Mysids resource from Songkhla Lagoon, southern Thailand

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Abstract

The first information about mysid in Songkhla lagoon system, southern Thailand, was reported in 1921 from Thale Sap water. In this present study, we try to give more information about the mysid diversity, species composition and abundance from Songkhla lagoon, southern Thailand. Sampling were conducted from June to November 2017 using a modified Riley's hand-pushed net at 12 stations (5 in Thale Sap and 7 in Thale Sap Songkhla). Three species of mysids, Mesopodopsis orientalis Tattersal, 1908, Nanomysis siamensis W. Tattersall, 1921 and Rhopalophthalmus egregius Hansen, 1910 were recorded from Songkhla Lagoon. Nanomysis siamensis was the predominant species with total abundance 245.55 ind.m⁻², and the density was higher in Thale Sap than Thale Sap Songkhla. Monthly mean salinity showed a great fluctuation from 0.64 to 17 ppt, however no correlation between the abundance of N. siamensis with salinity.

Keywords: Mysid, Nanomysis siamensis, Thale Sap, Thale Sap Songkhla
1. Introduction

Songkhla lagoon is the largest lagoon in southern Thailand where this area is shallow brackish water separated from the seawater of the Gulf of Thailand by a sand bank and connected with an inlets or a mouth part of the Thale Sap Songkhla. Songkhla lagoon also known as Songkhla Lake which covered about 1,042 km² area with four main parts; Thale Noi, Thale Luang, Thale Sap and Thale Sap Songkhla. The condition of this lagoon are shallow (about 1 to 2 meter) in depth and the salinity was vary from freshwater to brackish even salty (from 0 to 35 ppt), which influenced by the water runoff, rain and the seawater (Angsupanich, 1997; Bunsom & Prathep, 2012; Wangkulangkul, 2018). Songkhla Lagoon is one of a productive ecosystem in southern Thailand and local people have been used this ecosystem for fisheries and aquaculture (Chesoh & Lim, 2008; Pornpinatepong et al., 2010; Cookey, Darnswasdi, & Ratanachai, 2016). Lagoon ecosystem also rich in diversity because it can provide as habitat, nursery, feeding area and also protection for many living organisms (Kennish & Paerl, 2010), and one of them are the mysids (Yamada, Takahashi, Vallet, Taguchi, & Toda, 2007; Yusa & Goshima, 2011; Mayor, Chigbu, Pierson, & Kennedy, 2017).

Mysid is one of a group of small crustacean which occupy in all of aquatic ecosystem throughout the world (e.g. marine, lagoon, brackish or estuaries and freshwater) (Tattersall & Tattersall, 1951; Mauchline, 1980; Audzijonyte`, 2006; Porter, Meland, & Price, 2008). The mysids play an important key role in energy transfer as prey of aquatic food webs, such as shrimps (Hanamura & Matsuoka, 2003; Maher, Song, Park, & Oh, 2013), fish (Hosten & Mees, 1999), birds (Burkett, 1995), and mammals (Feyrer & Duffus, 2011). Even, this organism also consumed by human
(Mauchline, 1980; Mantiri, Ohtsuka, & Sawamoto, 2012) and cultured for sea horses food in public aquarium in Thailand (Pinkaew et al., 2001).

Study about the mysids in Songkhla Lagoon has been conducted since Tattersall (1921) reported two species from Patthalung river, Thale Sap, namely Nanomysis siamensis and Rhopalophthalmus egregius. Ansgupanich and Kuwabara (1995) also reported the occurrence of the mysids in Thale Sap Songkhla, however, they did not mention the specific name of the species in detail. Since the lacking of data about this mysids from Songkhla Lagoon, in this study, we try to present more information about the diversity, species composition and abundance of this mysid from Thale Sap and Thale Sap Songkhla, Songkhla Lagoon system, southern Thailand.

2. Materials and Methods

Day time sampling was conducted in Thale Sap and Thale Sap Songkhla, Songkhla lagoon, southern Thailand. A total of five stations at Thale Sap and seven stations at Thale Sap Songkhla were studied from June to November 2017 (Fig. 1). At each station, sampling was conducted with two sites and three replications, in total six collections on every station. Mysids were collected by using a modified Riley’s hand–pushed net with two nets (the mouth area 0.50 × 0.30 m²; the mesh opening 0.5 and 2 mm). We used the two nets in order collect more samples in numbers. The net was pushed by hand and walking along the shallow zone for 30 m for one haul at a depth 50–140 cm (6 hauls x 30 meter = 180 meter). The density of the mysid was calculated from the catch in numbers and area swept by the net and total collection from each station (net width × total distance of hauls) (Hanamura, Siow, Chee, & Kassim, 2009). The collected sample was completely cleaned from mud and debris, and the entire contents were then kept into a sample bottle fixed with 4% lagoon water–buffered
formalin. Environmental water parameters, e.g. temperature and salinity, were measured using a digital LCD meter (AZ 8371, model 8686) during every sampling session. The samples than deposited in the laboratory.

In the laboratory, mysid shrimps were sorted out, counted and identified based on morphological characteristic under a stereo microscope with several literature (Tattersall, 1908, 1914, 1921, 1922; Tattersall, 1965; Hanamura, Koizumi, Sawamoto, & Siow 2008; Hanamura, Murano, & Man, 2011).

Welch ANOVA test was used to determine the significant differences among the abundance of the mysids with monthly collection from each station, in Thale Sap and Thale Sap Songkhla, due to heterogeneity of variances and unequal sample sizes (Welch, 1951). All of the statistical analyses were performed by using Statistix 10.0.
Figure 1 The map of Thailand (A) showing the sampling area of mysids with 12 stations (B) in Songkhla lagoon, southern Thailand
3. Results

Environmental parameters

Monthly mean water temperature of the lagoon showed a small variation, ranged from 29.53 to 31.41°C in Thale Sap and 28.76 to 31.01°C in Thale Sap Songkhla, except for June 2017, the data was not available due to equipment malfunction (Figure 2a). Although the rainy season was occurred during October to November 2017 (in this study), a slight peak was recorded on November 2017 but it was encountered only in the afternoon and not influenced the temperature significantly. On the other hand, monthly mean salinity showed high fluctuation pattern, ranged from 0.7 to 6.8 ppt in Thale Sap and 0.64 to 17 ppt in Thale Sap Songkhla (Figure 2b). The lowest salinity was recorded on November 2017 and the highest on August 2017. The low salinity may have resulted from the influence of high freshwater of the runoff and of course the heavy rainfall during this period.
Figure 2 Monthly mean value of surface water temperature (a) and salinity (b) from at Thale Sap and Thale Songkhla, Songkhla lagoon, southern Thailand from June to November 2017. Data for temperature was not available in June due to equipment malfunction.

Species composition and abundance

A total of three species of the mysids were identified from this lagoon, namely *Mesopodopsis orientalis* Tattersall, 1908, *Nanomysis siamensis* W. Tattersall, 1921 and *Rhopalophthalmus egregius* Hansen, 1910. The abundance of the mysids in this study showed a very high variation within each species, where *N. siamensis* is the predominant species from the both locations. In Thale Sap, the abundance of *N. siamensis* was 141.44 ind./m², *M. orientalis* was 0.07 ind./m² and *R. egregius* was 0.20 ind./m². However, there was no significant difference on the abundance among the three of mysids statistically (Welch ANOVA \( F_{2,5.97} = 4.901, P>0.05 \)). Meanwhile in Thale Sap Songkla, the abundance of *N. siamensis* was 104.11 ind./m², *M. orientalis* was 28.48 ind./m² and *R. egregius* was 10.14 ind./m² and there was a significant difference on abundance among the three mysids statistically (Welch ANOVA \( F_{2,8.136} = 5.369, \)
P<0.05) (Figure 3a). Monthly collection showed that the highest abundance of this organisms were recorded on August 2017 (95.56 ind./m²) and the lowest on November 2017 (16.31 ind./m²) (Figure 3b).

**Figure 3** Species composition of mysids from Thale Sap and Thale Sap Songkhla (a) and monthly abundance of mysids (b) from Songkhla lagoon, southern Thailand.
4. Discussion

The occurrence of *Mesopodopsis orientalis* in this study was noted as a new record for Songkhla lagoon. In Thailand, this species was previously reported from Khlong Khon, cultivation pond at Aquatic Research Station of Kasetsart University, Chonburi (Gulf of Thailand), Muang Mai, Bang Saen Beach (Hanamura *et al.*, 2008a). Monthly abundance of the mysid in this study showed large fluctuations in the Songkhla Lagoon, whereas *N. siamensis* was the predominant and the density ranged from 16.05 to 72.29 ind./m². Meanwhile *M. orientalis* and *R. egregius* ranged from 0.15 to 24.33 ind./m² and 0.02 to 5.07 ind./m², respectively. The density was increased from June to August 2017 (25.79–95.56 ind./m²), however decreased from September to November (44.98–16.31 ind./m²) 2017. According to Mauchline (1980) one species of mysid could dominate a certain habitats. For example, *Acanthomysis thailandica* was the predominant species of in the Matang mangrove estuary, Malaysia (Ramarn, Chong, & Murano, 2012). Another species, *Mesopodopsis zeylanica* also reported as the most dominant in tropical estuary, Cochin backwater, India (Biju & Panampunnayil, 2010). At the temperate region, *M. slabberi* was the dominant species from subtidal sandbanks in the southern North Sea, Belgium (Dewilcle, Cattrijsse, Mees, & Vincx, 2003). *Neomysis americana* also showed the predominant abundance in the Cumberland basin, upper bay of Fundy, Canada (Prouse, 1986).

The variability abundance of the mysids in their habitat also influenced by the environmental factors, e.g. temperature, salinity and season. Our results showed monthly surface water temperature showed very small fluctuation as much as 1 until 2°C from June to November 2017. Tropical mysid mostly found at the temperature ± 25–33°C (Hanamura, Siow, & Chee, 2008; Hanamura *et al.*, 2009; Biju &
Panampunnayil, 2010, 2011) and this parameter also played important role to determine the occurrence and reproductive biology of mysids (Mauchline, 1980; Wittmann, 1984; Johnston, Stevens, & Watling, 2001). On the other hand, a great variation was occurred in salinity, where the maximum dilutions from 17 to the lowest 0.6 ppt. Result of this study showed the mysid in Songkhla lagoon could tolerate the salinity from freshwater until brackish water. However, the abundance of *N. siamensis* had no correlation statistically with the salinity ($r^2 = 0.06$ at Thale Sap, and $r^2 = 0.0011$ at Thale Sap Songkhla, respectively). The tropical mysids *M. zeylanica* could tolerate the salinity from 0 to 32.5 ppt (Biju & Panampunnayil, 2010). For *M. orientalis* and *R. egregius*, we assumed their occurrence just as a temporary visitor which driven from the seawater of the Gulf Thailand to the inner lagoon. Some species of mysid also had a wide range salinity tolerance. In their natural habitat, *M. orientalis* and *Rhopalophthalmus* spp., prefer to the salinity > 20 ppt (Baldó, Taracido, Arias, & Drake, 2001; Hanamura et al., 2008b; Taylor, 2008; Hanamura et al., 2009; Biju & Panampunnayil, 2010) and most of them live and more abundant in the open estuary or coastal in tropical region (Hanamura et al., 2008a, 2008b, 2009; Mantiri et al., 2012).

Variation of salinity in this study might influenced by seasonal pattern. Rainy season in southern Thailand occurred from May to July or October (southwest monsoon) and from October to December or January (northeast monsoon) (Phasook & Sojisuporn, 2005; Bansom & Prathep, 2012; Thai Meteorological Department, 2018). Our results showed density of the mysid tended to decrease during rainy season. Several researches also reported that population dynamics and abundance of mysids were correlated to the monsoon (George, 1958; Biju & Panampunnayil, 2010, 2011; Ramarn et al., 2012). Another factor which influenced the occurrence and existence of mysids is...
food availability (Hanamura et al., 2009). Phytoplankton and zooplankton are the main food for the mysids (Viherluoto, 2001; Mauchline, 1980). According to Angsupanich and Rakkheaw (1997) and Angsupanich, Phramthong, & Srichuer (1997), phytoplankton and copepod community occurred throughout the year in Thale Sap Songkhla, with the peak occurrence in northeast monsoon and southwest monsoon, although some decline caused by heavy rain. Hence, there was no doubt that the occurrence of mysids in this study caused by their ability to tolerate salinity and food source availability throughout the year in Songkhla lagoon. However, further investigations are needed to understand about mysid population structure and their reproductive biology and also their response to the environmental parameters more detail.

5. Conclusions

This study has documented the information about the mysid resource in Songkhla lagoon system, southern Thailand. Nanomysis siamensis was the predominant species, followed by Mesopodopsis orientalis and Rhopalophthalmus egregius. Our finding also similar with the results from Tattersall in 1921 that N. siamensis was more abundant in Thale Sap than Thale Sap Songkhla and a few numbers of R. egregius occurred in Thale Sap. However, for M. orientalis was a new one for this lagoon. The existence of the mysids will support the fisheries and aquaculture activities by the local people in this lagoon due to their role as prey for the fish. Therefore, we suggest that N. siamensis is the native species in this lagoon.

Acknowledgments

This study forms part of a Ph.D research carried out by the first author and he would like to express his gratitude to Graduate School, Prince of Songkla University for
providing the scholarship (TEH-AC No. 042/2017) and research grant. We also thank to Mr. Naratip Tubtimtong and Mr. Sompong Pachonchit for helping during the fieldwork.

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