Tilapia Diseases Management of Fish Farmers in Tilapia Cage Culture in Songkhram River

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Abstract
This study aim to summarize the current knowledge of fish cage farmers in Songkhram River with regard to fish diseases and their management. A total of 148 fish farmers who rearing fish cage culture in Songkhram River were interviewed on their knowledge about fish diseases and diseases management. Most fish farmers are a male and the average ages is 49.1 ± 11.5 years. Most farmers (92.6%) had faced disease problems in the last years. The risk for fish disease had frequency occurred during April and June, which is the interval between the summer and the rainy season. Fish farmers believe that the fish diseases were caused by the new water column in the river (98%), unsuitable water quality, the chemical from agriculture, disease outbreak, and weather variables. Most fish diseases found ectoparasite infection (66.9%) and bacterial infection (52%). The most clinical signs that observed by farmers was exophthalmia (97.3%). For the treatment and management of fish diseases, famers were removed infected fish (98.6%), add vitamin with feed, and applied antibiotic. The prevent practice of fish diseases, farmers were observed the fish, regularly cleaning cages, applied vitamin, and stop rearing fish during diseases outbreak period.

Keywords: *Tilapia diseases, Fish diseases management, Cage culture, Songkhram River*

1. Introduction
Nile Tilapia (*Oreochromis niloticus*) is a major economic fish in Thailand. It is widely rearing across all regions of the country. Nile Tilapia is rapid growth, tastes great and cheap. Therefore, it is popular among consumers. Cage-based aquaculture in rivers or other public water bodies is popular than ponds aquaculture on private land. The river-base cage culture is a high yielding farming, which contributes to the highest economic benefits and utilization of natural water resources, and also allows landless people could turn to fish farming [1]. Besides, it's also convenient in handing movement, harvest and is investing less than other forms of fish farming. The North-East is the number one of freshwater fish yields from cages culture farming of the country. In 2016, the number of fish farm in the north-east was 1,419 farms with a freshwater fish yield 10,200 tons [2], generated income to fish farmer in the area. However, most fish farmer has suffered more fish diseases, which are caused by wastewater, weather variation, parasite infestation, and bacterial infection [3,

4, 5] consequence farmers to risk of damage and loss. Fish farmers have different methods of managing treatment, prevention and coping. Therefore, this study is to collect information on fish diseases and management of fish farmers in Songkhram River, to be useful in the planning of fish diseases management for tilapia cage culture in the future.

2. Material and methods

The population of this study was 235 fish farmers in Sakonnakhon and Nakhonphanom province who rearing fish in floating cage in Songkhram River and registered with the provincial fisheries office. The sample of this study was 148 fish farmers, determine by formula of Taro Yamane [6] using a simple random sampling. The study site is five districts (Thauthen ,Khamtakla, Akatamnuai, Sisongkhram and Nathom; n=74, 30, 25, 11, 8 farms, respectively). The data were collected during April and December 2017.

This study collected data using a structure questionnaire that consists of both an open-ended question. Most questions covered the Nile tilapia rearing data, caused of fish diseases, the characteristic clinical sign of the disease, and how to treatment and prevention methods. The data of daily air temperature and amount of rainfall in 2017 of the study area were received from Sakonnakhon and Nakhonphanom provincial meteorological office. Data were statistical analysis with descriptive statistic.

3. Results

3.1 The features of fish farmers

Most fish farmers are male (54.7%) with an average ages of 49.1 ± 11.5 years and primary school graduates (71.6%). Most of fish farmer rear fish as a minor occupation (72.3%) from rice farming. Farmers have experience in fish cage culture on average 8.4±5.2 years with the average number of fish cages 15.6±33.9 cages. The most common cage sizes was 3 × 3 × 3 meters with fish stocking density 32 fish/m^3. Fish fry were obtained from private hatchery (95.1%) with average length .548±2.3 centimetre and the period of rearing fish was 5 months.

3.2 The weather data of the study area

An average air temperature in Sakonnakhon and Nakhonphanom during January and December 2017 was 26.5 ◦C. The highest average air temperature was in April (33.8 ◦C) and the lowest average air temperature was in December (16.6 ◦C) (Figure 1). For amount of rainfall in the study area found that July had the highest average amount of rainfall (726.3 millimetres) and January had the lowest average amount of rainfall (0.5 millimetres) (Figure 2) [7, 8].

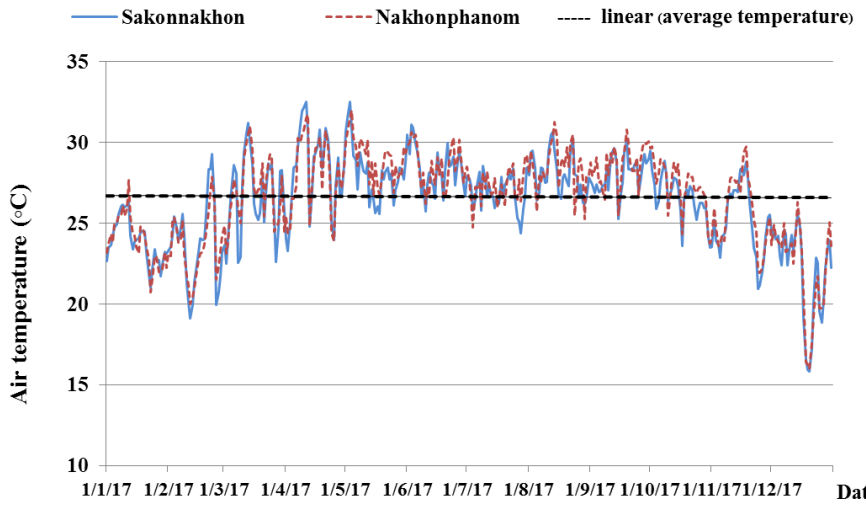

Figure 1 Air temperature of the study area between January and December 2017.

3.3 Fish diseases data

Most farmers (92.6%) had faced fish disease problems in the last years. The risk for fish disease had frequency occurred in May (54.7%), June (52.7%) and April (49.3%), which is the interval between the summer and rainy season (Figure 2). The fish had infected diseases after started rearing in cage average 82.2±40.1 days. The damage of fish disease is a death fish with the average number of death fish from disease 90.3±197.1 fish/cage.

Most fish farmers believed that the fish diseases were caused by the new water column in the river (98%), unsuitable water quality, chemical from agriculture, disease outbreak, and weather variables (Figure 3). Most farmers think that fish diseases were caused by ectoparasite infection (66.9%), followed by bacterial infection (52%), fungi infection (33.8%), and virus infection (12.2%).

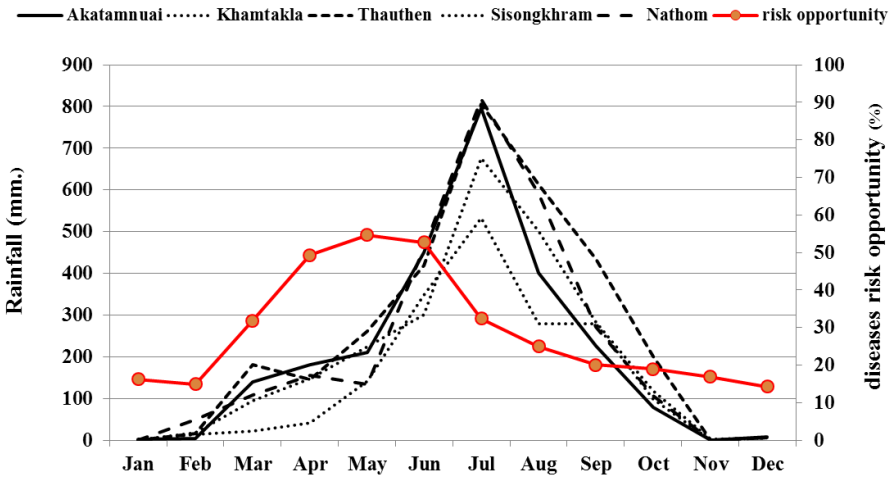

Figure 2 Amount of rainfall in the study area and the risk opportunity of fish diseases.

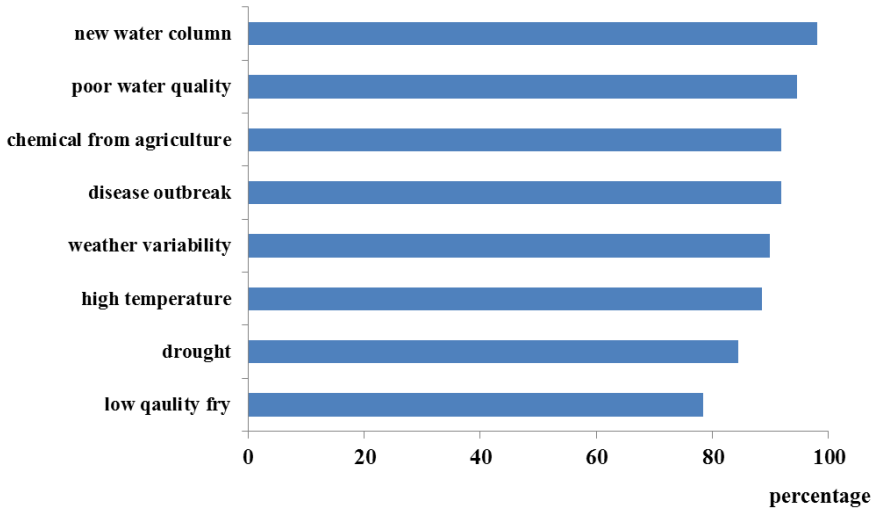

Figure 3 The cause of fish diseases from fish farmer interview (n=148).

The most clinical signs that observed by fish farmers were exophthalmia (97.3%), abnormal swimming, eat less feed, petechial hemorrhage, swollen, lesion on skin, abnormal gill colour, and fin rot (Figure 4). In addition, some farmers found an appearance of cotton wool on the body caused by fungi infection.

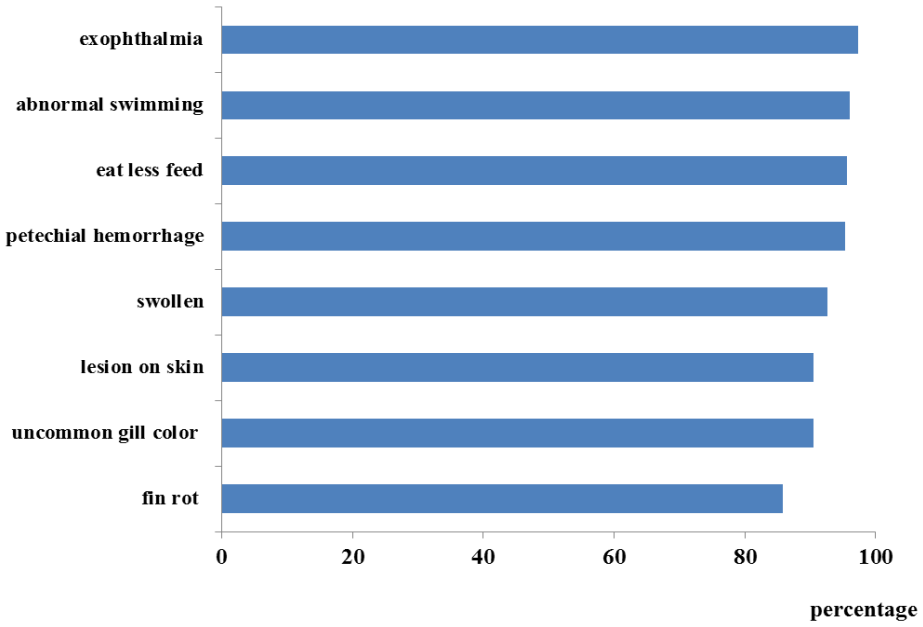

Figure 4 The clinical signs that observed by fish farmers (n=148).

For the treatment and management of fish diseases, famers were removed infected fish (98.6%), mixed vitamin with feed, reduced feed, applied antibiotic, treat with potassium permanganate ($KMnO_4$), using salt, and reduced stocking density (Figure 5). Herbs were also used for treatment as a replacement for antibiotics (39.9%), type of the traditional herbs such as ginger, galangal, kaffir lime, lime, papaya, banana, garlic and shallot. Some farmers may use one type of herb or use many types together.

The prevent practice of fish diseases, farmers were observed the fish (97.3%), regularly cleaning cages (92.6%), applied vitamin (95.3%), and stop rearing fish during diseases outbreak period (52.7%). The death fish were buried (79.7%), processed to food (69.6%) and made fertilizer (48%).

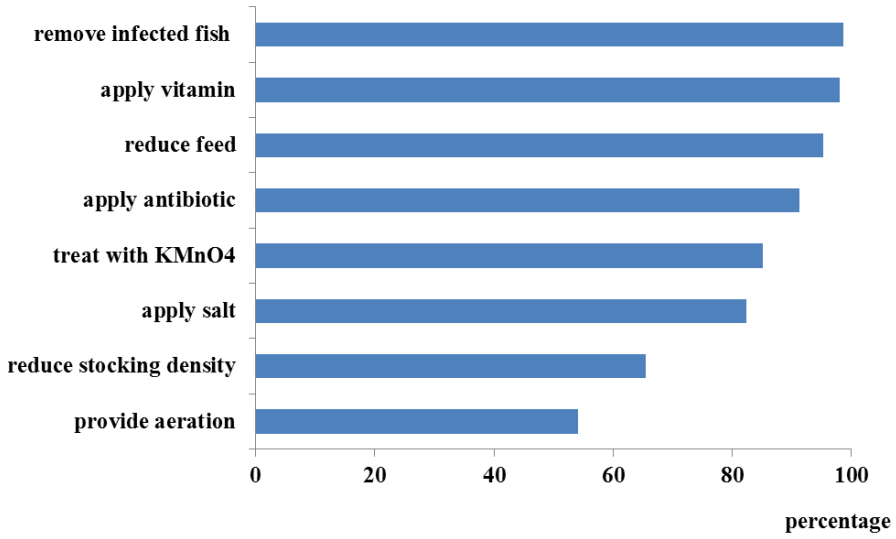

Figure 5 Methods for disease management of fish farms (n=148).

4. Discussion

The disease outbreak of fish culture in floating cages is one risk that fish farmers cannot be avoided, due to fish rearing in the river unable to control water quality [9]. Most fish farmer always faced with fish diseases problem, but they still cannot know the true cause of the fish diseases. Because fish farmers do not send infected fish to the Department of Fisheries or specialized agencies to diagnosis. Moreover, farmers do not regularly monitor water quality of water resource, it is also difficult to diagnosis a cause of fish disease.

Most farmers suffered fish diseases during April to June which is duration of summer and rainy season. During this period, water parameter of river was rapid changes due to the new water column from rainfall that caused damage fish in floating cages [3]. The weather variation effected to the change of water quality of the river such as water temperature, pH and dissolved oxygen (DO) which effect to fish stress and eventually cause diseases [3, 10, 11]. In addition, high flows in the rainy season might push a fish against the net cage that caused lesion on fish skin and leading to wound infection [12]. The water quality change is considered a weak point of fish cage culture in the river because farmers unable to manage water parameter in the river. This different from fish culture in the earthen pond that farmer can control or manage water quality in their pond. Therefore, farmers, stakeholders and government must be aware and find the effective procedure to solve this problem.

The symptom of fish disease from ectoparasite that observed from the farmers was abnormal swimming and the external parasites on fish gill or fish skin. The ectoparasite that

attached on fish skin is cause of lesion and leading to bacterial infection [3, 12, 13]. The type of ectoparasite that commonly found in fish cage culture is *Trichodina* spp., it is a very small protozoa that heavy infestation on gill and body surface. Infected fish display anxious swimming, rub body with the cage net and eat less feed. *Trichodina* also cause a high mortality in fish fry [12]. In addition, ectopararsite that can infestation in Nile tilapia are *Epistylis* sp., *Icthyophthirus* spp., monogens (*Gyrodactylus* sp., *Dactyrogyrus* sp. and *Cichlidogyrus* sp.), *Argulus* sp., and *Alitropus* sp. [3, 12, 14].

The most common clinical signs of bacterial infection that observed by farmers are bulging eyes, swirling swimming, skin haemorrhage, swollen, lesion on body, abnormal gill colour and fin rot. However, farmers did not send infected fish to diagnosis, so it is not identify the type of bacteria. Bacteria that cause diseases outbreak in Nile tilapia that frequency found are *Streptococcus* sp., *Flavobacterium columnare* and *Aeromonas hydrophila*.

The notable clinical signs of *Streptococcus* infection included spinning swimming or no balance swimming, darker or lighter body colour, exophthalmia, swollen abdominal, hemorrhagic in organ such as mount, operculum, eye, fin and body [12, 15, 16, 17]. The mortality rate of streptococcosis is high when the water temperature higher than 35 ℃ [18, 19].

Flavobacterium columnare is cause of acute or chronic infection in fish. It clinical signs are infection in gill, skin and fin. The clinical signs of the columnaris disease are gill damage, gill inflammation, gill rot, lesion of body, fade skin colour, hemorrhagic and fin rot. Some infected fish found inflammation of oral mucosa cause of canker, so call “cotton wool disease” or “mouth fungus” [20, 21]. The columnaris disease outbreaks usually more violent when water temperature increasing [22]. Water quality is the one of main factor of the outbreaks, columnaris disease usually occur during rapid changes in water temperature and other water quality after the rainfall. Decostere [23] reported that amount of *Flavobacterium columnare* in fish gill was higher when organic matter and amount of nitrite in the water were high.

Another bacterial disease is *Aeromonas hydrophila*, the clinical signs of infected fish are hemorrhagic septicemia, lethargy, not eat feed, fin erosion, swollen abdominal and intestinal hemorrhagic [24]. The environmental changes such as low dissolved oxygen level, increase of amount of ammonia and nitrite and increase of water temperature results more outbreak of *A. hydrophila* [11].

For treatment and management of fish diseases, most farmers removed infected fish, mixed vitamin in feed, reduce feeding and used antibiotic. From the study of antibiotic and chemical use of river-base cage culture in Thailand found that most fish farmers used antibiotics and chemicals. But farmers still have incorrect knowledge and less understanding about antibiotics and chemicals use [3, 9]. Farmers learn to treat fish disease by themselves, but they do not know the type of antibiotic that they used and lack of advice from government officials. As a result in the treatment may be not match with the disease, not effective treatment and cause of drug resistance in aquatic animals [12, 25]. Moreover, antibiotic residues also found in fish and sediment around floating cage area that have a

long time background of antibiotic used which affects consumers and the environment [9]. Therefore, the antibiotic use for fish treatment is an important issue that all stakeholders should be pay attention for sustainability in friendly to consumers and eco-friendly fish farming.

5. Conclusion

The tilapia disease management of fish farmers in floating cage culture in Songkhram River found that the farmers still have incorrect knowledge and understanding about disease management, especially the diagnosis of fish disease with sending infected fish to government agencies or experts to diagnose the exact cause of the disease, in order to use antibiotic that match with the type of bacteria. In addition, fish farmer also face with the changes of water quality of the river that farmers cannot control. Thus, farmers monitoring fish, reducing fish stocking density during the outbreak and add vitamin in feed to reduce the risk of damage.

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