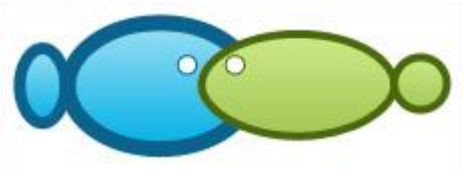

Fish species composition variability in Cu Lao Dung, Soc Trang, Vietnam

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Abstract. A study on fish diversity was conducted from August 2019 to June 2020 in Cu Lao Dung, which is located in the estuarine areas of the Mekong River. Fish and water samples were collected from 4 habitat types (represented by the 12 considered sampling sites: river/canal, garden pond, aquaculture farm and mangrove) by using hand nets, seine nets and measuring equipment. 67 species belonging to 22 families and 9 orders were identified. The most abundant order, containing 43 species (64.18%), was the Perciformes, and the least abundant were the Synbranchiformes and Tetraodontiformes, containing only 1 species (1.49%). The results also indicated that salinity had affected the distribution of the fish composition. The number of fish species in the mangrove habitat was higher than in other habitats. The highest number of species collected in the mangrove habitat was 54 species (80.60%), followed by the garden pond habitat, with 38 species (56.72%), the river/canal habitat, with 36 species (53.73%), and the aquaculture farm habitat, with 35 species (52.24%). The results showed 56 species (83.58%) in the rainy season and 53 species (79.1%) in the dry season, with the Perciformes as the most abundant order, with 35 species (66.04%) in the dry season and 34 species (60.71%) in the rainy season.
Key Words: fish diversity, distribution, estuarine areas, Mekong River.

Introduction. The Mekong River is well known as one of the great rivers with a high biodiversity, comparable to that of the Amazon. It flows 4,350 km through six countries: China, Myanmar, Thailand, Lao, Cambodia and Vietnam. In the Mekong Delta of Vietnam, the Mekong River divides into two tributaries, namely Hau and Tien Rivers (Coates et al 2005). The Cu Lao Dung or Cu Lao Dung District is an island in the Soc Trang Province, situated on the Hau River, at a distance of more than 40 km from the river mouths of the Mekong River. The island splits the Hau River into two branches flowing into the East Sea as Dinh An and Tran De estuaries. The favorable geographical location and the natural environment in Cu Lao Dung are very diverse, with three major aquatic ecosystems: freshwater, brackish and marine ecosystems, composed of three main habitats: mangroves, mud flats and estuaries (Le et al 2006; Soc Trang Statistical Office 2012).

However, the climate change and human activities, such as overfishing and hydropower dams construction upstream of the Mekong River, are essential issues that significantly affect the aquatic ecosystem in the Mekong Delta (Blate 2009), especially in the lower basin. The lack of freshwater leads to the saline intrusion that can change the aquatic habitats and the distribution of freshwater aquatic species living in areas. Besides, overfishing leads to a decline in fishery resources (Reid et al 2013). This can result in vulnerable habitats, by changing the fish distribution composition (Wilfried 2007) and thus significantly affecting the mangrove systems.

In recent years, many research and projects have been conducted to investigate the diversity of the fish composition in the Soc Trang Province, concerning different species, but mainly focused on the estuary and the coastal areas (Dinh 2008; Diep et al 2014; Le et al 2018; Tran et al 2020a,b). Therefore, this research was conducted to

determine for the first time the variation the of fish composition in different habitats in Cu Lao Dung, from fresh water to brackish water areas, in order to provide a more specific information about the fish composition, which is important for monitoring and managing the resources.

Material and Method

Description of the study sites. The research was implemented in Cu Lao Dung, Soc Trang Province, from August 2019 to June 2020. Twelve sampling sites, associated with four types of habitats, were chosen along the Cu Lao Dung. These habitats were described through the specific characteristics of the sampling sites. The river/canal habitat consisted of water areas within a natural river or canal. The garden pond habitat consisted of water areas in the canals storing the water for the gardens irrigation. The aquaculture farm habitat consisted of brackish water areas in the canals draining the white leg shrimp ponds. The mangrove habitat consisted of water areas next to the mangrove forests.

Figure 1. Map of sampling sites in Cu Lao Dung, Soc Trang Province (📌: sampling site; Đ1 and Đ8: river/canal habitats; Đ2-3 and Đ5-6: garden pond habitats; Đ4 and Đ7: aquaculture farm habitats; Đ9-12: mangrove habitats) (Source: Google Map).

Materials. Materials for research support included the following: hand net, seine net, cool box, plastic bags, formalin solution (10%), ethanol (75%), camera, GPS, Refractometer ATC, pH meter HI 98107, portable depth sounder HONDEX PS-7 and Secchi disc.

Fish sampling. Fish samples were collected in six sessions by hand net and seine net, from the Cu Lao Dung waters. The sample collection was regularly conducted for two days. At each sampling site the process took 25-30 minutes. The fishing gears were flexibly used, in adequation with the sampling sites. The hand net had a mesh size of 0.5 cm, and the seine net had a mesh size of 1 cm, a frame size of 1 m height and 3.5 m width. All samples after collection were marked for each area, kept in a bag containing water and preserved in a cool box or fixed with 10% formalin solution, and taken to the Aquatic Resources Lab, College of Aquaculture and Fisheries, Can Tho University, for analysis. After identifying the fish samples, these were preserved in ethanol (75%).

Environmental parameter measuring. At each site, the physical water parameters were recorded after being measured: the salinity with a refractometer with Automatic Temperature Compensation (ATC), the pH and temperature with a HI 98107 pH meter, the water depth with a Portable Depth Sounder HONDEX PS-7 and the water transparency with a Secchi disc.

Fish species identification. Fish samples were identified by measuring different morphological characteristics, including the total length, standard length, dorsal fin, pelvic fin, pectoral fin and lateral scale number (Figure 2).

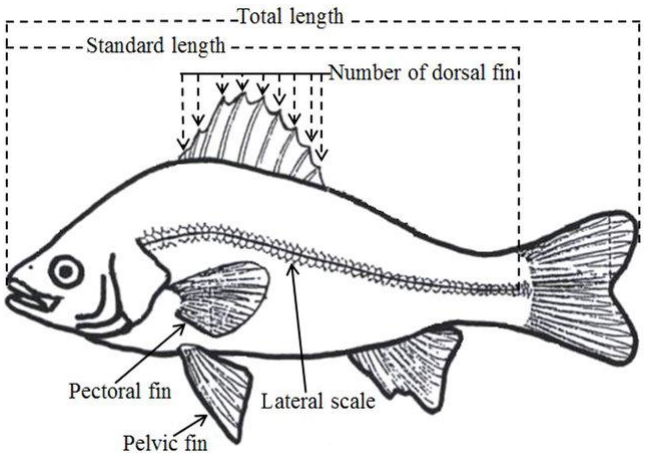

Figure 2. Morphological parameters for measuring species identification (Rainboth 1996).

Fish species classification. Fish was classified by using the taxonomic key provided by Mai (1992). Besides, we also used other literature of Rainboth (1996), Truong & Tran (1993) and Tran et al (2013). The taxonomic order was followed by Fricke et al (2020).

Results and Discussion

The environmental parameters in Cu Lao Dung

Salinity. The salinity recorded in Cu Lao Dung fluctuated in the range of 0-21‰ and tended to increase from August to February, then to gradually decrease until June (Table 1). The highest salinity was found in the mangrove habitat with 16.8±4.4‰ in February 2020, and the lowest salinity, of 0‰, was recorded in all habitats, in October 2019. The salinity differences were explained by the habitat type. The mangrove habitat was located in the estuary, so that it was affected by the seawater, being higher than in the other inland habitats, which were less impacted by seawater. Salinity was also influenced by the season. The freshwater volume was increased in the rainy season, leading to sweetening the Cu Lao Dung area. In contrast, the freshwater volume decreased, leading to an increased salinity in the dry season (December, February and April).

Table 1

Salinity in various habitats in Cu Lao Dung (‰)

Habitat	*Sampling time*					
	August 2019	*October 2019*	*December 2019*	*February 2020*	*April 2020*	*June 2020*
River/canal	0	0	3.0±4.3	12.0±4.2	6.5±5	3.5±5
Garden pond	0	0	3.3±2.8	10.8±3.9	7.3±2.9	4.0±4.7
Aquaculture farm	0	0	7.0±1.4	14.0±1.4	9.5±3.5	3.0±4.2
Mangroves	0.5±0.6	0	4.3±4.9	16.8±4.4	14.0±1.4	8.5±1.7

Temperature. The temperature recorded in Cu Lao Dung ranged from 23.4 to 31.3°C. The lowest temperature was recorded in the garden pond habitat: 24.6±0.8°C in October 2019 and the highest was recorded in the aquaculture farm habitat: 30±0.9°C in February 2020 (Table 2). There was a difference of average temperature between the rainy season (28.1±2.2°C) and the dry season (28.9±1.4°C) for all habitats in Cu Lao Dung. The temperature in October 2019, at the end of the rainy season, was lower than in the other months. The rain lasted during the sampling process, causing a decrease in the water temperature.

Table 2

Temperature in various habitats in Cu Lao Dung (°C)

Habitat	*Sampling time*					
	August 2019	*October 2019*	*December 2019*	*February 2020*	*April 2020*	*June 2020*
River/canal	28.9±1.6	27.1±1.7	29.7±0.4	29.7±2.3	28.5±0.7	29.1±0.8
Garden pond	29.5±1.0	24.6±0.8	28.7±0.6	29.1±1.0	28.7±1.1	29.6±1.9
Aquaculture farm	29.5±0.8	24.9±0.9	29.7±0.5	30.0±0.9	29.7±0.5	29.1±1.0
Mangroves	28.4±3.4	26.9±1.2	26.3±2.2	29.5±0.5	29.2±0.8	29.9±1.2

pH. The pH recorded in the water of Cu Lao Dung ranged from 7 to 9, with significant differences between months and no significant differences between habitats. The pH lowest value was recorded in the river/canal habitat: 7.3±0.4 in October 2019. The highest value was recorded in the aquaculture farm habitat: 8.7±0.5 in April 2020 (Table 3). The average pH in the rainy season (7.6±0.3) was lower than in the dry season (8.3±0.3), due to the rainwater and to the high temperature.

Table 3

pH in various habitats in Cu Lao Dung

Habitat	*Sampling time*					
	August 2019	*October 2019*	*December 2019*	*February 2020*	*April 2020*	*June 2020*
River/canal	8.1±0.7	7.3±0.4	8.4±0.3	8.6±0.1	8.3±0.1	8.1±0.4
Garden pond	7.5±0.2	7.6±0.2	8.4±0.2	8.4±0.1	8.0±0.5	7.9±0.4
Aquaculture farm	7.7±0.1	7.5±0.1	8.3±0.1	8.5±0.1	8.7±0.5	7.6±0.0
Mangroves	7.8±0.4	7.5±0.1	8.1±0.3	8.2±0.1	8.4±0.1	7.5±0.3

Water depth. The water depth of each habitat was different from inland to the estuary, ranging between 0.25 and 2.6 m (Table 4). The maximum average water depth of the river/canal habitat reached 1.04±0.47 m, followed by mangrove and aquaculture farm habitats, with 1.04±0.66 m and 0.84±0.38 m, respectively. In contrast, the minimum average water depth in the garden pond habitat had the lowest value, 0.6±0.4 m. The river/canal habitat is deeper, due to its role in the water supply, transport, aquaculture and daily needs, while the water areas next to the aquaculture farm and the garden ponds, belonging to the branches of the main river/canal, were not deep.

Table 4

Water depth in various habitats in Cu Lao Dung (m)

Habitat	*Sampling time*					
	August 2019	*October 2019*	*December 2019*	*February 2020*	*April 2020*	*June 2020*
River/canal	1.18±1.17	1.09±0.23	1.25±0.21	1.18±0.18	1.13±0.41	0.52±0.33
Garden pond	0.45±0.30	0.33±0.10	0.90±0.42	0.78±0.33	0.49±0.25	0.78±0.55
Aquaculture farm	0.64±0.23	0.43±0.25	1.15±0.35	1.15±0.21	0.60±0.47	1.08±0.18
Mangroves	1.43±1.19	0.58±0.27	1.12±0.59	1.00±0.26	0.71±0.37	0.83±0.22

Water transparency. Transparency of water varied with 10 to 33 cm. The average water transparency in the river/canal habitat was the lowest (15.4±5.02 cm), while in the garden pond habitat was the highest (21.6±11.57 cm). The aquaculture and mangrove habitats reached 16.5±5.85 cm and 19.4±9.75 cm, respectively (Table 5). The average water transparency in the rainy months (17.6±10.1 cm) was lower than in the dry months (20.4±8.8 cm). The rainy season precipitations impacted the water column,

leading to an increased turbidity and a decreased water transparency, especially in low-depth areas.

Table 5

Transparency in various habitats in Cu Lao Dung (cm)

Habitat	*Sampling time*					
	August 2019	*October 2019*	*December 2019*	*February 2020*	*April 2020*	*June 2020*
River/canal	13.5±3.5	15.5±3.5	22.5±0.7	19.5±0.7	10.0±2.8	11.5±3.5
Garden pond	11.3±3.6	10.8±1.7	19.0±4.2	27.0±13.4	33.0±12.1	28.8±10.2
Aquaculture farm	11.5±2.1	11.0±0.0	19.5±5	17.0±7.1	15.0±1.4	25.0±4.2
Mangroves	20.8±16.4	22.0±13.0	16.0±6.7	18.3±4.4	18.3±7.6	21.0±11.6

Fish species composition. The fish specimens were collected and analyzed for 12 sampling sites: 67 species belonging to 22 families and 9 orders were identified (Table 6).

Table 6

List of fish composition in various habitats of Cu Lao Dung

No.	*Scientific name*	*Habitat*				*Season*	
		(1)	*(2)*	*(3)*	*(4)*	*Dry*	*Rainy*
	Order Atheriniformes						
	Family Phallostethidae						
1	*Neostethus bicornis*				+		+
2	*Neostethus lankesteri*				+	+	
3	*Phallostethus cuulong* (Shibukawa, Tran & Tran, 2012)				+	+	+
4	*Phenacostethus smithi* (Myers, 1928)	+	+	+	+	+	+
	Order Beloniformes						
	Family Adrianichthyidae						
5	*Oryzias haugiangensis* (Roberts, 1998)	+	+	+	+	+	+
6	*Oryzias minutillus* (Smith, 1945)	+	+		+	+	+
	Family Hemiramphidae						
7	*Dermogenys siamensis* (Fowler, 1934)	+	+	+	+	+	+
8	*Zenarchopterus clarus* (Mohr, 1926)	+		+	+	+	+
	Family Belonidae						
9	*Xenentodon* sp.		+		+	+	+
	Order Cypriniformes						
	Family Cyprinidae						
10	*Barbonymus gonionotus* (Bleeker, 1849)	+					+
11	*Esomus metallicus* (Ahl, 1923)		+				+
12	*Rasbora aurotaenia* (Tirant, 1885)	+	+	+	+	+	+
13	*Rasbora paviana* (Tirant, 1885)		+		+	+	
14	*Rasbora urophthalmoides* (Kottelat, 1991)		+		+		+
	Order Gasterosteiformes						
	Family Syngnathidae						
15	*Doryichthys boaja* (Bleeker, 1850)	+		+	+	+	+
16	*Hippichthys heptagonus* (Bleeker, 1849)	+		+	+	+	+
	Order Mugiliformes						
	Family Mugilidae						
17	*Chelon subviridis* (Valenciennes, 1836)	+	+		+	+	+
18	*Moolgarda perusii* (Valenciennes, 1836)	+	+	+	+		+
19	*Paramugil parmatus* (Cantor, 1849)	+	+	+	+	+	+
	Order Perciformes						
	Family Ambassidae						
20	*Ambassis vachellii* (Richardson, 1846)	+		+	+	+	+
	Family Gerreidae						
21	*Gerres limbatus* (Cuvier, 1830)		+		+	+	
	Family Sillaginidae						
22	*Sillago sihama* (Forsskål, 1775)			+		+	

No.	Scientific name	Habitat				Season	
		(1)	(2)	(3)	(4)	Dry	Rainy
	Family Terapontidae						
23	*Terapon jarbua* (Forsskål, 1775)				+		+
	Family Cichlidae						
24	*Oreochromis niloticus* (Linnaeus, 1758)		+	+	+	+	+
	Family Scatophagidae						
25	*Scatophagus argus* (Linnaeus, 1766)	+		+	+	+	+
	Family Siganidae						
26	*Siganus fuscescens* (Houttuyn, 1782)				+	+	
	Family Osphronemidae						
27	*Trichopodus trichopterus* (Pallas, 1770)		+	+		+	+
28	*Trichopsis vittata* (Cuvier, 1831)		+	+	+	+	+
	Family Channidae						
29	*Channa striata* (Bloch, 1793)	+					+
	Family Eleotridae						
30	*Bostrychus scalaris* (Larson, 2008)				+	+	
31	*Butis butis* (Hamilton, 1822)	+	+	+	+	+	+
32	*Butis humeralis* (Valenciennes, 1837)	+	+		+	+	+
33	*Butis koilomatodon* (Bleeker, 1849)	+		+	+	+	+
34	*Eleotris melanosoma* (Bleeker, 1853)		+		+	+	
35	*Oxyeleotris urophthalmus* (Bleeker, 1851)	+	+		+	+	+
	Family Gobiidae						
36	*"Acentrogobius" globiceps* (Hora, 1923)			+		+	
37	*Acentrogobius viridipunctatus* (Valenciennes, 1837)			+	+	+	+
38	*Aulopareia unicolor* (Valenciennes, 1837)				+		+
39	*Boleophthalmus boddarti* (Pallas, 1770)	+	+	+	+	+	+
40	*Brachygobius sabanus* (Inger, 1958)	+	+	+	+	+	+
41	*Brachygobius* sp. (cf. *aggregatus*)	+	+	+	+	+	+
42	*Eugnathogobius siamensis* (Fowler, 1934)	+	+		+	+	+
43	*Glossogobius aureus* (Akihito & Meguro, 1975)			+	+		+
44	*Glossogobius sparsipapillus* (Akihito & Meguro, 1976)		+			+	
45	*Gobiopterus chuno* (Hamilton, 1822)	+	+	+	+	+	+
46	*Hemigobius hoevenii* (Bleeker, 1851)		+	+	+	+	+
47	*Mugilogobius cavifrons* (Weber, 1909)				+		+
48	*Mugilogobius chulae* (Smith, 1932)		+	+		+	+
49	*Mugilogobius tigrinus* (Larson, 2001)		+				+
50	*Oligolepis acutipennis* (Valenciennes, 1837)	+		+		+	+
51	*Periophthalmodon schlosseri* (Pallas, 1770)	+	+	+	+	+	+
52	*Periophthalmodon septemradiatus* (Hamilton, 1822)				+	+	
53	*Periophthalmus gracilis* (Eggert, 1935)	+	+	+	+	+	+
54	*Periophthalmus variabilis* (Eggert, 1935)	+					+
55	*Pseudapocryptes elongatus* (Cuvier, 1816)	+	+			+	
56	*Pseudogobius avicennia* (Herre, 1940)		+	+	+	+	+
57	*Pseudogobius javanicus* (Bleeker, 1856)	+	+		+	+	+
58	*Pseudogobius melanostictus* (Day, 1876)	+	+	+	+	+	+
59	*Pseudogobius yanamensis* (Rao, 1971)	+	+		+	+	+
60	*Redigobius bikolanus* (Herre, 1927)				+		+
61	*Redigobius chrysosoma* (Bleeker, 1875)	+		+	+	+	+
62	*Stigmatogobius pleurostigma* (Bleeker, 1849)	+	+	+	+	+	+
	Order Siluriformes						
	Family Plotosidae						
63	*Plotosus canius* (Hamilton, 1822)			+	+	+	+
	Family Bagridae						
64	*Mystus atrifasciatus* (Fowler, 1937)				+	+	+
65	*Mystus gulio* (Hamilton, 1822)	+			+	+	+
	Order Synbranchiformes						
	Family Synbranchidae						
66	*Monopterus albus* (Zuiew, 1793)			+			+
	Order Tetraodontiformes		+				
	Family Tetraodontidae						
67	*Tetraodon nigroviridis* (Marion de Procé, 1822)	+			+	+	+
	Total	36	38	35	54	53	56

Among a total of 67 species, the Perciformes was the most abundant order, with 43 species (64.18%), followed by the Beloniformes and Cypriniformes, with 5 species (7.46%). Atheriniformes, Mugiliformes and Gasterosteiformes were represented with 4 (5.97%), 3 (4.48%) and 2 (2.99%) species. The other orders comprised only 1 species (1.49%) such as the Synbranchiformes and the Tetraodontiformes (Figure 3).

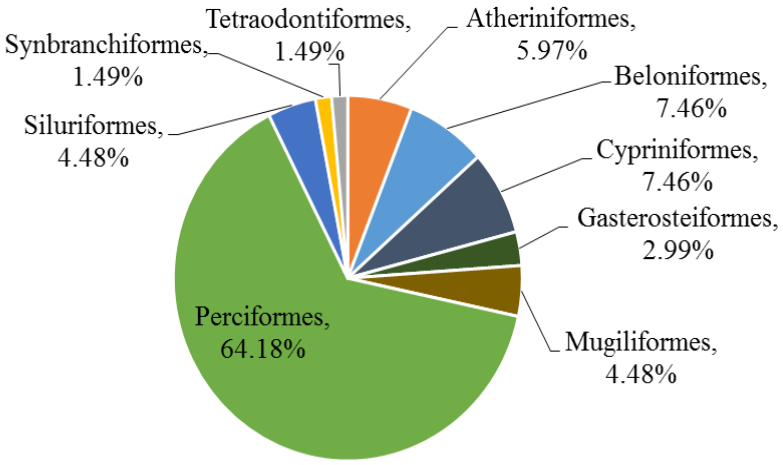

Figure 3. The percentage of the total number of fish order in Cu Lao Dung.

When comparing the 22 families, the Gobiidae was the highest, with 27 species (40.30%), followed by the Eleotridae, Cyprinidae, Phallostethidae and Mugilidae, with six species (8.96%), five species (7.46%), four species (5.97%) and three species (4.48%), respectively. The other families contained 1-2 species (32.84%) (Figure 4).

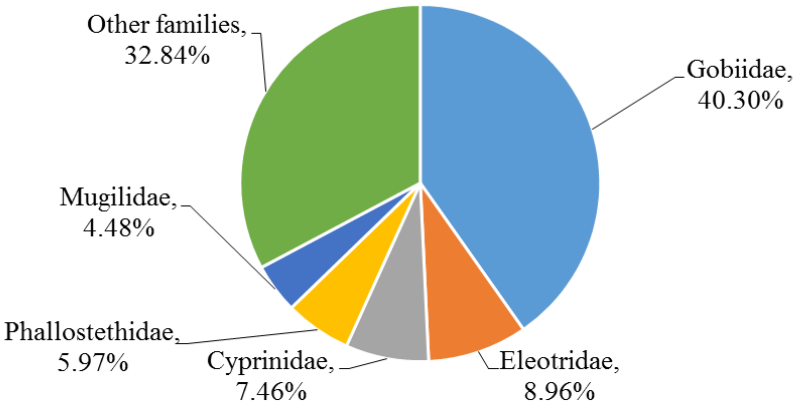

Figure 4. The percentage of fish species in the families.

Fish composition and water parameters. The correlation between the number of fish species and the water environmental parameters showed that the diversity of fish species in the study area fluctuated with the salinity (Figure 5). A change in the salinity affected the presence of the fish species and the mangrove habitat with the highest salinity, of 7.3‰, comprised the highest number of species. The aquaculture farm habitat had the lowest number of species, with a salinity of 5.6‰. From October to February, the salinity increased rapidly along with the number of the fish species (Figure 6). Although from April to June the salinity decreased, the number of species raised because the beginning of the rainy season is the primary season for spawning and migration of many species in the estuarine areas.

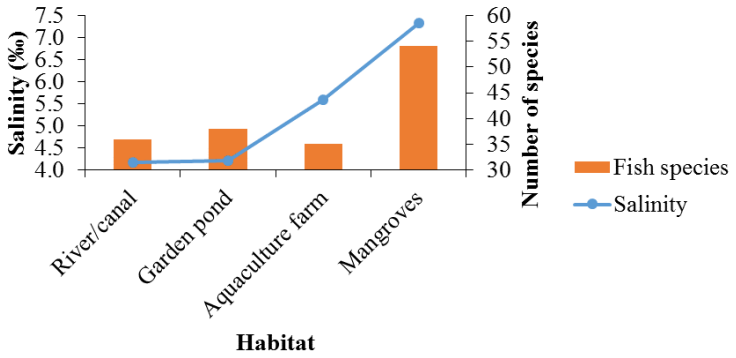

Figure 5. Number of species and salinity of various habitats in Cu Lao Dung.

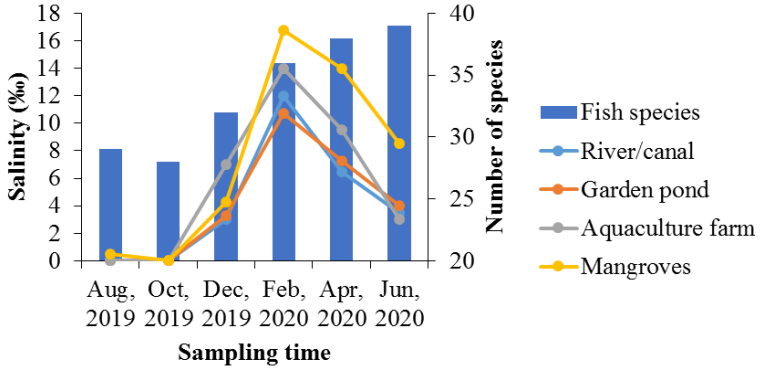

Figure 6. Fluctuation of the salinity and species composition in various habitats.

For the other environmental parameters, the result showed that the temperature was significantly different between months but it was entirely suitable for the fish growth, with 25-32°C. Also, the pH fluctuations were affected by the temperature and rainfall, but the pH was suitable for the fish growth, with 6.5-9 (Boyd & Tucker 2012). Therefore, the temperature and pH did not affect the distribution of fish species composition in Cu Lao Dung. The results showed that the water depth and water transparency in the study area recorded significant differences between months, but there was no effect of the depth and clarity on the distribution of fish species composition (Figure 7).

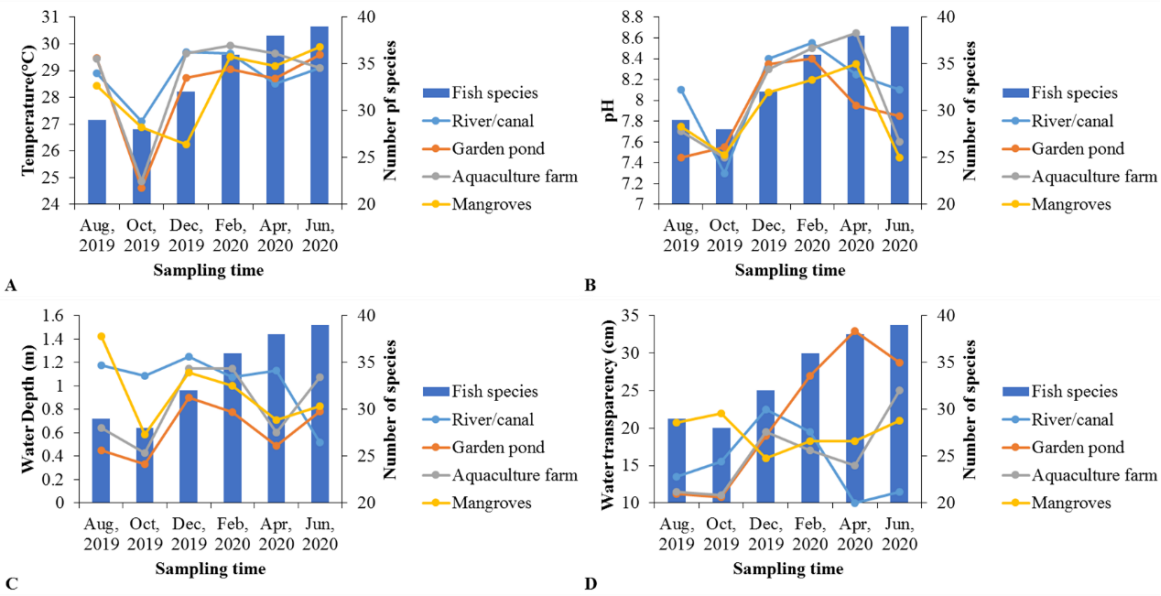

Figure 7. Fluctuation of water quality and species composition in various habitats (A-temperature; B-pH; C-water depth; D-water transparency).

In recent years, there were several studies on fish composition in the coastal areas of Soc Trang province. The investigation on the Tran De Estuary of Tran & Hong (2019) found 55 species belonging to 28 families and 12 orders in total 84 species belonging to 36 families and 12 orders were recorded in lower areas of Hau River. Later, Tran et al (2020a) showed that there are 138 species belonging to 65 families and 22 orders in the coastal water of the Mekong Delta. Compared with previous studies, the fish species composition collected in this study was poorer. The reasons for the difference of fish species compositions are related to the sampling process design, namely the duration, period and sites (number and type).

Characteristics of the fish species distribution in Cu Lao Dung

The distribution of the fish species composition by season. Three sampling sessions were conducted in the rainy season (in August 2019, October 2019 and June 2020) and three other in the dry season (December 2019, February 2020 and April 2020). The results showed that among the 67 collected species, there were 56 species (83.58%) found in the rainy season and 53 species (79.1%) in the dry season. Of a total of nine orders, *Perciformes* was the largest order in both dry and rainy seasons, with 35 species (66.04%) in the dry season and 34 species (60.71%) in the rainy season (Figure 8). The difference in the fish species composition between the two seasons explains the spawning migration of some fish species in the rainy season.

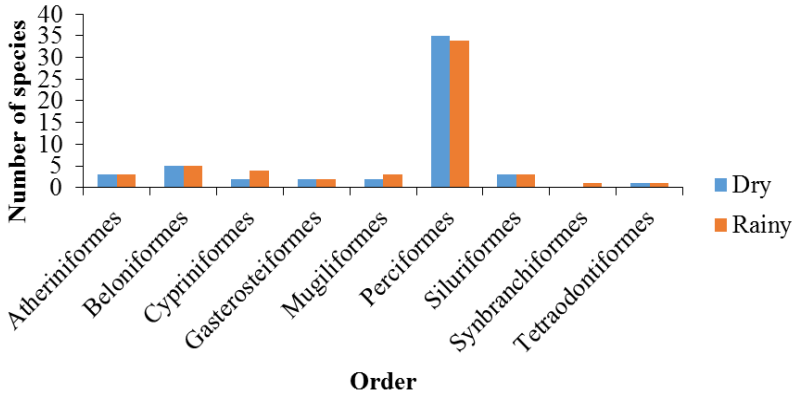

Figure 8. Number of fish species in different orders.

The results also indicated that 11 species (16.42%) were only found in the dry season, while 14 species (20.90%) were found only in the rainy season and 42 species (62.69%) were found in both seasons (Figure 9). The difference in speices apprarences could be resulted of the salinity and fish spawning behavior.

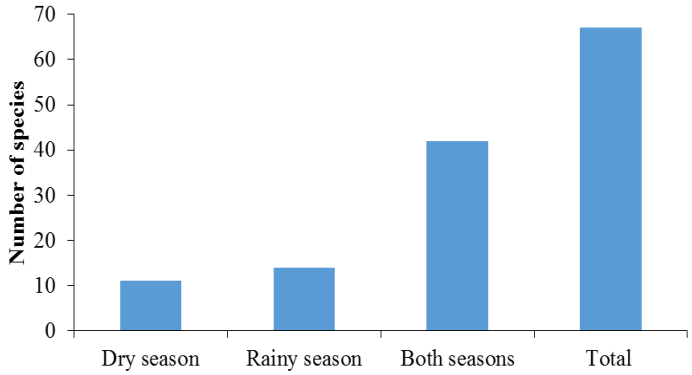

Figure 9. Number of fish species in the different seasons.

The distribution in fish species composition by habitat. The results showed the different number of fish species from inland to estuaries (Figure 10): the highest number

of species was found in the mangrove habitat, with 54 species (80.60%), followed by the garden pond habitat, with 38 species (56.72%), the river/canal habitat, with 36 species (53.73%), and the aquaculture farm habitat, with 35 species (52.24%).

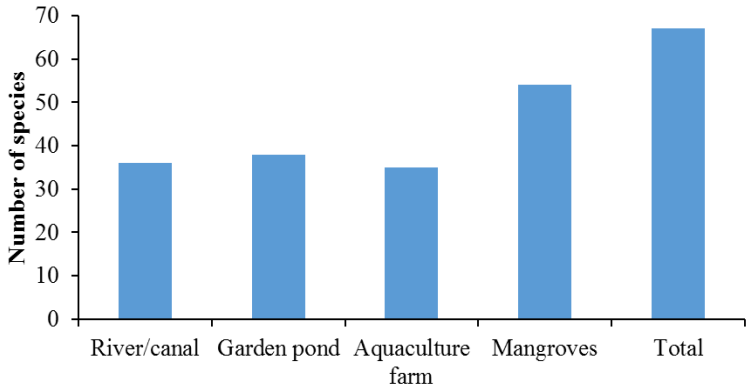

Figure 10. Number of species in various habitats of Cu Lao Dung.

The results also indicated that in the river/canal habitat, there were 36 species belonging to 13 families and eight orders, in which the Perciformes was the most diverse order, with 22 species (61.11%), followed by the Beloniformes, with four species (11.11%), the Mugiliformes, with three species (8.33%), and the other orders, with 1-2 species (2.78%-5.56%) (Figure 11A). In the garden pond habitat, the Perciformes was the largest order, with 25 species (65.79%), followed by the Beloniformes and Cypriniformes, with four species (10.53%) and the Mugiliformes, with three species (8.33%). In the aquaculture farm habitat, the Perciformes also had the highest number of species, 24 (68.57%), followed by the Beloniformes, with three species (8.57%).
In the mangrove habitat, the Perciformes was also the most abundant order with 33 species (61.11%), followed by the Beloniformes, with five species (9.26%), and the Atheriniformes, with four species (7.41%) (Figure 11).

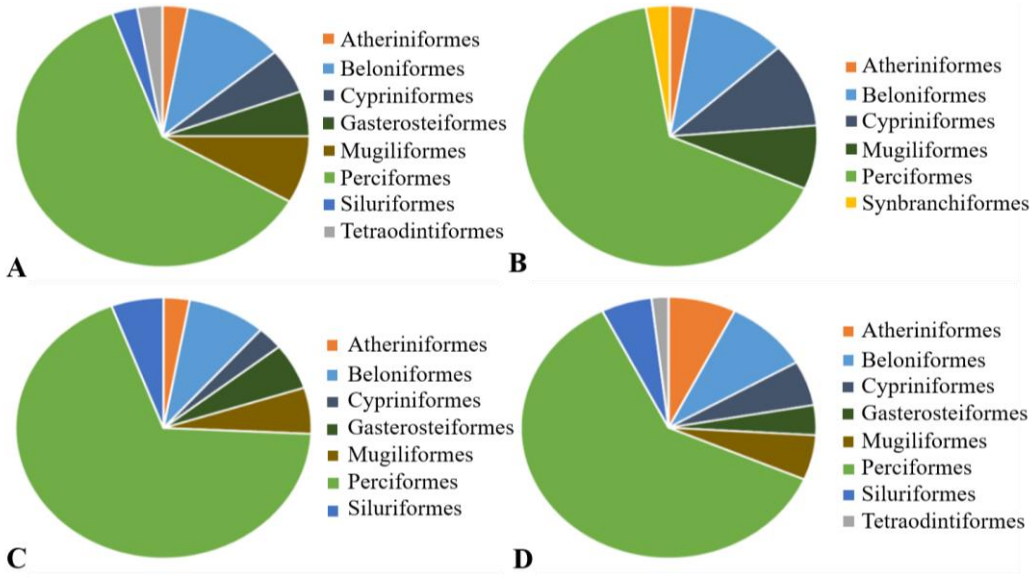

Figure 11. The proportion of fish species in various habitats (A-river/canal; B-garden pond; C-aquaculture farm, and D-mangroves).

The difference of the fish species composition between habitats was due to the different characteristics of each habitat. The mangrove habitat plays a unique role in the complex food web systems, wproviding shelter, spawning ground and feed for many species. Mangrove leaves decompose and provide organic matter, being an important feed source for aquatic species. In addition, the mangrove habitat provided safety for many fish

species. Therefore, the number of species in the mangrove habitat's composition was higher than in other habitats.

Conclusions. In the Cu Lao Dung waters, 67 species were recorded, belonging to 22 families and nine orders. Salinity affected the distribution of the fish composition. The fish species composition also fluctuated seasonally, with 56 species (83.58%) in the rainy season and 53 species (79.1%) in the dry season. Among the four habitats met in Cu Lao Dung, the highest number of species was found in the mangrove habitat, with 57 species (85.07%), and the lowest one in aquaculture habitat, with 35 species (52.24%). Mangrove is one of the most important habitats for the estuarine fish species of the Mekong River.

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Conflict of interest. The authors declare no conflict of interest.

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