introduced by Thai shrimp farmers during 1980–1990. It was an advanced system that required high capital for farm establishment, pond construction and farm operation. Moreover, high quality pelleted feed or formulated feed, water aeration and regular treated seawater exchange were required. The main species for intensive shrimp farming system was *Penaeus monodon*, at high stocking density of 300,000–500,000 larvae/ha and productions of newly established farms reached 7 to 8 metric tons (MT)/ha per crop (Lang and Sothea, 2016).

In 1999, intensive shrimp farming in Koh Kong province seriously suffered from disease outbreaks caused by White Spot Syndrome Virus (WSSV), Monodon baculovirus (MBV), and Yellowhead Disease (YHD). Black tiger shrimp was the main affected species during these outbreaks and there were many shrimp farmers who stopped their intensive shrimp farming systems and reverted to fish culture. Eventually, shrimp farming areas dropped to 850 hectares out of 1,000 hectares in the year 2000 and decreased gradually each year (Racy, 2004).

Due to *P. monodon* severely attacked by diseases leading to a substantial loss of economy to the farmers, a new alternative or complementary species with special characteristics like high disease resistance, fast growing and high tolerance to wide range of climate changes was discovered. Finally, *Penaeus monodon* was immediately replaced by *Litopenaeus vannamei* and it became a popular species at that time, but unfortunately its production gradually declined due to infection with Early Mortality Syndrome (EMS) during 2011–2013 (Lang and Sothea, 2016).

Touch (2002) reported that intensive shrimp farming in Koh Kong province increased up to 1,000 ha until the onset of white spot syndrome virus (WSSV) outbreaks and it was the most serious problem faced by farmers in Cambodia causing economic losses of approximately USD 14.5 million per year. To date,

extensive and semi-intensive shrimp farming are practiced mainly in Kampot, Kep and Preah Sihanouk and Koh Kong. Only one super intensive RAS Indoor white leg shrimp farm in Kampot started to operate in 2019.

Sea bass external parasitic diseases monitoring

Recently, Mam *et al*., (2019) studied the parasitic diseases of sea bass in the Marine Research and Development Center (MARDeC) and in the cage and pond culture systems in coastal provinces such as Koh Kong, Preah Sihanouk, and Kampot provinces. This investigation aimed to identify the types of parasitic disease which occur in MARDeC, in cage and pond culture in coastal provinces. A total of 8 different species of external parasites were found, 2 with ciliate protozoa (*Cryptocaryon irritans* and *Trichodina* sp.), 1 with crustacean sea lice (*Caligus* sp.), 1 with Crustacean copepod (*Lernaea* sp.), 2 with Capsalid monogenean (*Benedenia* sp. and *Ancyrocephalidae* sp.), 1 with Dinoflagellate (*Amyloodinium* sp.), and 1 with *Myxozoa* (*Myxozoa* sp.). This showed that 3 types of parasites such as *Ancyrocephalidae* sp., *Trichodina* sp. and *Cryptocaryon irritans* have the highest prevalence of infection followed by *Myxozoa* sp., *Caligus* sp. and *Lernaea* sp. in those coastal provinces including MARDeC, while *Amyloodinium* sp. occurred in MARDeC only.

Activities on freshwater fish disease and health monitoring program

From 2016–2018, under the European Union funded program "Promotion of Inclusive and Sustainable Growth in the Agriculture Sector: Fisheries and Livestock, DCI-ASIE/ 2012/ 023-197 Fisheries sub-sector Component, DCI-ASIE/2013/331-574 (EU-PGA-FiA)," a team of aquatic animal disease and health management from the Department of Aquaculture Development (DAD) carried out a fish health monitoring program in 10 target provinces. In each mission, a team was formed with a combination of officers from DAD and Marine Aquaculture Research and Development Center (MARDeC) and a provincial FiA officer. The current status of fish disease occurrence in the province was discussed first before conducting the fish health monitoring activities. Fish monitoring activities were divided in two main phases. Phase 1 is on-site fish sample collection phase. The activities include interviewing farm owners and inspection of fish farms (pond/cage system). Water samples were collected to test water quality parameters that mainly influenced the health of farmed fish. The team gave recommendations to the farmers for reconditioning their farm as a primary and urgent solution then finally the team collected suspected fish samples for further diagnosis. For phase 2, suspected fish samples were transported from each province to an aquatic animal health laboratory of the Marine Aquaculture Research and Development Centre (MARDeC) for further disease diagnosis. The diagnosis mainly focused on pathogenic parasites and bacteria that notoriously infected major farmed fish species. The leader of the team collected and synthesized the information from on-site monitoring/interviews and laboratory diagnosis. The leader then inform fish farmers about diagnosis and provided technical recommendations to solve the occurring problems at their fish farms. A summary of farms visited during the Diseased fish sample collection from 10 target provinces under the National Fish Disease and Health Monitoring Program funded by the European Union is presented in the table on the next page.

Province	Farm	Culture System		Sampled Species	Year
		Pond	Cage		
Kampong	17	10	7	-*Channa micropeltes*	2016
Chhnang				-*Channa striata*	
Kandal	16	16	0	-*Pangasianodon hypophthalmus*	2016
Banteay Meachey	14	14	0	-*Oreochromis niloticus*	2017-2018
Battambang	18	14	4	-*Anabas testudineus*	2017-2018
Kampong Thom	18	9	9	-*Oxyeleotris marmorata*	2017-2018
Kampong Cham	9	6	3	-*Cyprinus carpio*	2018
Pursat	14	6	8	-Hybrid catfish	2018
Prev Veng	9	6	3	(*Clarias batrachus* and *C. gariepinus*)	2018
Takeo	13	13	0	-*Pangasius larnaudii*	2018
Preah Sihanouk	11	11	0	-*Hypsibarbus pierrei*	2018
Total	139	105	34		

Sources: (Khan *et al*., 2019)

During the monitoring program, Marine Aquaculture Research and Development Center (MARDeC) was the only main laboratory for aquatic animal health diagnosis. Some diseases such as Bacillary necrosis of pangasius (BNP), Red spot or Motile aeromonas septicemia, are of concern in farmed aquatic animals of Cambodia at that time. Several pathogens have been identified from collected farmed fish such as Fish parasites: *Trichodina* sp., *Ichthyophthirius multifiliis*, *Epistylis*, *Apiosoma*, *Dactylogyrus* sp., *Gyrodactylus* sp., *Lernaea* sp., *Argulus* sp. and Acanthocephalan. Fish pathogenic fungi: *Aphanomyces invadans* and *Saprolegnia* sp. Fish pathogenic bacteria: *Aeromonas* spp. and *Edwardsiella ictaluri*. Marine Aquaculture Research and Development Center (MARDeC) was the only main laboratory for aquatic animal health diagnosis. To date, diagnostic laboratories can perform level I and II but not for all species of aquatic animals and diseases, whereas level III is not yet effectively performed due to the lack of facilities, skills and knowledge.

Conclusion and way forward

Intensive shrimp farming systems along the Cambodian coastal line have been severely affected by diseases due to limitation of aquaculture skills, GAP and biosecurity practices. To date, extensive and semi-intensive shrimp farming have started mainly in Kampot, Kep and Preah Sihanouk and Koh Kong. Only one super intensive RAS Indoor white leg shrimp farm in Kampot operated in 2019. According to the recent research on fish disease and health management program, commercial freshwater and marine fish species in floating net cage

and pond systems suffered from some external parasitic and bacterial diseases. Concerning the diagnostic capability, the officers can perform level I and II but not all aquatic animals and diseases, also level III it is not yet effectively performed.

Disease is considered as a major problem in developing aquaculture in Cambodia because it has caused serious losses in the livelihood of farmers. Thus, to minimize the spread of disease, outbreaks and promote the expansion of aquaculture production in Cambodia. The tasks for sustainable aquaculture should be performed including:

- Improvement, amendment, and enforcement of the regulations, laws, SOPs and other relevant documents for responsible management to establish the aquatic emergency preparedness and response systems for effective management of transboundary disease outbreaks in Cambodia.
- Capacity building of aquatic animal health management officers on technique and skills for monitoring and disease surveillance.
- Development of national guidelines on Good Aquaculture Practice (GAqP), Biosecurity practice and management of chemical and organic residues, and invasive species in Cambodia.
- Establishment of laboratory for aquatic animal health monitoring, diagnosis and analysis, extension services and seeking for continuous funding for research.
- Strengthening collaborations among central officers, provincial officers, researchers, farmers' networks, ASEAN member states and other NGOs to have good technical expertise particularly aquatic animal health management.

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