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Preliminary study of the zooplankton comunity in the Mae Klong Estuary, Samut Songkhram Province

Tanatorn Tienpothong, Kittikhun Suksamai, Koraon Wongkamhaeng, Patchara Danaisawadi, Tosaphol Saetung Keetapithchayakul, Chanikan Katnoum and Satreerat Pramkasem

Department of Zoology, Faculty of Science, Kasetsart University, Bangkok 10300

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Corresponding author
Tanatorn Tienpothong
E-mail: tanatorn.t@ku.th

Editor
Dr. Weeyawat Jaitrong
E-mail: polyrhachis@yahoo.com/
weeyawat@nsm.or.th

Abstract

The Zooplankton community in the Mae Klong Estuary, Samut Songkhram, was investigated using a 330-micrometer plankton net from 14 stations on 27 April 2023. A total of three phyla of zooplankton were identified: Phylum Annelida, Phylum Arthropoda, and Phylum Chordata. The density of zooplankton was highest at station 12.2 (2,254 individuals/10m^3) and lowest at station 10 (2 individuals/10m^3). The dominant groups were calanoid copepod and crab zoea; fish larvae were found in almost every station. The major environmental parameters affecting zooplankton communities in the Mae Klong Estuary include salinity, total dissolved solids (TDS), and pH.

Keywords
distribution, species diversity, Thailand, zooplankton comunity

Introduction

Zooplankton are usually weak swimmers and usually drift along with the currents. Zooplankton are comprised of two main groups: permanent members of the plankton, called holoplankton (such as diatoms, radiolarians, dinoflagellates, foraminifera, amphipods, krill, copepods, salps, etc.), and temporary members (such as most larval forms of sea urchins, sea stars, crustaceans, marine worms, some marine snails, most fish, etc.), which are called meroplankton (Damontharan, 2010). Along with zooplankto, They are key components of marine ecosystems, forming the base of most marine food webs (Richardson, 2008).

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Copepods are the most common and abundant holoplanktonic organisms worldwide, occurring in all oceans, seas, estuaries, rivers, and lakes. While zooplankton studies have been carried out for a long time in Thailand, there are few studies focusing on estuaries. In Sikhantakasamit (2002), 31 groups from 11 phyla were reported, with copepods contributing to 40% of the zooplankton. In Punnaruk (2004), 24 copepod species were reported, with calanoid copepods being the primary group, comprising 22 species. Additionally, Maiphae (2011) studied zooplankton in the Southern Sea Island and reported 16 copepod genera in families, with calanoid copepods being the primary group, with nine species. A recent study conducted from 2011 to 2018 in the inner Gulf of Thailand on the zooplankton community structure, reported that calanoid copepods dominated the zooplankton community, with a total of 42 taxa groups from 12 phyla (Punnarak *et al*., 2020).

In Mae Klong Estuary, Samut Songkhram province, there is still a lack of studies on the diversity and abundance of zooplankton, which play an important role in indicating the abundance and habitability of young aquatic animals (Ferdous, 2009). Therefore, this aim of this study is to investigate the zooplankton community in the Mae Klong Estuary, Samut Songkram province. The results of this study can provide essential information about the species diversity and abundance of zooplankton.

Materials and methods

Study area

The Mae Klong River, situated in the western-central region of Thailand (Figure 1), flows through Kanchanaburi, Ratchaburi, and Samut Songkhram before emptying into Thailand's inner Gulf. The study sites in this region features urban areas and zones dedicated to aquaculture, making it a significant hub for fishing and aquaculture activities.

The sampling sites were at the mouth of the Mae Klong River, Samut Songkhram Province. The sampling was carried out in April 2023. The spatial sampling was performed in 14 stations, ranging from upstream in Bang Khonthi District to the river mouth at Don Hoi Lot (Figure 1). A global position system (GPS) was used to determine the coordinates of the sampling sites. The physio-chemical environmental factors, including temperature (°C), salinity, conductivity (μS/m), dissolved oxygen (mg L−1) and pH were measured in situ using a multi-parameter probe (EXO). The zooplankton were collected by horizontal tows using a plankton net with a mesh size of 330 μm at the same depth as the water sampling, with an average tow speed of 1 knot. A calibrated flow meter was used to estimate the volume filtered by each haul. The collected samples were immediately preserved in situ in a 70% ethanol solution for further analysis. In the laboratory, the organisms were identified to the lowest taxonomic level possible and counted under a stereoscopic microscope using appropriate identification keys (Wanna suwanrumpha,1987, A key for identifying copepods collected in the Gulf of Thailand waters, Technical Paper No. 29/4 Marine Fisheries Laboratory, Marine Fisheries Division, Department of Fisheries). Abundances were expressed as individuals per cubic meter (ind.m−3) for all identified taxa.

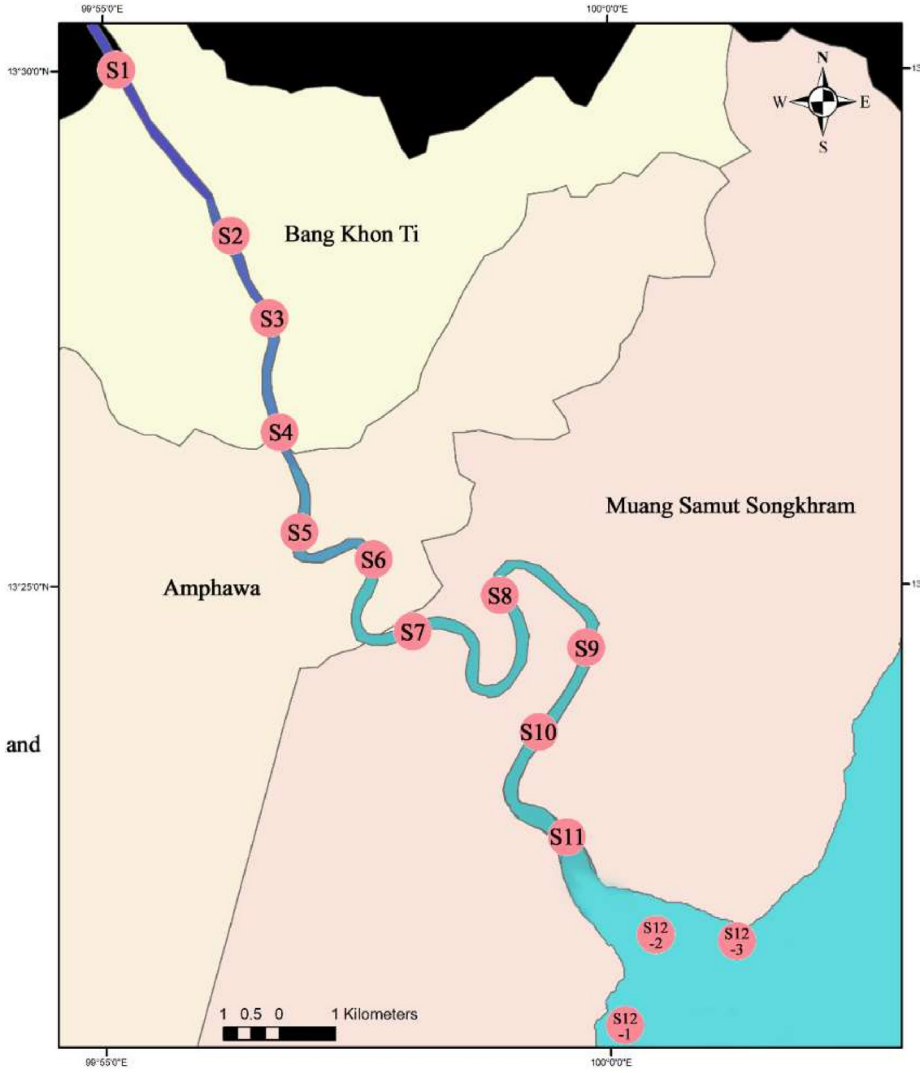

Figure 1. Sampling sites in the Mae Klong Estuary, Samut Songkhram.

Results and discussion

Diversity of Zooplankton in Mae Klong Estuary

The zooplankton community in Mae Klong Estuary was composed of 13 taxa groups. Among these, holoplankton composed 10 taxa groups, including amphipods, hymenopterans, aracneaens, isopods, mysids, fish larvae, copepods, ostracods, crustaceans, and decapod zoea. Calanoid copepods and decapod zoea were the dominant zooplankton in all stations except stations 4, 10, and 11, where decapod zoea outnumbered the calanoid copepods (Figure 2).

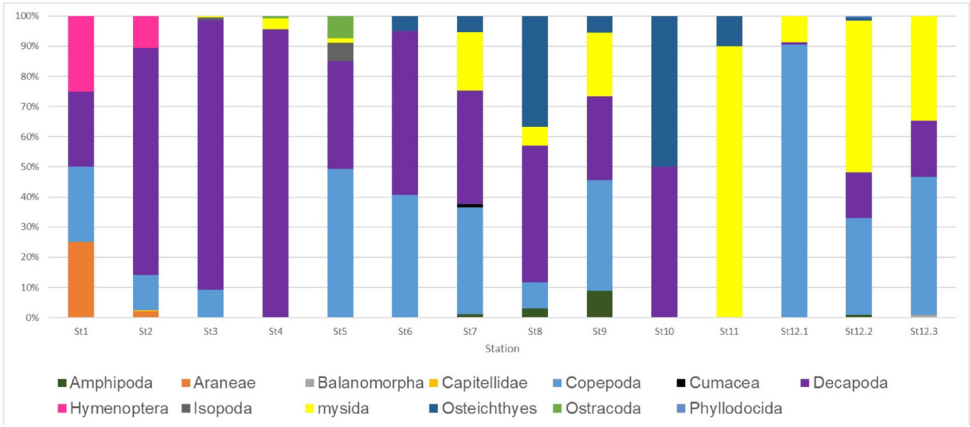

Figure 2. Zooplankton communities in the Mae Klong Estuary.

This study found similar compositions of zooplankton communities in the Mae Klong Estuary to previous works, with copepods and decapod larvae being the most common and abundant organisms at almost all stations. A total of 17 species from 6 families were identified. *Pseudodiaptomus clevi* was the most common species found at almost every station (Table 1).

Table 1. Copepods density at the Mae Klong Estuary. (individual/10 m³).

Taxa		station													
Family	(species)	1	2	3	4	5	6	7	8	9	10	11	12.1	12.2	12.3
Acartiidae	*Acartia bispinosa*	-	-	-	-	-	-	-	-	-	-	-	400	-	-
	Acartia bowmani	-	-	-	-	-	-	-	-	-	-	-	6700	-	-
	Acartia edentata	-	-	-	-	-	-	-	-	-	-	-	400	-	-
	Acartia lilljeborgi	-	-	-	-	-	-	-	-	-	-	-	200	-	-
	Acartia mertoni	-	-	-	-	-	-	-	-	-	-	-	109200	-	300
	Acartia pacifica	-	-	-	-	-	-	-	-	-	-	-	25100	12600	23800
	Acartia spinicauda	-	-	-	-	-	-	-	-	-	-	-	88200	3300	74800
Pontellidae	*Calanopia aurivilli*	-	-	-	-	-	-	-	-	800	-	-	-	1900	-
	Labidocera bipinnata	-	300	1200	-	-	-	-	1400	6200	-	-	-	2800	-
Paracalanidae	*Calocalanus styliremis*	-	-	-	-	-	-	-	-	400	-	-	-	500	-
Halicyclopidae	*Halicyclops magniceps*	-	-	-	-	-	-	-	-	-	-	-	-	1400	-
Pseudodiaptomidae	*Pseudodiaptomus annandalei*	-	-	-	-	-	-	-	-	1600	-	-	-	2800	4500
	Pseudodiaptomus aurivilli	-	1300			1200	3200	800	1300	-	-	-	-	1400	
	Pseudodiaptomus clevi	-	2900	5600		2700	7100	800	1400	400	-	-	6700	1400	2800
	Pseudodiaptomus masoni	-	-	-	-	-	-	400	-	-	-	-	-	-	-
	Pseudodiaptomus sp.	2400	1300	1600	-	3100	1800	-	-	400	-	-	-	-	-
Oithonidae	*Oithona simplex*	-	600	-	-	1200	400	4800	-	-	-	-	-	-	-

Regarding copepod species diversity and evenness indices, the seaward station (St12.2) exhibited the highest diversity and evenness index values (Figure 3). Stations 4, 10, and 11 did not yield copepods, likely due to higher decapod densities, which dominated the zooplankton community.

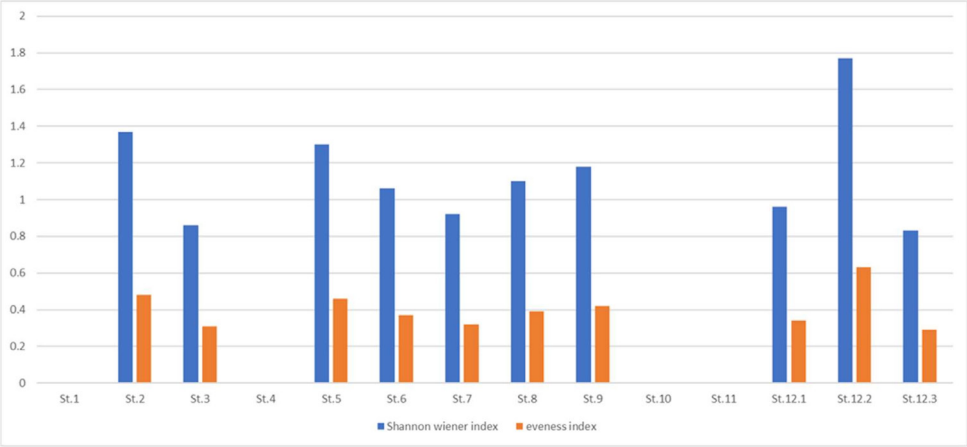

Figure 3. Shannon wiener diversity index and eveness index of copepods along the Mae Khlong Estuary.

The copepod community in each station changed along the river. Most of them showed a preference for specific salinity levels; for example, *Acartia* spp. prefer saline water, while *Pseudodiaptomus clevi* was found in almost all stations (Figure 4).

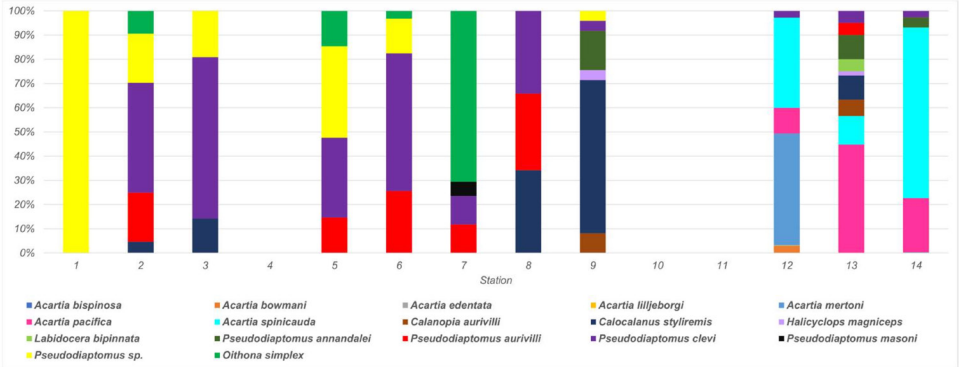

Figure 4. Copepods composition along the Mae Klong Estuary.

The two-way clustering analysis with temperature, pH, Dissolved oxygen, chlorophyll A, conductivity, TDS, and salinity revealed three main clusters with a 42% difference. Stations 1 to 8 were classified as freshwater, while stations 2 to 8 were classified as brackish water. The outer stations (S9, S10, S11, S12.1, S12.2 and S12.3) were classified as marine water. However, station 9, classified as marine water, still fell under the influence of tides and was categorized as part of the brackish water group (Figure 5).

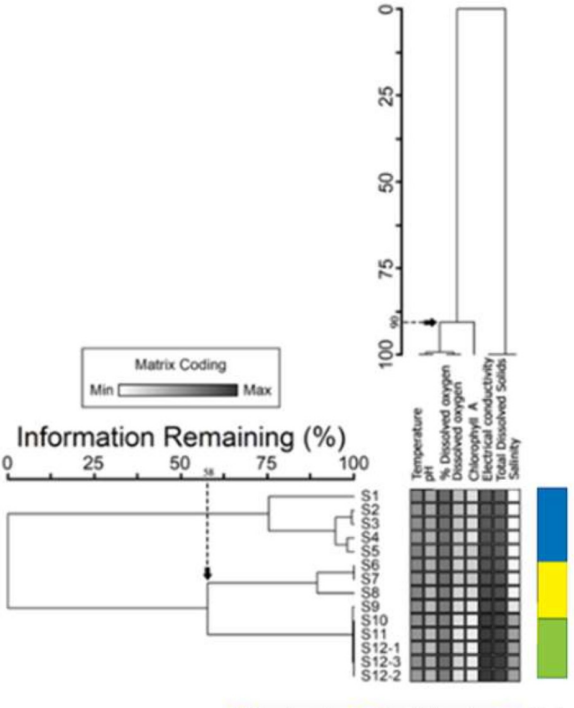

Figure 5. Environmental parameters two-way clustering analysis in Maeklong Estuary.

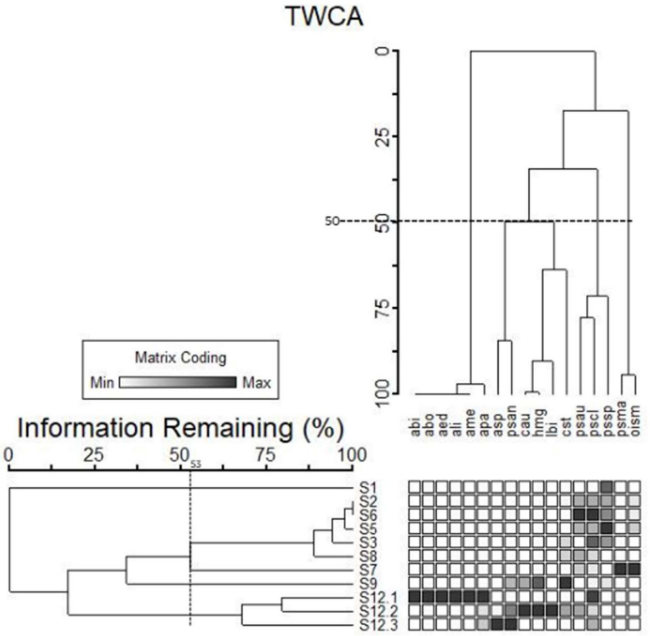

Figure 6. Two-way clustering analysis of environmental parameters and copepod species in the Maeklong Estuary.

Two-way clustering analysis of environmental parameters and copepod species in the Maeklong Estuary shows that salinity shapes copepod diversity and distribution. Most copepod species exhibit different specific salinity preferences. The analysis revealed that copepod species, with a 50% difference, were classified into three groups: freshwater, brackish water, and marine water (Figure 6).

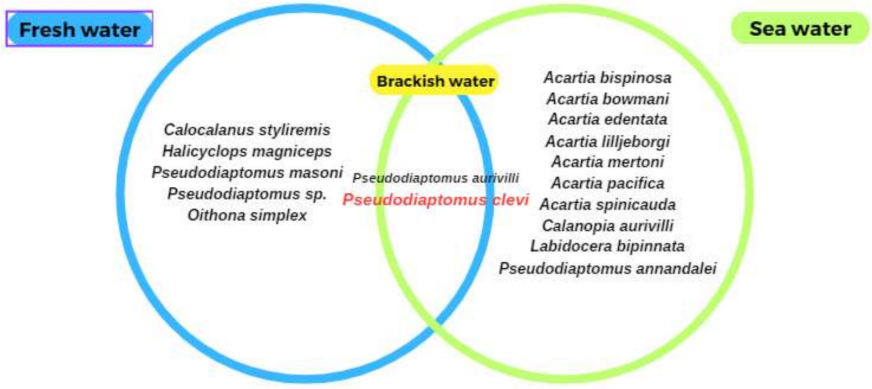

Figure 7. Copepod species distribution in different salinity levels.

The copepod diversity in this study was similar to a previous study by Sikhantakasamit (2002), who studied in Baan Klong Kone, adjacent to this recent study. However, the number of species in this work is lower than those of Klong Pak-Meng (Punnarak, 2004) in the Andaman Sea. The work of Maiphae (2011) on Mo Ko Thale Tai found a similar copepod diversity to this study. The dominant species from these four researches were different (Table 2).

Table 2. The copepod diversity studies in Thai Waters.

Location	Family	Species	Dominant Species	Reference
Mae Klong Estuary, Samut Songkhram Province	6	17	*Pseudodiaptomus clevi*	Recent study
Coastal area of Klong Pak-Meng, Trang Province	15	33	*Microsetella norvegica*	Punnarak (2004)
Baan Klong Kone, Samut Songkhram Province	9	18	*Acartia clausi*	Sikhantakasamit (2002)
Mo Ko Thale Tai, Gulf of Thailand	10	17	*Oithona, Euterpina, Acrocalanus, Corycaeus*, and *Microsetella*	Maiphae (2011)

Summary

The dominant group was calanoid copepod, crab zoea, and fish larvae found in almost every station. In particular, this study identified 17 copepod species from six families. *Pseudodiaptomus clevi* was the most common species, found in almost all stations, and was dominant in low salinity water. *Acartia pacifica* and *Acartia spinicauda* were the dominant groups in high-salinity water. Station 12.2 had the highest Shannon Winer index and evenness index values. The diversity and distribution of copepods were influenced by salinity, with most copepod species exhibiting specific salinity preferences. Brackish water tends to have lower diversity than saline and freshwater environments due to its salinity and alkaline tolerance. Salinity resulted in the highest population growth and the highest percentage of copepodites and nauplii of copepods (Magouz, 2021)

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References

Punnarak, P., P. Sojisuporn, J. Hattaya and A. Piumsomboon. 2020. Effect of Flood Disaster and Long Term Changes during 2011 to 2018 on Community Structure of Zooplankton in the Inner Gulf of Thailand. **International Journal of Environmental Science and Development** 11(8): 383–389.

Richardson, A.J. **2008.** In hot water: zooplankton and climate change. **ICES Journal of Marine Science 65: 279–295.**

Maiphae, S., P. Maha, and C. Sirindhorn. 2011. Marine copepods at Mo Ko Thale Tai, Gulf of Thailand. **Songklanakarin Journal of Science and Technology** 33(6): 641–651.

Magouz, F. I., M. Essa, M., Matter, A.T. Mansour, A. Gaber and M. Ashour. 2021. Effect of different salinity levels on population dynamics and growth of the cyclopoid copepod *Oithona nana*. **Diversity 13 (5)**: 190.

Suwanrumpha, W. 1987. **A key for identifying Copepods collected in the Gulf of Thailand waters.** Technical Paper No. 29/4 Marine Fisheries Laboratory r·Iarine Fisheries Division Department of Fisheries.

Sikhantakasamit, B. 2002. **Variations in copepod, cladoceran and rotifer populations in mangrove swampat Baan Klong Kone, Samut SongKhram Province.** Master Thesis. Chulalongkorn University. Bangkok (Thailand).