
Species Diversity and Distribution of Fishes in Pranburi River, Phetchaburi Province and Prachuap Khirikhan Province

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Abstract Species diversity and distribution pattern of freshwater and brackish water fishes in Pranburi river, Phetchaburi province and Prachuap Khirikhan province, west Thailand, resulting from a study carried out in the period January to December 2015. The fish samples and environmental factors were collected very 4 months; covering, hot-dry (April), rainy (August) and cool-dry (December) seasons at six sampling stations followed longitudinal gradient. A total of 1,247 individuals fish representing 48 species from 28 families were found. The most dominant family was Cyprinidae [9 species (19%)], followed by Balitoridae, Bagridae, Gobiidae and Channidae with three species (6%) and other families with one or two species each. Three freshwater fishes, *Pangio oblonga*; *Batasio tigrinus* and *Amblyceps variegatum* were newly recorded in Pranburi river. Fish distribution in the study area, consisted of two ecosystems: 1) freshwater ecosystem, the distribution of fished in the upstream, mainstream and reservoir ecosystems; 2) estuary ecosystem. Additionally, found that many species of fishes had potential for commercial culture such as *Mystacoleucus marginatus*, *Rasbora paviana*, *Barilius ornatus*, *Mastacembelus favus*, *Pristolepis fasciata*, *Moolgarda cunnesius*, *Ellochelon vaigiensis*, *Sillago sihama* and *Pseudogobius javanicus*.

Keywords: Species diversity, distribution of fishes, freshwater and brackish water fishes, Pranburi River

Introduction

Pranburi river is originally situated on Tanow Sri mountain range where is in Kaeng Krachan national park, Phetchaburi province located in the west of Thailand. This river system is formed by a combination of several small tributary streams. The assemblage point of stream is in Ban Karng, Tayang district, Phetchaburi province and then a beam of water has run throughout a series of different river, with entire distance of 180 km. From merged site, the river flows via the original zone of Pa La-U in Huahin district, Prachuap

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Khirikhan province. Later, it goes into Pranburi reservoir in Pranburi district, Prachuap Khirikhan province, west Thailand and finally run off to northwest Gulf of Thailand at Ban Pak Num Pran, Pranburi district, Prachuap Khirikhan province (Chittapalapong *et al.*, 2000). Importantly, local people have received advantages from this river in various aspects, such as, irrigation, agriculture, tourism and especially being the biggest freshwater fish productive zone in the west and the southern part of central Thailand (Sripatrprasit, 1996).

Regards, biodiversity in particular fish populations, observations species diversity and distribution of fishes were carried out in the lower Phetchaburi river and the upper Khwae Yai river and these are the vicinity river basins where, sharing the original site with Pranburi river. Empirical outcomes showed that several fished potentially became commercial species for the international ornamental fish markets, especially The United States of America and Singapore. They are *Devario* spp., *Opsarius* spp., *Poropuntius* spp., *Crossocheilus* spp., *Batasio fluviatilis* and *Mystus bocourti* (Kulabtong *et al.*, 2011; Kulabtong, 2012; Kunlapapuk *et al.*, 2014).

However, Pranburi river, although many observations were done, the study sites were intensively in narrow zones such as Pranburi reservoir and the estuary of Pranburi river. Clearly, future survey in biodiversity of fish resources, in a series of main rivers is required since its results would serve as the scientific information, used in aquaculture purposes. Importantly, effective utilization on limited fish resources as its potential to be new economic species needs to collect sufficient basic data both fish distribution as well as ecosystem. Therefore, this study aims to investigate species diversity and distribution of fishes throughout entire Pranburi river where is situated in Phetchaburi province and Prachuap Khirikhan province. With respect to result, it would benefit for aquaculture of potentially economic species in the future and in addition, the local communities would further employ the knowledge to pave the way for conservation of fish and aquatic animal resources.

Materials and methods

Study area

A field study in Pranburi river, Phetchaburi province and Prachuap Khirikhan province composed of two issues: 1) the freshwater and brackish water fishes; 2) water quality and environmental parameters. Study area separated into six regions: 1) small tributary stream in Tanow Sri mountain range, Kaeng Krachan district, Phetchaburi province, west Thailand (ST1) (E 099° 32.294' N 12° 39.752') (transparent rapid water with an average width of

about 3-5 m, average depth less than 1 m, and sandy bottom); 2) small tributary stream in Pa La-U, Hua Hin district, Prachuap Khirikhan province, west Thailand (ST2) (E 099° 33.057' N 12° 32.086') this area is characterized by the formation of sandy alternated with rocky bottom with transparent rapid water; 3) main stream of Pranburi river in Hua Hin district, Prachuap Khirikhan province (ST3) (E 099° 42.295' N 12° 27.024') (transparent slow moving water with an average width of about 8-10 m, average depth about 1.0 m); 4) Pranburi reservoir in Pranburi district, Prachuap Khirikhan province (ST4) (E 099° 46.906' N 12° 28.650') (the shallow zone near the shore, this is where rooted wetland plants occur); 5) main stream of Pranburi river in Pranburi district, Prachuap Khirikhan province (ST5) (E 099° 47.901' N 12° 28.694') (transparent slow moving water with an average width of about 10 m, average depth about 1.0 m); 6) mangrove areas and estuary of Pranburi river in Pranburi district, Prachuap Khirikhan province, northwest Gulf of Thailand (ST6) (E 099° 59.489' N 12° 24.541'), this zone is composed mainly by mudflat and moderately occupied by indigenous fisheries community.

Sample collection and laboratory analysis

Species diversity and distribution

The fish specimens were collected very 4 months; covering, hot-dry (April), rainy (August) and cool-dry (December) seasons at six sampling stations in Pranburi river (ST1-ST6), using the pull net, mesh size 1×1 mm, 10 m width and 1.2 m depth, labeled by location and date of collection, and transported to laboratory. Fish samples preserved in 10 percent formalin-freshwater solution, and deposited at the Department of Agricultural Technology, Faculty of Science, Ramkhamhaeng University, Bangkok. The species identification following Smith (1945); Rainboth and Kottelat (1987); Kottelat *et al.* (1993); Rainboth (1996); Doi (1997); Kottelat (2001) and Liao *et al.* (2010).

Water quality and environmental parameters

Water quality and environmental factors were collected very 4 months; covering, hot-dry (April), rainy (August) and cool-dry (December) seasons at six sampling stations (ST1-ST6). Physical and chemical factors were recorded seasonally at the moment of each sampling. Water depth, water temperature, transparency, pH, dissolved oxygen (DO) and salinity were measured in the field. Water temperature and dissolved oxygen (DO) were determined using dissolved oxygen meter (Aqualytic Model Al 15). Salinity was determined by hand refractometer (YSI Model 57); pH was measured using a pH meter (YSI

Model 60) and water transparency by secchi disc. For chemical variables, nutrient concentration in the water was evaluated. Water quality was sampled from each study site and fixed in ice chests to examine alkalinity, hardness, ammonia, nitrate, nitrite and orthophosphate, using the methods of Rice *et al.* (2012).

Results and discussion

Species diversity

The diversity of freshwater and brackish water fishes in Pranburi river, west Thailand. A total of 1,247 individuals fish representing 48 species from 28 families were collected (Table 1). The most dominant family was Cyprinidae [9 species (19%)], e.g. *Rasbora borapetensis*, *Rasbora paviana*, *Barilius ornatus*, *Mystacoleucus marginatus*, *Puntius brevis*, *Puntius rhombeus*, *Osteochilus vittatus*, *Osteochilus waandersii* and *Hampala macrolepidota*, followed by Balitoridae [3 species (6%)], e.g. *Nemacheilus binotatus*, *Schistura poculi* and *Homaloptera smithi*, Bagridae [3 species (6%)], e.g. *Batasio tigrinus*, *Pseudomytus siamensis* and *Hemibagrus nemurus*, Gobiidae [3 species (6%)], e.g. *Gobiopterus chuno*, *Pseudogobius javanicus* and *Acentrogobius* sp., Channidae [3 species (6%)], e.g. *Channa gachua*, *Channa striata* and *Channa lucius* and other families with one or two species each. Table 1 shows the most abundance species were found in freshwater ecosystem (ST1-ST5), are in *Pseudogobius javanicus* (13.31%), *Mystacoleucus marginatus* (11.07%) and *Pristolepis fasciata* (5.21%), respectively. And the most abundance species were found in estuarine ecosystem (ST6), are in *Moolgarda cunnesius* (10.51%) *Sillago sihama* (4.49%) and *Ellochelon vaigiensis* (4.17%), respectively.

In this study, investigators firstly discovered new record of three fishes in Pranburi river. They were *Pangio oblonga* (Valenciennes, 1846), *Batasio tigrinus* (Ng and Kottelat, 2001) and *Amblyceps variegatum*. (Ng and Kottelat, 2000) The first two species are commonly found in various places such as the main stream in certain area and upstream containing high oxygen concentration. Surprisingly, although *Amblyceps variegatum* was considered as indigenous species, existing in Mae Klong river, this study was firstly reported its existence in Pranburi river.

Distribution of fish

The study of fish distribution was carried out in two main ecosystems: 1) freshwater ecosystem, the observations on fish distribution were done in the upstream, mainstream, and reservoir ecosystems. For the upstream ecosystem (ST1 and ST2), results clearly indicated the highest biodiversity of fish in Pranburi river with 26 species (Table1) and there were many species which could only be found in this ecosystem such as *Batasio trigrinus* and *Barilius koratensis*. Regards the mainstream ecosystem (ST3 and ST5), water current in this zone was slow in related with its slope. In addition, geography of this site was coincided overlapping with the upstream ecosystem because of a short distance of Pranburi river. Therefore, a plenty of fish were similarly reported such as *Mystacoleucus marginatus* and *Puntius rhombeus*. In the reservoir ecosystem (ST4), the area was large standing water, the dominant fish was juvenile economic species, that is, *Oreochromis niloticus*, *Parambassis siamensis*, *Trichogaster trichopterus* and *Oxyeleotri smarmorate*; 2) estuary ecosystem (ST6), the diversity of fishes were different from other sites because environment was brackish water and seawater. Results showed that a majority of fish was fingerlings of significant commercial species such as *Moolgarda cunnesius*, *Terapon jarbua*, *Gerres erythrourus*, and *Sillago sihama* (Table1).

Water quality and environmental parameters

Water quality and environmental parameters were measured in all stations (ST1-ST6) (Table2). An intensive dissolved oxygen (DO) ranging from 8.1-9.6 mg/L, was recorded in the upstream ecosystem (ST1 and ST2) where water condition was shallow, transparent, and strong current. In the mainstream ecosystem (ST3 and ST5), higher level of alkalinity was noted in ST3 than in ST5 with ranging of 342-523 ml/L as CaCO₃ and 255-620 ml/L as CaCO₃, respectively and water flowing was slower than the upstream. According to the reservoir ecosystem (ST4), dissolved oxygen (DO) was high at 8.1-10.09 mg/L, with stagnant and transparent water. In the estuary ecosystem (ST6), salinity and alkalinity significantly differed from others at 10-25 ppt and 5,650-6,385 ml/L as CaCO₃, respectively.

Table 1. Fishes species distribution in Pranburi river, Phetchaburi province and Prachuap Khirikhan province, west Thailand

Family	Scientific Name	Frequency	Percent (%)	ST1	ST2	ST3	ST4	ST5	ST6
Notopteridae	<i>Notopterus notopterus</i>	2	0.16	X	X				
Cyprinidae	<i>Rasbora borapetensis</i>	1	0.08	X					
	<i>Rasbora paviana</i>	61	4.89	X		X			
	<i>Barilius ornatus</i>	32	2.57	X	X				
	<i>Mystacoleucus marginatus</i>	138	11.07	X	X	X			
	<i>Puntius brevis</i>	2	0.16			X			
	<i>Puntius rhombeus</i>	30	2.41	X		X			
	<i>Osteochilus vittatus</i>	34	2.73		X	X			
	<i>Osteochilus waandersii</i>	5	0.40	X		X			
	<i>Hampala macrolepidota</i>	3	0.24	X					
Balitoridae	<i>Nemacheilus binotatus</i>	5	0.40	X					
	<i>Schistura poculi</i>	2	0.16	X					
	<i>Homaloptera smithi</i>	1	0.08		X				
Cobitidae	<i>Pangio oblonga</i>	1	0.08	X					
Amblycipitidae	<i>Amblyceps variegatum</i>	2	0.16	X					
Bagridae	<i>Batasio tigrinus</i>	2	0.16	X					
	<i>Pseudomystus siamensis</i>	8	0.64	X	X			X	
	<i>Hemibagrus nemurus</i>	3	0.24		X	X			
Clariidae	<i>Clarias batrachus</i>	3	0.24	X					
Mastacembelidae	<i>Mastacembelus favus</i>	50	4.01	X	X			X	
Synbranchidae	<i>Monopterus albus</i>	1	0.08					X	

Remark : ST1–ST6 = Sampling stations for collecting fishes

Table 1. (cont.) Fishes species distribution in Pranburi river, Phetchaburi province and Prachuap Khirikhan province, west Thailand

Family	Scientific Name	Frequency	Percent (%)	ST1	ST2	ST3	ST4	ST5	ST6
Hemiramphidae	<i>Dermogenys siamensis</i>	27	2.17		X		X	X	
Belontiidae	<i>Xenentodon cancila</i>	33	2.65	X	X	X	X		
Poeciliidae	<i>Gambusia affinis</i>	4	0.32			X			
Nandidae	<i>Pristolepis fasciata</i>	65	5.21	X	X			X	
Ambassidae	<i>Parambassis siamensis</i>	59	4.73				X	X	
	<i>Ambassis</i> sp.	11	0.88						X
Mugilidae	<i>Ellochelon vaigiensis</i>	52	4.17						X
	<i>Moolgarda cunnesius</i>	131	10.51						X
Terapontidae	<i>Terapon jarbua</i>	13	1.04						X
Lutjanidae	<i>Lutjanus russellii</i>	1	0.08						X
Gerreidae	<i>Gerres erythrourus</i>	14	1.12						X
	<i>Gerres oyena</i>	1	0.08						X
Sillaginidae	<i>Sillago sihama</i>	56	4.49						X
Siganidae	<i>Siganus javus</i>	1	0.08						X
Leiognathidae	<i>Equulites oblongus</i>	42	3.37						X
Platycephalidae	<i>Platycephalus</i> sp.	6	0.48						X
Cichlidae	<i>Oreochromis niloticus</i>	56	4.49			X	X		
Belontiidae	<i>Trichogaster trichopterus</i>	24	1.92			X	X		
	<i>Trichopsis vittata</i>	18	1.44		X			X	
Eleotridae	<i>Oxyeleotris marmorata</i>	11	0.88			X	X		
Gobiidae	<i>Gobiopterus chuno</i>	14	1.12				X		
	<i>Pseudogobius javanicus</i>	166	13.31			X	X	X	

Remark : ST1–ST6 = Sampling stations for collecting fishes

Table 1. (cont.) Fishes species distribution in Pranburi river, Phetchaburi province and Prachuap Khirikhan province, west Thailand

Family	Scientific Name	Frequency	Percent (%)	ST1	ST2	ST3	ST4	ST5	ST6
	<i>Acentrogobius</i> sp.	3	0.24						X
Channidae	<i>Channa gachua</i>	13	1.04	X		X			
	<i>Channa striata</i>	7	0.56	X	X	X			
	<i>Channa lucius</i>	32	2.57		X			X	
Engraulidae	<i>Stolephorus indicus</i>	1	0.08						X
Total		1,247	100						

Remark : ST1–ST6 = Sampling stations for collecting fishes

Table 2. Water quality parameters in Pranburi river, Phetchaburi province and Prachuap Khirikhan province, west Thailand

Water quality parameters	Sampling stations for collecting water					
	ST1	ST2	ST3	ST4	ST5	ST6
Water depth (cm)	30-90	20-80	90-120	70-110	100-110	40-100
Water temperature (°C)	26-29.1	26-30.2	27-33.4	26-32.3	26-34.5	28-33
Transparency (cm)	bottom soil (transparent)	bottom soil (transparent)	bottom soil (transparent)	bottom soil (transparent)	bottom soil (transparent)	30-50
Alkalinity (ml/L as CaCO ₃)	105-221	49-118	342-523	93-106	96-107	107-129
Water pH	7.31-8.04	7.42-8.15	7.63-8.27	7.42-8.46	7.35-8.44	7.5-8.32
Dissolved oxygen (ml/L)	8.1-9.6	8.7-8.9	6.9-9.4	8.1-10.09	6.7-8.9	8.3-9.1
Hardness (ml/L as CaCO ₃)	196-390	81-175	299-620	108-175	92-175	5,650-6,385
Nitrite-Nitrogen (ml/L)	0.0078-0.0130	0.0024-0.0103	0.0041-0.0130	0.0018-0.0100	0.0068-0.0115	0.0035-0.0219
Nitrate-Nitrogen (ml/L)	0.0183-0.1350	0.0107-0.0799	0.0173-0.1119	0.0186-0.0485	0.0335-0.0991	0.0201-0.0512
Ammonia-Nitrogen (ml/L)	0.0196-0.0465	0.0128-0.0322	0.0173-0.0647	0.0236-0.0435	0.0210-0.0365	0.0322-0.0349
Orthophosphate-Phosphorus (ml/L)	0.0047-0.0224	0.0061-0.0259	0.0039-0.0258	0.0046-0.0207	0.0074-0.0224	0.0095-0.0612
Salinity (ppt)	-	-	-	-	-	10-25

Discussion

Species diversity of fish resources in Pranburi river, located in Phetchaburi and Prachuap Khirikhan provinces, west Thailand were observed in January to December 2015 and a variety of fish species was identified into 28 families with 48 species. Accordingly, Cyprinidae, which is dominant family in particular freshwater, was recorded with nine species. (Berra, 2001; Nelson, 2001). Obviously, species in Cyprinidae was notable e.g. *Mystacoleucus marginatus*, *Rasbora poviara*, *Osteochilus vittatus* and *Barilius ornatus*. Moreover, followed by Balitoridae, Bagridae, Gobiidae and Channidae were also noted with three species for individual family and other families with one or two species each.

Geographically, the river basin in the western forest of Thailand composed of three major river basins that is, Mae Klong river basin, Phetchaburi river basin and Pranburi river basin (Vidthayanon *et al.*, 1997). In this study, observed results of fish biodiversity were compared with those studies in the vicinity fish resources, in particular Phetchaburi river and there were 41 families with 126 species, in which, among these, 39 new record species were reported in 2015 (Kunlapapuk *et al.*, 2014; Kunlapapuk *et al.*, 2015). Similarly, the three new record species were *Pangio oblonga* (Valenciennes, 1846), *Batasio tigrinus* (Ng and Kottelat, 2001) and *Amblyceps variegatum* (Ng and Kottelat, 2000) in Pranburi river in this study, indicated to the river basins in the western forest of Thailand, very little is study about fish populations (Vidthayanon *et al.*, 1997). Moreover, data collective of fish biodiversity from three major river basins e.g. Mae Klong river basin (Tarnchalanukit *et al.*, 1980; Kulabtong *et al.*, 2011), Phetchaburi river basin (Kunlapapuk *et al.*, 2014; Kunlapapuk *et al.*, 2015), and Pranburi river, study results showed that the similar discovered fish species because these river basins shared the identical original headwater site. As a result, fish was able to widely distribute throughout these river basins (Vidthayanon *et al.*, 1997).

Fish distribution in Pranburi river in relation with freshwater and estuary ecosystem

1) freshwater ecosystem, fish distribution was investigated in the upstream, mainstream, and reservoir ecosystem. Firstly, plentiful fish species were discovered in the upstream such as *Mystacoleucus marginatus*, *Batasio tigrinus*, *Schistura poculi*, *Nemacheilus binotatus*, *Amblyceps variegatum* and *Barilius ornatus*. Accordingly, the dominant species in this zone were *Mystacoleucus marginatus* and *Barilius ornatus*, They existed in good water quality only. In addition, there species in Balitoridae are found living at bottom of the upstream where has rapid flowing and also noted existing on the gravel

substrate in mainstream. (Kottelat, 1990; Rainboth, 1996; Lothongkham and Musikasinthorn, 2006). Likewise, physical geography of the upstream ecosystem was shallow, the gravel bottom, and strong current. Therefore, fish living in this zone must adapt with special characters. For example, *Homaloptera smithi* must adapt itself by wide pectoral and pelvic fins to attach on substrate and *Barilius ornatus* has thin shape (Suvarnaraksha, 2015). Hence, these species are rarely seen in other ecosystems. In addition, Balitoridae was important indicator for excellent water quality at the upstream ecosystem in Pranburi river. In essence, distribution of fish in the upstream was considerably vital characteristic in the Pranburi river and it is similar to result from biodiversity study of fish in the upper Nan river, Nan provinces, northern Thailand (Lothongkham and Duangjai, 2010).

Secondly, fish distribution was widespread throughout the mainstream ecosystem. These species were *Mastacembelus favus*, *Dermogenys siamensis*, *Gambusia affinis*, *Pristolepis fasciata*, *Parambassis siamensis* and *Channa lucius*. Accordingly, their wide distribution was due to high resistance on the fluctuated water quality. It reflects that they can well adapt to environmental condition. In this zone, it is running water ecosystem, containing clear water and light penetrating into water until reach the bottom. In fact, Pranburi river is likely the short distance river with 180 km long in total (Chittapalapong *et al.*, 2000). As its short geography, the certain water quality parameters are somewhat similar to those in the upstream ecosystem, especially, the coincided level of dissolved oxygen. However, some different factors can be identified in both ecosystems as slower rate of current, lesser steep slope area, and higher dissolved nutrients because of close to agricultural zone were noted in the mainstream ecosystem.

Finally, the reservoir ecosystem was described as transparent lentic water, and low slope area. Accordingly, a number of fish species were normally found in this zone, that is *Oreochromis niloticus*, *Oxyeleotris marmorata*, *Parambassis sismensis*, *Trichogaster trichopterus*, *Gobiopterus chuno* and *Pseudogobius javanicus*. These species exhibited abroad distribution because they were high tolerant to water quality fluctuation as similar as those were found in the mainstream ecosystem such as *Trichogaster trichopterus* which likely lived in the standing water (Rainboth, 1996).

2) estuary ecosystem, survey results showed that the most fish permanently existed in mangrove forest and were economic juvenile fish e.g. *Ellochelon vaigiensis*, *Moolgada cunnesius*, *Terapon jarbua*, *Lutjanus russellii*, *Gerres erythrourus*, *Sillago sihama* and *Equulites oblongus*. With respect to distribution, these species had similar distribution when compared with study of fish biodiversity in mangrove located in Andaman sea side on the south of

Thailand (Ratmuangkhwang *et al.*, 2014). Additionally, distribution of fishes in this region was limited by salinity which is a crucial factor. Consequently, these species hardly distributed to live in the upper river ecosystem.

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