A study about water quality, fish and phytoplankton in Pak-pra canal, Phatthalung province, Thailand

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Abstract

The objective of this research is to study the number and type of fish in the estuary compere with those along Pak-pra canal. And study the relationship of the types of phases and water quality to the number and type of fish estuary and along Pak-pra canal, Phanang Tung Subdistrict, Khuan Khanun District, Phatthalung Province By collecting samples of plankton water quality and number and type of fish at 6 study points, total 12 study points from May to October 2018, measuring air temperature, water temperature, pH, DO, EC, TDS, classify the type of fish obtained from giant Chinese net flattering Collecting plankton area at the surface with plankton bags once a month. We found 16 species of fish in Pak-pra canal by catching fish in upatream canal more than at mouth. By capturing 3,479 fish in the along Pak-Pra Canal and 785 in the estuary. In July, the villagers caught the highest number of fish, 1,688, by catching fish in the along Pak-pra canal more than the estuary. Pak-pra canal found 12 species of phytoplankton and found that plankton is positively correlated with the number of fish in each species The number of plankton is positively correlated with pH and water temperature. The number of fish is negatively correlated with air temperature.

Key words: Giant Chinese net,water quality, Plankton, fish, Pak-Pra canal

Introduction

Pak-pra Canal is an important water source, a canal that connects to Songkhla Lake. Which the connection area is called estuary. The area is a source of abundant water for many kinds of fish and has a large amount of fish. Villagers that live in the Pak-pra Canal area will prefer to catch fish with giant Chinese net. Which is the local wisdom in catching fish, *Clupeichthys aesarnensis* with a large number of giant Chinese net, the area has beautiful scenery

that has become a new tourist attraction in Phatthalung Province today. The research team has the following objectives: 1) the number and type of fish in upstream and canal mouth 2) the number and type of plankton in the canal And 3) the relationship of phases and water quality to the number and type of fish in Pak-pra canal In order to provide information to the community for further use in the conservation of the Pak-pra Canal area

Research questions

1. Is there any difference in the numbers of different types of fish between upstream and at the canal mouth?

2. Is there any effect of water quality on fish or phytoplankton in Pak-pra canal?

Research hypothesis

1. There would be differences in the water qualities between upstream and canal mouth

2. There would be differences in the fish or phytoplankton numbers between upstream and canal mouth

3. There would be some correlations between water qualities and fish or phytoplankton numbers.

Materials and methods of conducting experiments

1. Study area

This research was conducted in the area of Khlong Pak Pra, Phanang Tung Subdistrict, Khuan Khanun District, Phatthalung Province. It is located on latitude 7.7299 E 100.148 N as shown in Figure 1.

2. Time interval and sampling point setting

Sampling The researchers collected fish samples. Plankton and water quality in the area where the villagers catch fish by using giant yokes during the months of May to October 2561, the 4th week of the month. The study is divided into 2 areas, namely upstream and canal mouth. Each area carries out a study of 6 points, with each area depending on the location of the giant chines netthat that the villagers have installed. In the upstream (A1-A6), there is a distance from the canal mouth area (B1-B6) about 1.40 km, as shown in Figure 2

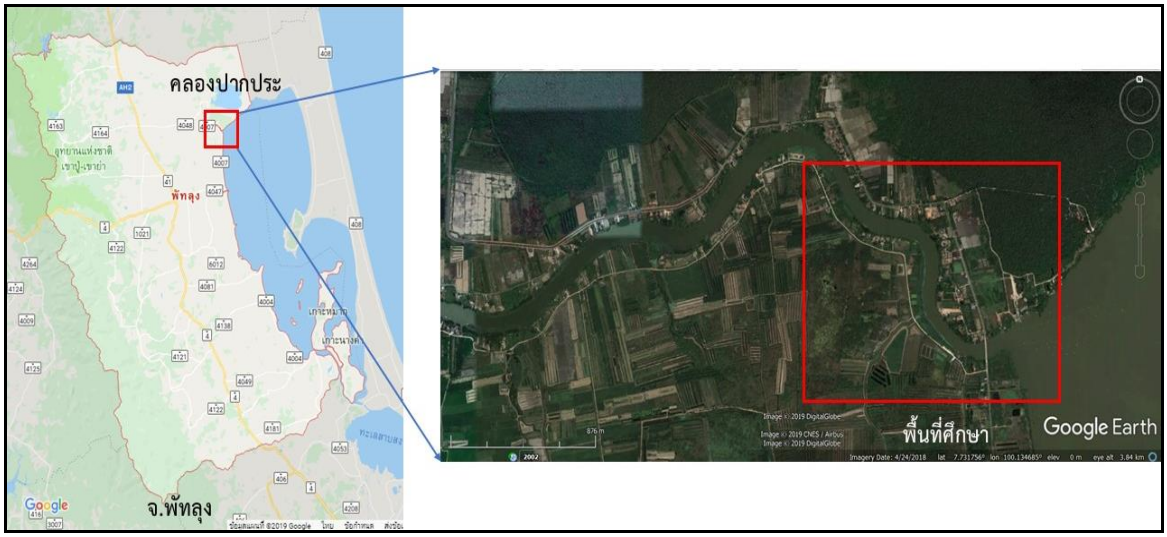


Figure 1 Study area at Pak Pra Canal, Khuan Khanun District, Phatthalung Province

3. Collection of fish samples

The study of the number of fish and the type of giant chines net in the water with a 15-minute timer will be flattering. Repeat this 3times. Count the number of fish. Size of giant chines net is 121 m^2. The sample is collected once a month for 6 months from May to October 2018.

Figure 2 Determination of fish collection points, water quality and plankton at Pak Pra Canal

4. Collection of water quality sampling

Collection of water samples in the study area in period time 06.00-12.00am. Measured water quality with equipment used in water quality analysis as shown in Table 1 and input data in GLOBE Observer.

Table 1 Equipment used in water quality analysis

parameter	equipment
Water temperature (°C)	Infrared Thermometer
Air temperature (°C)	Infrared Thermometer
pH	PC Test 35 Multi-Parameter
Dissolved Oxygen (DO) (Mg/L)	Lutron PDO-519
Electrical conductivity (EC) (µs/cm)	PC Test 35 Multi-Parameter
Total dissolved solids (TDS) (ppm)	TDS meter TDS-EZ
Nitrate (NO_3) (Mg/L)	Laquatwin Nitrate meter

5. Collection of plankton sampling

Sampling the surface water plankton at a depth of 30 centimeters by using a plankton net traction bag with a horizontal drag at the surface level. Drag the bag horizontally for a period of 60 seconds. Collect 120 ml of sample water. Put on a plastic bottle. 6 samples were collected at 1 area. Study the amount of plankton. Count the amount of plankton samples by sampling into the slides, counting the plankton quantity and identify types of plankton by using microscope.

6. Data analysis

Statistical data were analyzed by using the SPSS program, version 22, as follows: 1) Analyzed the differences in numbers of each fish species between upstream and canal mouth by using Chi-square tests. 2) Analyzed the differences in total fish numbers between two sites and among 6 months by using Two-way ANOVA tests**.** 3) Analyzed the differences in mean numbers of phytoplankton species between two sites bu using Independent sample *t*-tests and 4) Analyzed correlations between water quality and numbers of fish or phytoplankton by using Spearman correlation.

Result

Fish species in upstream and at mouth of Pak-pra canal in May to October, 2018

In this study , we found 16 fish species in Pak-pra canal. In May we found 7 spices in upstream and no fish at canal mouth. In June we found 6 spices in upstream and 2 fish at canal mouth. We found more fish in upstream. In July we found 8 species in upstream and 4 species at canal mouth. In August we found 3 species in upstream and no fish at at canal mouth. In both

mouth there were more fish in upstream than at canal mouth. In September we found 5 species in upstream and 3 species at canal mouth. In October we found 10 species in upstream and no fish at canal mouth. In both mouth there were more fish in upstream than at canal mouth (Table 1).

We found fish in upstream all the months , but at canal mouth in June , July and September. In June total fish numbers was higher in upstream than at canal mouth (Figure 3)

Phytoplankton types in upstream and at mouth of Pak-pra canal

In this study we found 8 phytoplankton species such as *Volvox* spp., *Nitzschia* spp., *Pediastrum* spp., *Scenedesmus* spp., *Navicula* spp., *Ceratium* spp., *Gynosigma* spp., and *Closterium* spp.. While in upstream and 3 species at canal mouth such as *Volvox* spp., *Nitzschia* spp., and *Pediastrum* spp. (Table 2).

Numbers of phytoplankton in Pak-pra canal

In May to October, there was no differences in phytoplankton number between 2 sites (Figure 3).

Correlations of water quality, phytoplankton and fish in upstream in Pak-pra canal

Correlations between water quality, fish and phytoplankton in upstream we did not find any correlations. We found that only water temperature was positively correlated with Phytoplankton numbers (Table 3).

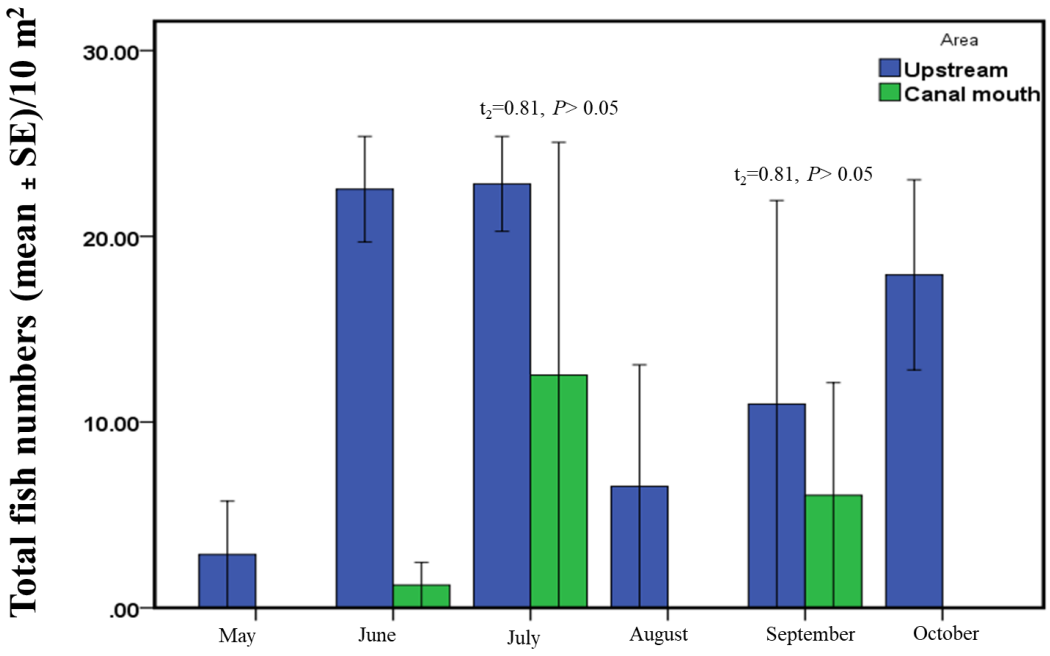


Figure 3 shows the number of fish caught in Pak-pra Canal and estuary from May to October 2018.

Table 1 The numbers and species of fish in upstream and at mouth of Pak-pra canal in May to October, 2018

Fish species	Month											
	May		June		July		August		September		October	
	Upstream	Canal mouth	Upstream	Canal mouth	Upstream	Canal mouth	Upstream	Canal mouth	Upstrea m	Canal mouth	Upstrea m	Canal mouth
Barbonymus gonionotus	1	0	3	0	1	0	0	0	0	0	4	**0**
Thryssa dussumieri	1	0	0	0	0	0	5	0	2	0	0	0
Amblypharyngodon chulabhornea	1	0	0	0	0	0	0	0	0	0	1	0
Stolephorus dubiosus	0	0	1	0	1	0	0	0	0	0	10	0
Cirrhinus chinensis	3	0	0	0	0	0	0	0	6	0	0	0
Toxotes chatareus	5	0	0	0	0	0	0	0	0	0	5	0
Rasbora sumatrana	20	0	1	1	1	1	3	0	0	0	1	0
Clupeichthys aesarnensis	2	0	0	0	0	625	163	0	470	130	660	0
Hippichthys spicifer	0	0	0	0	1	0	0	0	0	0	0	0
Henicorhynchus siamensis	0	0	0	0	12	0	0	0	0	0	2	0
Corica sorbowa	0	0	983	5	659	0	0	0	0	0	2	0
Leiognathu decorus	0	0	42	0	333	1	0	0	2	17	8	0
Strongylura strongylura	0	0	2	0	47	1	0	0	0	0	0	0
Arius maculatus	0	0	0	0	0	0	0	0	1	0	0	0

Fish species	Month											
	May		June		July		August		September		October	
	Upstream	Canal mouth	Upstream	Canal mouth	Upstream	Canal mouth	Upstream	Canal mouth	Upstream	Canal mouth	Upstream	Canal mouth
Rasbora_tornieri	0	0	0	0	0	0	0	0	0	0	2	0
Gonialosa modesta	0	0	0	0	0	0	0	0	0	4	0	0
Statistical test	χ^2_6=60.55, *P*<0.001	-	χ^2_5=4596.30,*P*<0.001	χ^2_1=2.67,*P*>0.05	χ^2_7=3096.86, *P*<0.001	χ^2_3=1860.07, *P*<0.001	χ^2_2=295.72, *P<0.05*	-	χ^2_4=1815.73, *P*<0.001	χ^2_2=190.82, *P*<0.001	χ^2_9=5575.78, *P*<0.001	
			χ^2_5=85.37,*P*<0.001		χ^2_8=1672.41, *P*<0.001				χ^2_5=62.14, *P*<0.001			

Table 2 Phytoplankton types in upstream and at mouth of Pak-pra canal

Phytoplankton species	Upstream	Canal mouth
Volvox spp.	✓	✓
Nitzschia spp.	✓	✓
Pediastrum spp.	✓	✓
Scenedesmus spp.	✓	-
Navicula spp.	✓	-
Ceratium spp.	✓	-
Gynosigma spp.	✓	-
Closterium spp.	✓	-

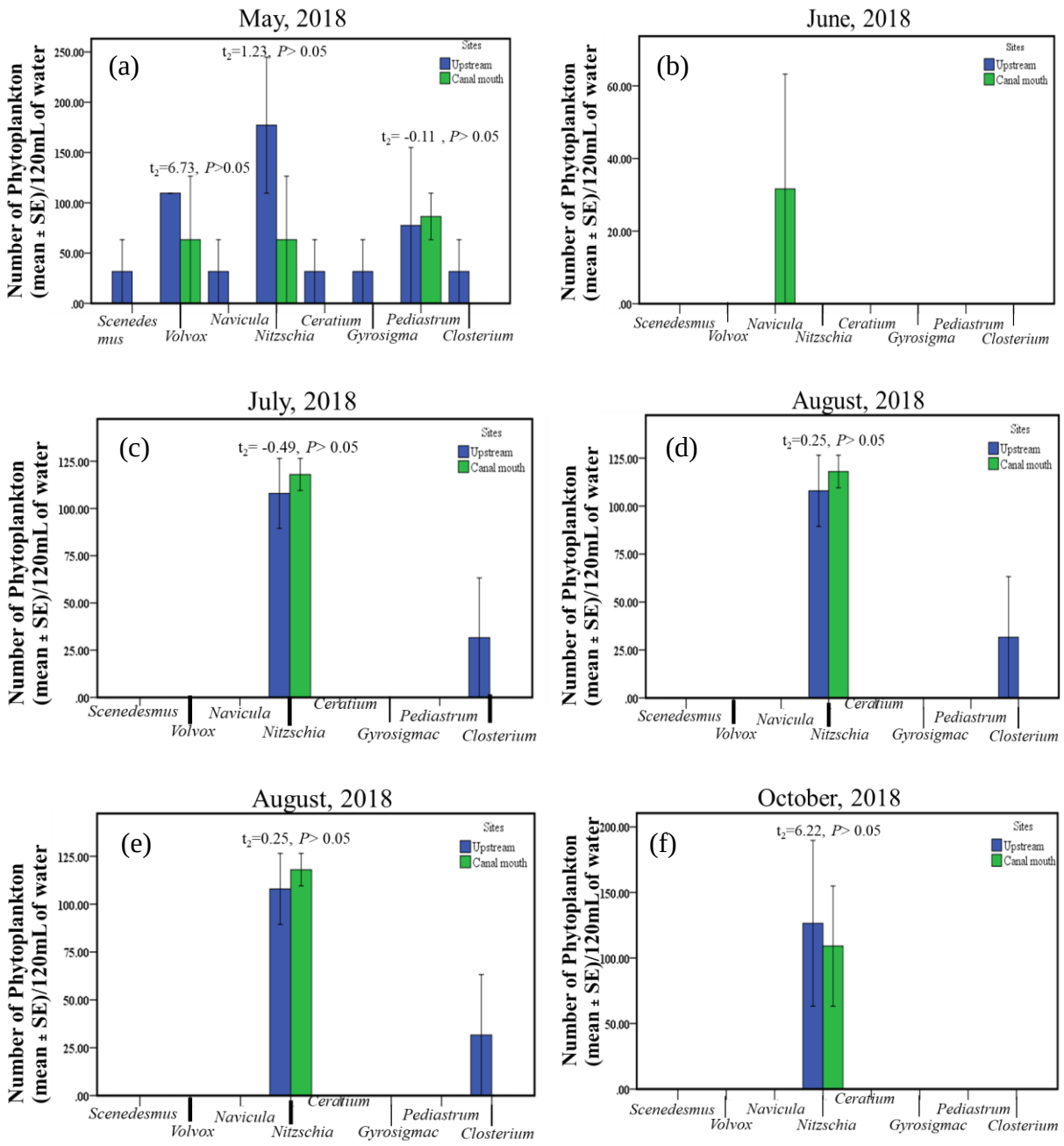
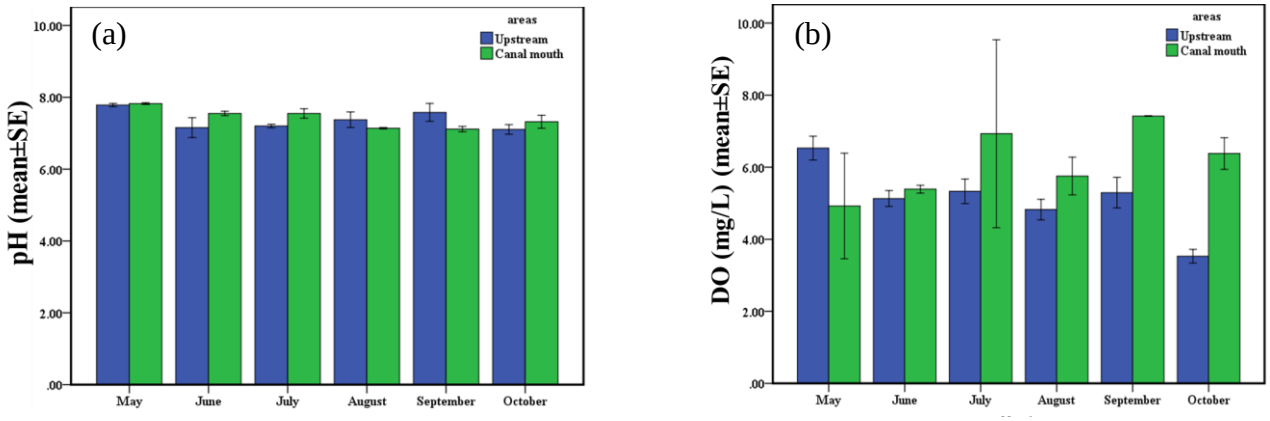


Figure 4 The numbers of phytoplankton in upstream and canal mouth in (a) May, (b) June, (c) July, (d) August, (e) September, and (f) October, 2018



(c) (d)

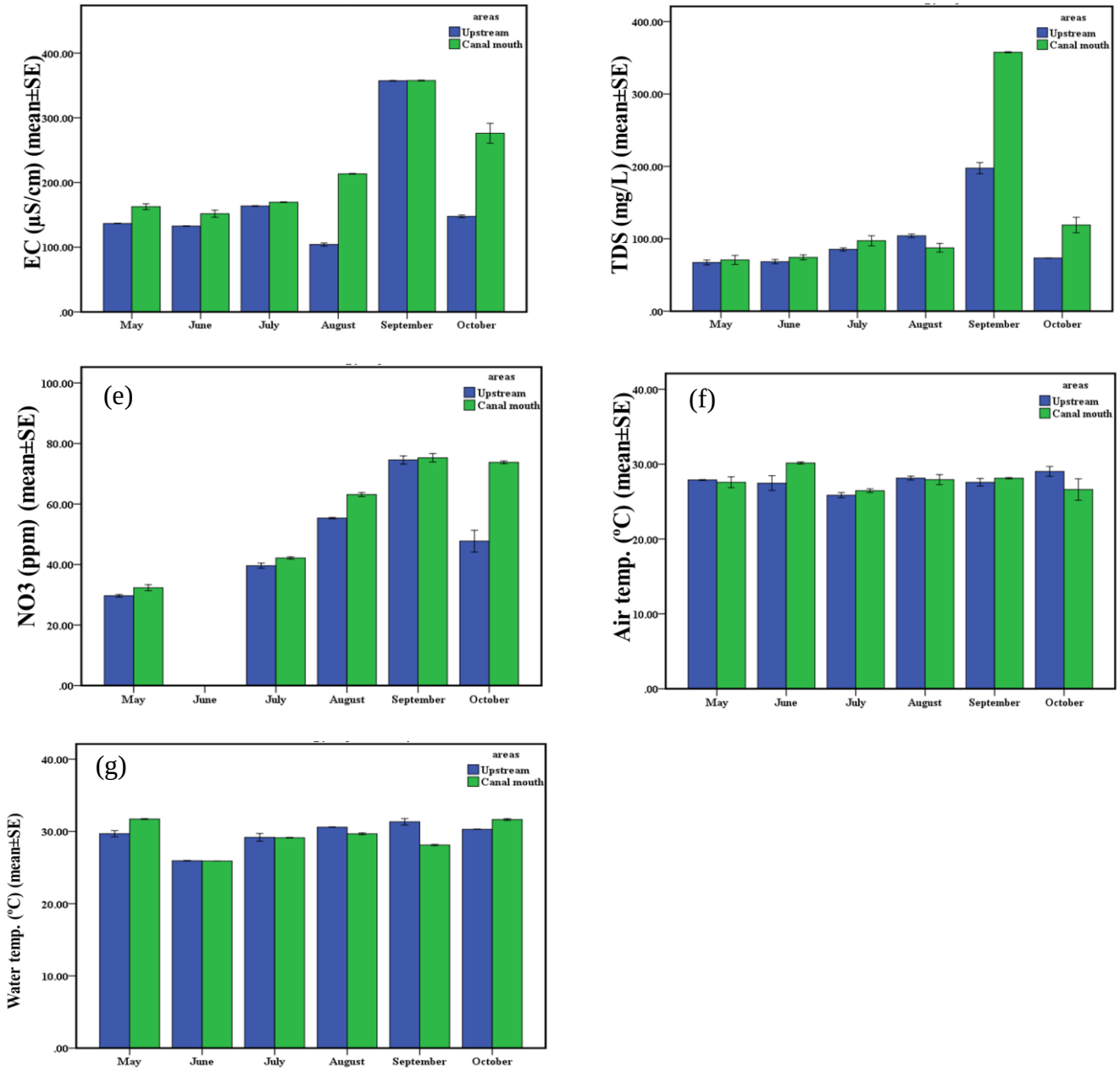


Figure 4 Water quality (a) pH, (b) DO, (c) EC, (d) TDS, (e) NO_3, (f) Air temperature, and (g) Water temperature between in upstream and canal mouth in May to October, 2018

Table 3 Correlations of water quality, phytoplankton and fish in upstream in Pak-pra canal

Water quality	Upstream				Canal mouth			
	Phytoplankton		Fish		Phytoplankton		Fish	
	R	*P*	*R*	*P*	*R*	*P*	*R*	*P*
pH	0.129	*P>0.05*	-0.194	*P>0.05*	0.470	*P>0.05*	-0.055	*P>0.05*
Dissolved oxygen (DO) (Mg/L)	0.177	*P>0.05*	-0.282	*P>0.05*	-0.059	*P>0.05*	0.340	*P>0.05*
Electrical conductivity (EC) (µs/cm)	-0.194	*P>0.05*	0.159	*P>0.05*	-0.078	*P>0.05*	-0.046	*P>0.05*
Total dissolved solids (TDS)	-0.208	*P>0.05*	-0.071	*P>0.05*	-0.196	*P>0.05*	0.193	*P>0.05*

Water quality	Upstream				Canal mouth			
	Phytoplankton		Fish		Phytoplankton		Fish	
	R	*P*	*R*	*P*	*R*	*P*	*R*	*P*
(mg/l)								
Nitrate (NO_3) (Mg/L)	-0.035	*P>0.05*	-0.253	*P>0.05*	-0.002	*P>0.05*	-0.069	*P>0.05*
Air Temperature (°C)	-0.078	*P>0.05*	-0.233	*P>0.05*	-0.085	*P>0.05*	-0.046	*P>0.05*
Water Temperature (°C)	0.124	*P>0.05*	-0.399	*P>0.05*	**0.584***	***P<0.05***	-0.496	*P>0.05*

Discussion

The results of data collection of fish caught in the mouth of Pak Pra canal and in Pak Pak canal from May to October, 2019, found that the villagers caught 16 species of fish, including *Barbonymus gonionotus*, *Thryssa dussumieri*, *Amblypharyngodon chulabhornea*, *Stolephorus dubiosus* , *Cirrhinus chinensis*, *Toxotes chatareus*, *Rasbora sumatrana*, *Clupeichthys aesarnensis*, *Hippichthys spicifer*, *Henicorhynchus siamensis*, *Corica sorbowa*, *Leiognathus decorus*, *Strongylura strongylura*, *Arius maculatus*, *Rasbora tornieri* and *Gonialosa modesta*. By catching fish in the Pak Pra canal more than the mouth of Pak Pra Canal By capturing 3,479 in Pak Pra canal And the mouth of Pak Pra Canal catching a total of 785 fish in July, the villagers caught the highest number of fish 1,688, caught in upstream more than at canal mouth.

From the study of plankton species, 12 species of phytoplankton, including *Volvox*, *Scenedesmus*, *Chorella*, *Navicula*, *Nitzschia*, *Ceratium*, *Gyrosigma*, *Pediastrum*, *Closterium*, *Vorticella*, *Spirogyra* and *Pinnularia*. 6 species of zooplankton, including *Planarian*, *Daphnia*, *Rotifers*, *Copepod*, *Moina* and *Amphipod*. And 4 species of protozoa, including *Frontonia Paramecium*, *Amoeba* and *Euplotes*. From the study of phytoplankton of Chi River in Mahasarakham Province, Yuwadee In-Samran et al. (2017) found plankton Division Chlorophyta is the group that has the highest volume, followed by Division Bacillariophyta. The dominant phytoplankton found in the genus is *Pediastum* sp. and *Scenedesmus* sp. Our result indicate that Phytoplankton can be the indicator of various qualities of water sources and contamination of high nutrient content, and grouping plankton that cannot create toxins or cause direct effect for aquatic animals.

The study of the relationship between the number of plankton species and the number of fish found that *Scenedesmus* phytoplankton had a positive correlation with *Barbonymus gonionotus*, *Thryssa dussumieri*, *Amblypharyngodon chulabhornea*, *Cirrhinus chinensis* and *Rasbora sumatrana*. *Nitzschia* phytoplankton has a positive relationship with some *Amblypharyngodon chulabhornea* and *Rasbora sumatrana*. *Pediastrum* phytoplankton has a positive relationship with some *Stolephorus dubiosus*, *Toxotes chatareus* and *Corica sorbowa*. *Closterium* phytoplankton has a positive relationship with some *Amblypharyngodon chulabhornea*, *Stolephorus dubiosus*, *Cirrhinus chinensis*, *Toxotes chatareus*, *Corica sorbowa*,

Hippichthys spicifer. *Spirogyra* phytoplankton has a positive relationship with some *Thryssa dussumieri, Cirrhinus chinensis, Arius maculatus* and *Clupeichthys aesarnensis*. *Daphnia* zooplankton is positively correlated with *Corica sorbowa* and *Stolephorus dubiosus*. And *Frontonia* protozoa is positively correlated with *Stolephorus dubiosus*, *Thryssa dussumieri* and *Corica sorbowa.*

Conclusion

We observed 16 fish species, and 8 phytoplankton species in Pak-pra canal, and most of them were found in upstream than at the canal mouth. Most of the water qualities varied among the months, it could happen due to the seasonal differences. Most of the water qualities were not correlated with fish and phytoplankton numbers; only phytoplankton numbers were positively correlated with water temperature at canal mouth. It could be due to the small sample size in this study. From our research, we have an idea about fish, phytoplankton and water quality status in Pak-pra canal for the first time. The data can be used to compare with fish, phytoplankton and water quality data with other water-bodies in Thailand. The data will help the Fisheries Department for fisheries management.

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