Species Diversity of Plankton in Suan Sunandha Rajabhat University, Samut Songkhram Campus

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Abstract: The study of phytoplankton and zooplankton in Suan Sunandha Rajabhat University, Samut Songkram Campus by collecting the samples following the seasons: the cool season (December, 2012), the hot season (March, 2013) and the rainy season (June, 2013). The plankton samples were collected from 5 stations by using 70 micrometers mesh size of plankton net and examined the water quality. The results showed that, in total, there are plankton in 48 genera, 77 species which consist of 36 genera, 58 species of the phytoplankton, and 12 genera, 19 species of the zooplankton. The phytoplankton: Class Bacillariophyceae was the dominant group and the most diverse was the genus *Chaetoceros* (8 species). The zooplankton: Phylum Sarcomastigophora had the most species diversity and most diverse zooplankton was the genus *Ceratium* (5 species). The cool season was the season when the greatest species diversity of the plankton could be found and the water temperature average was 27.79 $^\circ$C. The pH average was 7.82. The dissolved oxygen average was 6.21 mg/l. The salinity average was 24 ppt. These conditions are the appropriate environment for these living aquatic organisms**.**

Keywords: Species diversity, Plankton, Samut Songkhram

Introduction

Plankton are the tiny organisms that are floating in the water resources and they consist of the phytoplankton and the zooplankton. Plankton have diverse morphology that it can be found in every type of water source: fresh water, brackish water and seawater (Ariyadej et al., 2004; Teanpisut & Patarajinda, 2007) Phytoplankton is important producer of the food chain while the zooplankton is the primary consumer which transmits the energy to other aquatic organisms in the food chain and the food web in the aquatic ecosystem. The varieties of environment factors affected plankton community structure (Liu et al., 2010). Both the phytoplankton and the zooplankton are the important food sources for aquatic organisms, so the abundance of plankton can affect organism diversity. Meanwhile, the rapid growth of the plankton or the toxins from some plankton species can both directly and indirectly affect water sources. Some plankton can be harmful to living organisms and also to human beings. The abundance of plankton was also used to evaluate water resources for being an indicator for the quality of the environment.

Samut Songkhram Province is located in the central region on the west coast of the Gulf of Thailand. This province is divided into 3 districts: Amphawa District, Mueang Samut Songkhram District and Bang Khonthi District. The population's employment consists of agriculture and gardening, such as in the coconut groves, the fruit gardens, fisheries and culturing aquatic animals along the coastal area. Most of Samut Songkhram Province consists of low plains; however the coastal area length is 23 kilometers. There are 3 seasons which are the hot season, the period beginning around February until May; the rainy season, this period starts around May and lasts until October; and the last one is the cool season, beginning around October and lasts to the middle of February.

The purpose of this study was to research the species diversity of the phytoplankton and the zooplankton in the area of Suan Sunandha Rajabhat University, Mueang District, Samut Songkhram Province and use this study as the

database of the biological diversity and as a guideline for the sustainable use of biological resources.

Materials and Methods

The species diversity study of the phytoplankton and the zooplankton was conducted at Suan Sunandha Rajabhat University, Mueang District, Samut Songkhram Province at latitude 13° 25' 22.8" N, and longitude 100° 02'14.1" E. This area is close to the coast and influenced by the tide-seawater. Furthermore, there are the mangrove forests in which *Avicennia* sp. is the dominant species. In the study, water samples were collected in each season from 5 stations (Figure 1), and during 3 periods, being representative of each season. In the cool season, collecting the samples was in December 2012; March 2013 was the period for

collecting the samples in the hot season; and the rainy season, the samples were collected in June 2013 by towing 70 micrometer mesh size of plankton net at the depth level of 30 centimeters from the surface of the water. The water samples were fixed with 4% buffered formalin for preservation of the samples. The plankton was identified by using a compound microscope and the samples were photographed. The study of the phytoplankton was made using the reference of Wongrat (1999). The study of the zooplankton was made using the reference of Wongrat (1998) and World Register of Marine Species (WoRMS). In addition, there was an examination of environment factors: the water temperature, pH, salinity, and the dissolved oxygen (DO), which were measured by use of a thermometer, pH meter, salinity refractometer and DO meter, respectively.
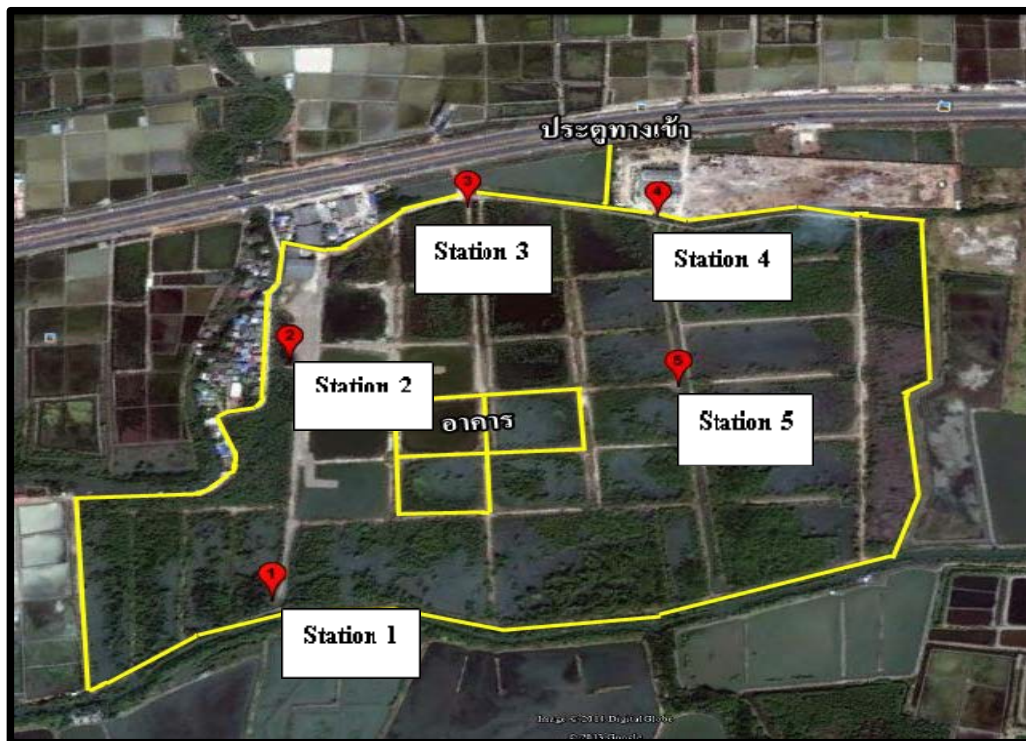

Figure 1. The stations for sample collection

Results and Discussion

The study of species diversity of the phytoplankton and the zooplankton in Suan Sunandha Rajabhat University, Bang Kaeo Sub-district, Mueang District, Samut Songkhram Province consisted of research in the cool, the hot and the rainy seasons; the samples were collected one time each season from 5 stations. The result of

the study revealed a total of 48 genera, and 77 species of the plankton were found which could be divided into phytoplankton in 3 divisions, 36 genera, and 58 species; consisting of Division Cyanophyta: 4 genera 4 species of Class Cyanophyceae, Divison Chlorophyta: 3 genera, and 3 species of Class Chlorophyceae: Division Chromophyta: 27 genera, and 51 species of Class Bacillariophyceae. However, the most abundant

phytoplankton found was Class Bacillariophyceae: 51 species or 66.23% of the total plankton found and the second most abundant was Class Cyanophyceae: 4 species (5.19%), and the least abundant was Class Chlorophyceae: 3 species (3.89%). The phytoplankton which were the most abundant were *Chaetoceros* (8 species) and the second-most abundant was *Nitzschia* (5 species). When comparing results with Teanpisut & Patararajinda (2007), they reported that *Chaetoceros* were the most common genera in Koh Chang, Trat Province, which is similar to this studied.

Most of the phytoplankton could be found in the cool season, when 38 species were found; the second-most was in the rainy season, when 34 species were found, and the season that the fewest phytoplankton were found was in the hot season, when 24 species were found. That result is different than Arkronrat et al. (2012), who reported in Prachuap Khiri Khan Bay, that the most phytoplankton could be found in the rainy season. For the station rank in the collection of the most phytoplankton species was the first station, with 41 species; the second one was the fifth station with 40 species, the third one was the fourth station with 34 species; the fourth one is the second station with 23 species; and the station with the fewest species of phytoplankton was the third station with 17 species.

The study found zooplankton consisting of a total 4 phyla, 12 genera and 19 species which consist of 6 genera and 11 species of Phylum Sarcomastigophora, 4 genera and 5 species of Phylum Ciliophora, 1 genus and 2 species of Phylum Rotifera, 1 genus and 1 species of Phylum Arthropoda. In addition, the study found 3 groups of the zooplankton which are cyclopoid copepods, copepod nauplii and cirripede nauplius. The most diverse zooplankton found were 11 species or 14.28 % of the Phylum Sarcomastigophora; the second-most diverse was 5 species (6.49%) of Phylum Ciliophora and the third-most diverse was Phylum Rotifera 2 species (2.59%) and the least diverse was Phylum Arthropoda 1 species (1.29%) (Figure 2). The genus of the zooplankton which was the most diverse was *Ceratium* (5 species) and the second-most diverse was *Favella* and *Brachionus* (2 species). The season in which the greatest diversity of plankton was found was in the cool season, in which 15 species were found; the second greatest diversity was found in the hot season, in which 8 species were found; and the least diversity of zooplankton found was in the rainy season: 5 species. The station rank for finding of zooplankton is as follows: the most diversity was at the fourth station with 12 species; the second most diversity was the first station with 11 species; the fifth station had 9 species; the second station had 8 species; and the station with the least diversity of zooplankton was the third station with 4 species (Figure 3).
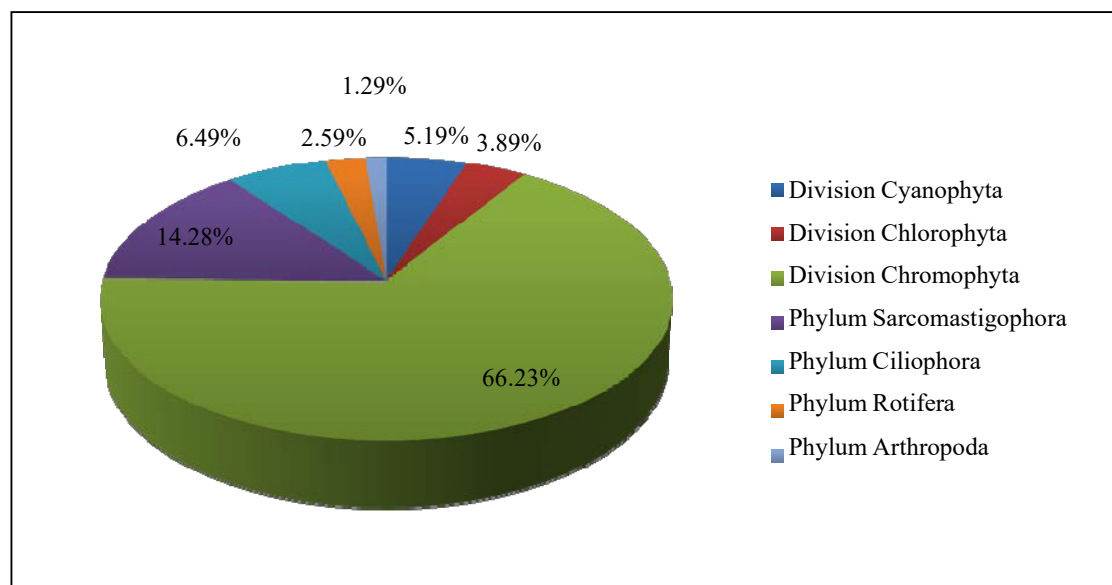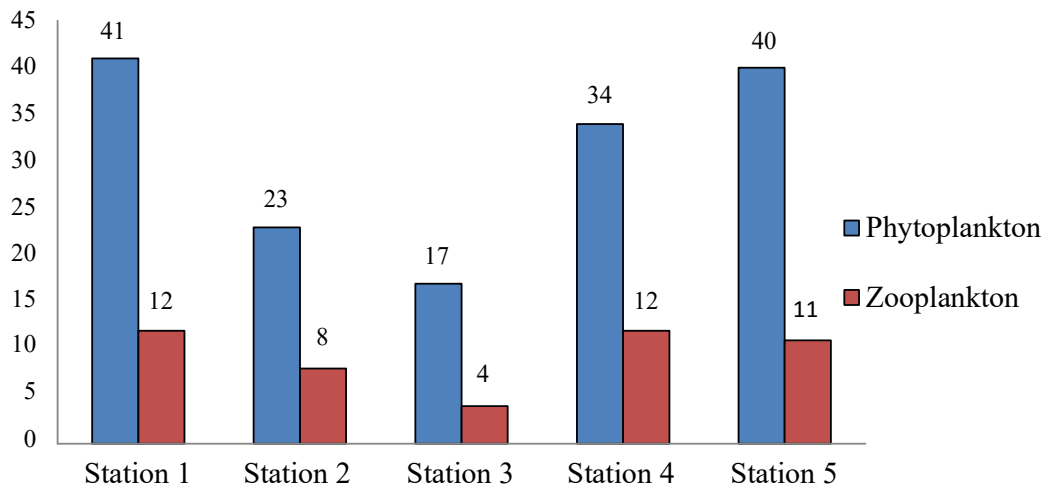

Figure 2. Percentage of plankton species in Suan Sunandha Rajabhat University, Samut Songkram Campus

Number of species

Figure 3. Number of plankton species in each station

In comparison with the types of the plankton in the area of Mueang District, Samut Songkhram Province, the ratio of the phytoplankton is greater than the zooplankton ratio. The phytoplankton totaled 58 species or equal to 75.32% of the complete plankton found. The zooplankton totaled 19 species or equal to 24.68% of the totally plankton found (Figure 4). The comparison of the number of the species of plankton, the zoo-plankton had a smaller number of the species than the phytoplankton. Collection of the samples should be made with different sizes of the plankton nets to get a greater variety of plankton. Moreover, this study used a plankton net with a mesh size of 70 micrometers which may have had an effect to the number of plankton species collected.
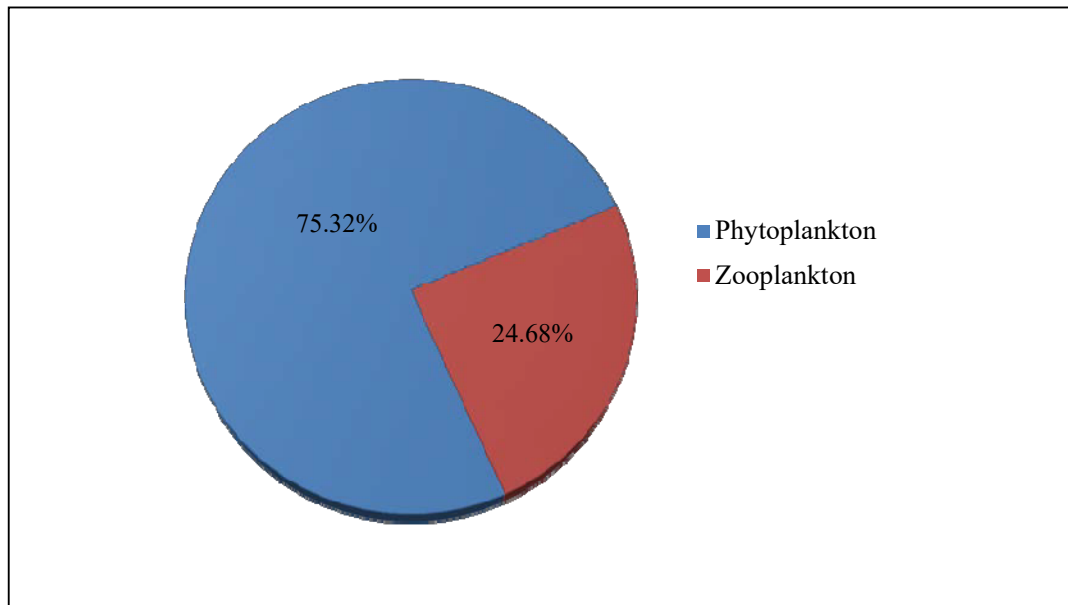
Figure 4. The ratio of the phytoplankton and the zooplankton

The results of the plankton species collection at Suan Sunandha Rajabhat University, Samut Songkhram Campus found that it had a similar result as the previous reporter, in which diatoms in Division Chromophyta (Class Bacillariophyceae) were the dominant group of the phytoplankton in lotic sites (Al-Saadi et al., 2000; Wu et al., 2011). This study also found all seasons were similar to the study of Arkronrat et al. (2012). The plankton found in this period of the study was calanoid copepods, cyclopoid copepods and copepod nauplii which were all the varieties of plankton groups found most. Furthermore, copepod are the plankton which indicated the abundance of biodiversity in the water sources and are the important food for aquatic organisms (Drillet et al., 2011).

The study of the environmental characteristics found that the water temperature average in the period of the study was 27.79 degrees Celsius (ranged from 25.0-29.4 °C). The highest water temperature average was 29.04 °C in the hot season. The water temperature average in the cool season was 27.82 °C, and the rainy season recorded the lowest water temperature average was 26.50 °C. The salinity average was 24 ppt (ranged from 19-28 ppt). The highest salinity average was 25 ppt in the hot season. The salinity average in the cool season was 24 ppt and the rainy season which the lowest salinity average was equally 23 ppt. The pH average was 7.82 (ranged from 6.60-9.05). The highest pH average was 8.87 in the rainy season. The pH average in the cool season was 7.42, and the lowest was in hot season when the pH average was equal to 7.16. The dissolved oxygen average was 6.21 milligram per liter (ranged from 5.53-6.92 mg/l). These environmental factors values was in standard level of the National Environment Committee Announcement (Ministry of Science and Technology, 1994) The cool season had the highest dissolved oxygen average equal to 6.91 mg/l. The dissolved oxygen average in the hot season was 6.00 mg/L. In the rainy season, there was the lowest dissolved oxygen average which was equal to 5.71 mg/l.

Table 1. Average of environmental characteristics in different seasons

Season	Water temperature (^{o}C)	Salinity (ppt)	pH	Dissolved oxygen (mg/L)
Cool season	27.82	24	7.42	6.91
Hot season	29.04	25	7.16	6.00
Rainy season	26.50	23	8.87	5.71
Average	27.79	24	7.82	6.21

Conclusions

The species composition of the phytoplankton and the zooplankton in the area of Suan Sunandha Rajabhat University, Samut Songkram Campus were studied by collecting samples of the plankton following the cool, the hot, and the rainy season. The samples were collected from 5 stations that found plankton in 48 genera, and 77 species, which consisted of the phytoplankton in 36 genera, and 58 species; the zooplankton consisted of 12 genera, and 19 species. Class Bacillariophyceae had the most species of phytoplankton and genus *Chaetoceros* (8 species) had the greatest variety species. Phylum Sarcomastigophora was the zooplankton which had the most species diversity, and genus *Ceratium* (5 species) had the greatest variety of species. The cool season was the season when the most species of plankton could be found, and the water temperature average was equal to 27.79 degrees Celsius. The salinity average was 24 ppt. The pH average was equal to 7.82. The dissolved oxygen average was 6.21 milligram per liter and the results indicated that these conditions were an appropriate environment for the living aquatic organisms.

Acknowledgements

References

Al-Saadi, H. A., Kassim, T. I., Al-Lami, A. A. & Salman, S. K. (2000). Spatial and seasonal variation of phytoplankton populations in the upper regions of the Euphrates River, Iraq. *Limnologica*, *30*, 83-90.

Ariyadej, C., Tansakul, R., Tansakul, P. & Angsupanich, S. (2004). Phytoplankton diversity and its relationships to the physico-chemical environment in the Banglang Reservoir, Yala Province. *Songklanakarin Journal of Science and Technol*ogy, *26*(5), 595-607.

Arkronrat, W., Oniam, V. & Chuchit, L. (2012). Relationships between water qualities and phytoplankton at coastal Prachuap Khiri Khan Bay, Prachuap Khiri Khan Province in 2008-2009. *Burapha Science Journal*, *17*, 108-116.

Drillet, G., Frouël, S., Sichlau, M. H., Jepsen, P. M., Højgaard, J. K., Joarder, A. K. & Hansen, B. W. (2011). Status and recommenda-tions on marine copepod cultivation for use as live feed. *Aquaculture*, *315*, 155-166.

Liu, C., Liu, L. & Shen, H. (2010). Seasonal variations of phytoplankton community structure in relation to physico-chemical factors in Lake Baiyangdian, China. *Procedia Environmental Sciences*, *2*, 1622-1631.

Ministry of Science and Technology. (1994). *Standard Surface Water Quality of Thailand.* Bangkok: Pollution Control Department.

Teanpisut, K. & Patarajinda, S. (2007). Species diversity of marine planktonic diatoms around Chang Islands, Trat Province. *Kasetsart Journal (Natural Science)*, *41*, 114-124.

Wongrat, L. (1998). *Zooplankton*. Bangkok: Faculty of Fisheries, Kasetsart University Press. (in Thai).

Wongrat, L. (1999). *Phytoplankton*. Bangkok: Faculty of Fisheries, Kasetsart University Press. (in Thai).

Wu, N., Schmalz, B. & Fohrer, N. (2011). Distribution of phytoplankton in a German lowland river in relation to environmental factors. *Journal* of *Plankton Research*, 33, 807-820.