



Fish Diversity and Fish Community Structure in Wang Nong Reservoir, Nakhon Phanom Province, Thailand

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Abstract: Fish diversity in reservoirs is vital for sustaining food security and livelihoods in rural communities. Wang Nong Reservoir, in Nakhon Phanom Province, northeastern Thailand, supports local fisheries but has remained scientifically unexplored until now. This study presents the first comprehensive assessment of fish community diversity and structure from January to December 2024. Monthly samples were collected at four stations using gill nets and a beach seine. A total of 8,294 specimens representing 47 species from 14 families were recorded. Dominant families included Cyprinidae (51.06%), Bagridae (10.64%), Cobitidae (6.38%), and Osphronemidae (6.38%). The most abundant species were *Rasbora borapetensis* (17.36%), *Esomus metallicus* (11.35%), *Thynnichthys thynnoides* (5.57%), *Cyclocheilichthys repasson* (4.77%), and *Puntius brevis* (4.46%), with twelve species occurring in all samples. Most species were classified as Least Concern on the IUCN Red List, while two were Vulnerable and one was Data Deficient. Seasonal variation was evident, with peak abundance and species richness in summer. The average Shannon-Wiener diversity (H'), richness (R), and evenness (E) indices were 3.12, 4.46, and 0.87, respectively. Water temperature and dissolved oxygen were positively correlated with H' , R , and E ($p < 0.01$), whereas transparency showed a negative correlation; other parameters (TDS, pH, NH_3 , NO_2 , and NO_3) were not significantly related. These findings provide the first baseline dataset on fish diversity in Wang Nong Reservoir, filling a critical knowledge gap for inland fisheries in northeastern Thailand and offering a robust scientific foundation for site-specific conservation planning and evidence-based sustainable fisheries management.

Keywords: Fish diversity; community structure; wang nong reservoir; Nakhon Phanom Province

1. Introduction

Wang Nong Reservoir is a medium-sized earthen reservoir located at 17°45'55.5"N, 104°03'31.0"E in Ban Dontoei, Na Thom District, Nakhon Phanom Province, northeastern Thailand, approximately 717 km northeast of Bangkok (Figure 1). Constructed in 1990, the reservoir has a maximum storage capacity of 2.52 million m³, receives runoff from a catchment area of approximately 20.68 km², and lies at an elevation of 141 meters above mean sea level. It drains into the Songkhram River, a tributary of the Mekong River Basin [1]. Reservoirs, defined as artificial lakes, may or may not be hydrologically connected to river systems [2]. They serve multiple functions, including irrigation, livestock watering, flood control, and the provision of seasonal habitats for riverine fishes,

while also supporting diverse fish assemblages [3]. Fish resources are crucial to local livelihoods, providing both dietary protein and supplementary income [4]. Wang Nong Reservoir is primarily utilized for rice irrigation and domestic water supply. Additionally, it supports recreational activities such as swimming, boating, and fishing, and serves as an important source of livelihood for local fishers. Fish caught from the reservoir are marketed either fresh or processed, including dried and fermented products.

Although the diversity of fish species has been documented in several major reservoirs across northeastern Thailand, such as Sirindhorn Reservoir in Ubon Ratchathani Province [5], Bung Klua Reservoir in Roi Et Province [6], Ubolratana Reservoir in Khon Kaen Province [7], Lam Pao Reservoir in Kalasin Province [8], Nam Oun and Huay Huat Reservoirs in Sakon Nakhon Province [9, 10], and Huai Kao Reservoir in Maha Sarakham Province [11], Wang Nong Reservoir remains scientifically unexplored. This significant gap in ecological knowledge limits our understanding of the reservoir's unique fish communities and impedes efforts to manage them sustainably. Given the reservoir's crucial role in supporting agriculture, domestic water supply, and local communities' livelihoods, documenting its fish diversity is both timely and essential. Therefore, this study aims to assess fish species diversity and community structure in Wang Nong Reservoir, representing the first comprehensive assessment of the fish assemblage in this reservoir and providing baseline data for conservation and fisheries management.

2. Materials and Methods

2.1 Study Area and Fish Sampling

The study was conducted in Wang Nong Reservoir (17°45'55.5"N, 104°03'31.0"E) (Figure 1), a multipurpose reservoir located in Ban Dontoei, Na Thom District, Nakhon Phanom Province, Thailand. Fish specimens were collected monthly from January to December 2024 at four sampling stations (ST1-ST4). For seasonal analysis, sampling months were grouped into three seasons based on regional climatic patterns: winter (January and October–December), summer (February–May), and rainy (June–September). The winter season, which spanned January 2024 and October–December 2024, was used for seasonal comparisons. Samples were collected using gill nets with three mesh sizes (2.0, 4.0, and 6.0 cm; 100 m long and 1.5 m deep) and a beach seine with a mesh size of 0.5 × 0.5 cm (25 m long and 1.5 m deep). At each sampling station, the gill nets were deployed three times per sampling event and left in the water for approximately 12 hours (overnight), while the beach seine was hauled three times along the shoreline. Thus, the sampling effort consisted of three gill-net deployments and three seine hauls per station per month. Specimens were preserved in 10% formalin for one month before being transferred to 75% ethanol for permanent preservation and taxonomic identification. Taxonomic identification was conducted following standard references and taxonomic keys described by Smith [12], Rainboth [13], Doi [14], Kottelat [15], Vidthayanon [16], Nelson *et al.* [17], and Taki *et al.* [18]. The threat status of each fish species was determined according to the IUCN Red List [19]. All identifications were performed at the Fisheries Research Laboratory, Faculty of Agriculture and Technology, Nakhon Phanom University, Nakhon Phanom, Thailand.

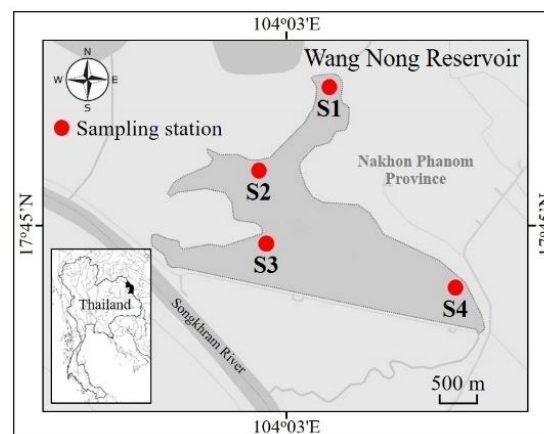


Figure 1. Map of Wang Nong Reservoir and location of sampling stations.

2.2 Environmental parameter sampling

The physicochemical water quality parameters were measured in situ using a YSI® 556 multi-probe system, including temperature, total dissolved solids (TDS), pH, and dissolved oxygen (DO). Water transparency was measured using a Secchi disk. Other parameters, including ammonia (NH₃), nitrite (NO₂), and nitrate (NO₃), were sampled for laboratory analyses using standard methods [20].

2.3 Statistical analyses

To determine the species composition and diversity of the fish population in the study area, the number of fish species and individuals per species were calculated using the following formulas:

Percentage composition by number (%N)

$$\%N = (\text{Number of individuals of a given species} / \text{Total number of individuals}) \times 100$$

Frequency of occurrence (%F)

$$\%F = (\text{Number of times each fish species was found} / \text{Total number of sampling events}) \times 100$$

Shannon-Wiener diversity index (H') [21]

$$H' = -\sum_{i=1}^s p_i \ln p_i$$

where s is the total number of species, $p_i = n_i/N$, n_i is the number of individuals in species i , and N is the total number of individuals.

Species richness index (R) [22]

$$R = (S - 1) / \ln N$$

where S is the number of species, and N is the total number of individuals.

Evenness Index (E) [23]

$$E = H' / H'_{\max}$$

where H' is the Shannon-Wiener diversity index, and $H'_{\max}$ is its maximum value.

All data were statistically analyzed. The Shannon-Wiener diversity index, species richness index, and evenness index, obtained from each sampling station and season during the survey period at Wang Nong Reservoir, were analyzed using one-way ANOVA followed by Tukey's Honestly Significant Difference (HSD) test at a significance level of $p < 0.05$. Pearson's correlation coefficients were calculated to assess the relationships between physicochemical parameters and these three indices using monthly observations ($n = 12$) at the $p < 0.01$ significance level. All analyses were performed using SPSS software version 24.0 (IBM SPSS Inc.).

2.4 Ethical statement

This research project was reviewed and approved in accordance with the Ethical Principles and Guidelines for the Use of Animals (Approval No. ACNPU67-001) by Nakhon Phanom University, Thailand.

3. Results and Discussion

3.1 Results

A total of 8,294 fish specimens, representing 47 species across 14 families, were collected (Table 1). The family Cyprinidae was the most abundant, comprising 24 species (51.06%), including *Parachela oxygastroides*, *P. siamensis*, *Esomus metallicus*, *Rasbora borapetensis*, *R. aurotaenia*, *R. trilineata*, *Thynnichthys thynnoides*, *Puntioplites proctozyston*, *Scaphognathops bandanensis*, *Barbonymus altus*, *B. schwanenfeldii*, *B. gonionotus*, *Hampala dispar*, *Puntius brevis*, *Puntigrus partipentazona*, *Cyclocheilichthys enoplos*, *C. repasson*, *Labiobarbus siamensis*, *Osteochilus vittatus*, *O. lini*, *O. microcephalus*, *O. melanopleura*, *Henicorhynchus siamensis*, and *H. ornatipinnis*. This was followed by five species (10.64%) from Bagridae, and three species (6.38%) each from Cobitidae and Osphronemidae (Figure 2). The dominant species were *R. borapetensis* (17.36%), *E. metallicus* (11.35%), *T.*

thynnoides (5.57%), *C. repasson* (4.77%), and *P. brevis* (4.46%), while all other species accounted for less than 4% each. Species with 100% occurrence included *E. metallicus*, *R. borapetensis*, *T. thynnoides*, *P. proctozystron*, *B. altus*, *B. schwanenfeldii*, *B. gonionotus*, *P. brevis*, *C. repasson*, *Oreochromis niloticus*, *Anabas testudineus*, and *Channa striata* (Figure 3). Notably, only one exotic species, *O. niloticus* (1.57%), was recorded. Among the 47 recorded species, the majority (93.62%) were classified as Least Concern (LC), while two species (4.25%), *Scaphognathops bandanensis* and *Mystus bocourti*, were listed as Vulnerable (VU). One species (2.13%), *Hemibagrus filamentus*, was categorized as Data Deficient (DD), according to the IUCN Red List (2025) (Table 1). Regarding the distribution of fish species across sampling stations, Station 1 had the highest species richness (36; 76.60%), whereas Station 4 had the lowest (30; 63.83%). The highest fish abundance was recorded during the summer season, with a total of 3,409 individuals (41.10%), followed by the rainy season with 2,639 individuals (31.82%), and the winter season with 2,246 individuals (27.08%). A similar seasonal trend was observed in species richness, with the highest number of fish species recorded in summer (42 species, 89.36%), followed by the rainy season (36 species, 76.60%) and the winter season (31 species, 65.96%) (Figure 4).

The mean Shannon-Wiener diversity index (H') was 3.12. No significant differences were observed among the sampling stations ($p > 0.05$), with the highest value recorded at Station 1 (3.20), followed by Station 2 (3.19), Station 3 (3.07), and Station 4 (3.03) (Table 2). In contrast, H' varied significantly across seasons ($p < 0.05$), with the highest value recorded in the summer (3.33), followed by the rainy (3.13) and winter (2.89) seasons (Table 3). The mean species richness (R) was 4.46, with no significant differences among stations ($p > 0.05$). Station 1 exhibited the highest richness (4.85), followed by Station 2 (4.60), Station 3 (4.23), and Station 4 (4.15) (Table 2). However, seasonal variation in species richness was significant ($p < 0.05$), with the highest richness observed in summer (5.04), followed by the rainy (4.44) and winter (3.89) seasons (Table 3). The mean evenness index (E) was 0.87. No significant differences were found among stations or across seasons ($p > 0.05$). The highest evenness was recorded at Station 1 (0.90), followed by Station 2 (0.89), Station 3 (0.86), and Station 4 (0.84) (Table 2). Seasonally, evenness was highest in summer (0.89), followed by the rainy (0.87) and winter (0.84) seasons (Table 3).

Seasonal variations in physicochemical water parameters were observed throughout the study period (Table 4). Water temperature ranged from 24.21°C to 30.74°C, while transparency ranged from 34.50 to 57.25 cm. Total dissolved solids (TDS) ranged from 69.25 to 87.75 mg/L, pH values ranged from 7.34 to 7.89, and dissolved oxygen (DO) concentrations ranged from 4.67 to 6.24 mg/L. Regarding nutrients, ammonia (NH_3) ranged from 0.01 to 0.02 mg/L, nitrite (NO_2) ranged from 0.01 to 0.02 mg/L, and nitrate (NO_3) ranged from 0.05 to 0.06 mg/L. To examine the relationship between physicochemical parameters and fish faunal diversity in Wang Nong Reservoir, Nakhon Phanom Province, Thailand, Pearson's correlation coefficients were calculated (Table 5). Water temperature and dissolved oxygen were significantly positively correlated with H' , R , and E ($p < 0.01$), whereas transparency was negatively correlated with these indices. In contrast, TDS, pH, NH_3 , NO_2 , and NO_3 showed no significant correlations.

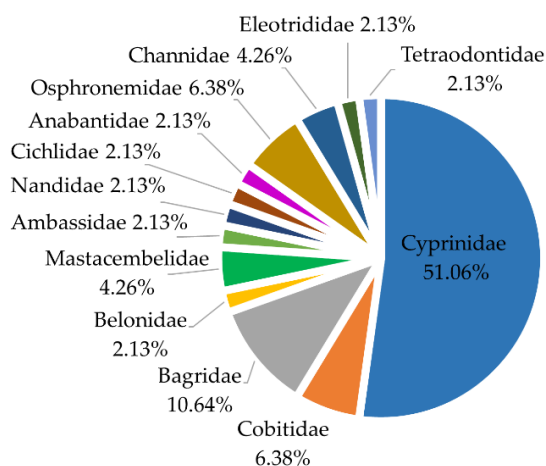


Figure 2. Composition of fish families in Wang Nong Reservoir, Nakhon Phanom Province, Thailand.

Table 1. List of fish species found at each station and season in Wang Nong Reservoir, Nakhon Phanom Province, Thailand (January-December 2024).

No.	Scientific name	Station				Season			Percentage (%)	IUCN status
		S1	S2	S3	S4	S	R	W		
Family Notopteridae										
1	<i>Notopterus notopterus</i>	+	+	+		+	+	+	0.59	LC
Family Cyprinidae										
2	<i>Parachela oxygastroides</i>	+	+	+		+	+		0.58	LC
3	<i>Parachela siamensis</i>	+	+	+		+	+		0.63	LC
4	<i>Esomus metallicus</i>	+	+	+	+	+	+	+	11.35	LC
5	<i>Rasbora borapetensis</i>	+	+	+	+	+	+	+	17.36	LC
6	<i>Rasbora aurotaenia</i>			+	+	+	+		2.66	LC
7	<i>Rasbora trilineata</i>	+		+	+	+			1.52	LC
8	<i>Thynnichthys thynnoides</i>	+	+	+	+	+	+	+	5.57	LC
9	<i>Puntioplites proctozystron</i>	+	+		+	+	+	+	3.54	LC
10	<i>Scaphognathops bandanensis</i>	+	+	+		+	+	+	1.02	VU
11	<i>Barbonymus altus</i>	+	+	+	+	+	+	+	2.25	LC
12	<i>Barbonymus schwanenfeldii</i>	+	+	+	+	+	+	+	1.56	LC
13	<i>Barbonymus gonionotus</i>	+		+	+	+	+	+	3.23	LC
14	<i>Hampala dispar</i>		+	+	+	+	+	+	1.62	LC
15	<i>Puntius brevis</i>	+	+	+	+	+	+	+	4.46	LC
16	<i>Puntigrus partipentazona</i>	+	+	+			+	+	2.72	LC
17	<i>Cyclocheilichthys enoplos</i>		+	+	+	+	+	+	1.02	LC
18	<i>Cyclocheilichthys repasson</i>	+	+	+	+	+	+	+	4.77	LC
19	<i>Labiobarbus siamensis</i>	+	+			+	+	+	3.05	LC
20	<i>Osteochilus vittatus</i>	+	+			+	+	+	1.24	LC
21	<i>Osteochilus lini</i>	+	+			+	+	+	0.95	LC
22	<i>Osteochilus microcephalus</i>	+				+	+		1.10	LC
23	<i>Osteochilus melanopleura</i>	+	+				+	+	0.43	LC
24	<i>Henicorhynchus siamensis</i>	+	+		+	+	+		1.72	LC
25	<i>Henicorhynchus ornatipinnis</i>	+			+	+	+		1.39	LC
Family Cobitidae										
26	<i>Acantopsis dinema</i>			+	+	+			1.53	LC
27	<i>Syncrossus helodes</i>	+					+	+	0.47	LC
28	<i>Yasuhikotakia modesta</i>	+					+	+	0.51	LC
Family Bagridae										
29	<i>Pseudomystus siamensis</i>	+				+		+	0.08	LC
30	<i>Mystus bocourti</i>	+	+			+		+	0.89	VU
31	<i>Mystus atrifasciatus</i>		+		+	+	+		0.58	LC
32	<i>Mystus mysticetus</i>		+		+	+	+		0.69	LC
33	<i>Hemibagrus filamentus</i>			+	+		+		0.53	DD
Family Belonidae										
34	<i>Xenentodon cancila</i>			+	+	+	+	+	0.98	LC
Family Mastacembelidae										
35	<i>Macrognathus siamensis</i>	+	+			+			1.06	LC
36	<i>Mastacembelus armatus</i>	+				+		+	0.11	LC
Family Ambassidae										
37	<i>Parambassis siamensis</i>	+	+	+		+	+	+	2.91	LC
Family Nandidae										
38	<i>Pristolepis fasciata</i>		+		+	+	+	+	1.13	LC

Table 1. List of fish species found at each station and season in Wang Nong Reservoir, Nakhon Phanom Province, Thailand (January-December 2024) (cont.).

No.	Scientific name	Station				Season			Percentage (%)	IUCN status
		S1	S2	S3	S4	S	R	W		
Family Cichlidae										
39	<i>Oreochromis niloticus</i>	+	+	+	+	+	+	+	1.57	LC
Family Anabantidae										
40	<i>Anabas testudineus</i>	+	+	+	+	+	+	+	2.29	LC
Family Osphronemidae										
41	<i>Trichopodus microlepis</i>	+	+	+	+	+			1.62	LC
42	<i>Trichopodus trichopterus</i>	+	+	+	+	+			2.23	LC
43	<i>Trichopsis vittata</i>	+	+	+	+	+			1.46	LC
Family Channidae										
44	<i>Channa striata</i>	+	+	+	+	+	+	+	1.59	LC
45	<i>Channa micropeltes</i>			+	+	+		+	0.59	LC
Family Eleotrididae										
46	<i>Oxyeleotris marmorata</i>			+	+	+	+		0.65	LC
Family Tetraodontidae										
47	<i>Pao barbatus</i>	+		+	+	+		+	0.18	LC
Total		36	34	31	30	42	36	31	100	

Note: S1-S4 = Sampling stations for fish collection; Season abbreviations: S = Summer, R = Rainy, W = Winter; IUCN Red List categories: DD = Data Deficient, LC = Least Concern, VU = Vulnerable.

Table 2. Diversity index, species richness index, and evenness index of the fish community by station in Wang Nong Reservoir.

Parameters	S1	S2	S3	S4	Mean
Shannon-Wiener diversity index (H')	3.20	3.19	3.07	3.03	3.12
Species richness index (R)	4.85	4.60	4.23	4.15	4.46
Evenness index (E)	0.90	0.89	0.86	0.84	0.87

Note: Means in the same row are not significantly different among stations ($p > 0.05$).

Table 3. Diversity index, species richness index, and evenness index of the fish community by season in Wang Nong Reservoir.

Parameters	Summer	Rainy	Winter	Mean
Shannon-Wiener diversity index (H')	3.33 ^a	3.13 ^{ab}	2.89 ^b	3.12
Species richness index (R)	5.04 ^a	4.44 ^{ab}	3.89 ^b	4.46
Evenness index (E)	0.89	0.87	0.84	0.87

Note: Means in a row with different superscript letters are significantly different ($p < 0.05$).

Table 4. Seasonal variations of physicochemical water parameters in Wang Nong Reservoir.

Parameters	Summer	Rainy	Winter	Range
Temperature (°C)	30.74	28.52	24.21	24.21-30.74
Transparency (cm)	44.00	34.50	57.25	34.50-57.25
Total dissolved solids (TDS, mg/L)	76.50	87.75	69.25	69.25-87.75
pH	7.89	7.34	7.52	7.34-7.89
Dissolved oxygen (DO, mg/L)	5.78	6.24	4.67	4.67-6.24
Ammonia (NH ₃ , mg/L)	0.01	0.02	0.02	0.01-0.02
Nitrite (NO ₂ , mg/L)	0.01	0.01	0.02	0.01-0.02
Nitrate (NO ₃ , mg/L)	0.05	0.06	0.05	0.05-0.06

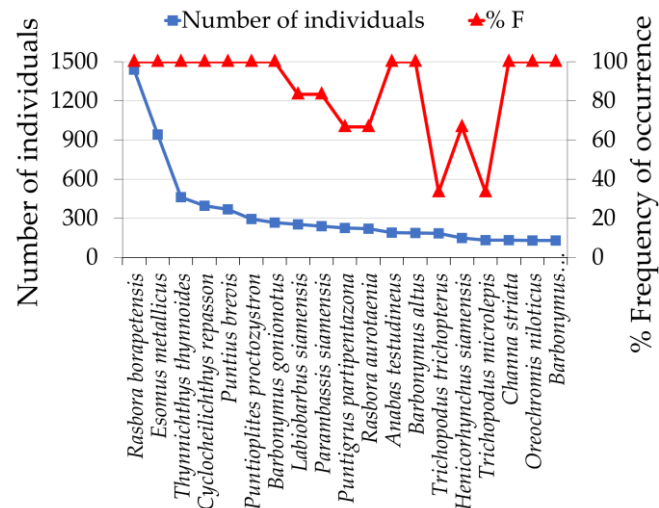


Figure 3. Number of individuals and frequency of occurrence (%F) of fish species in Wang Nong Reservoir, Nakhon Phanom Province, Thailand.

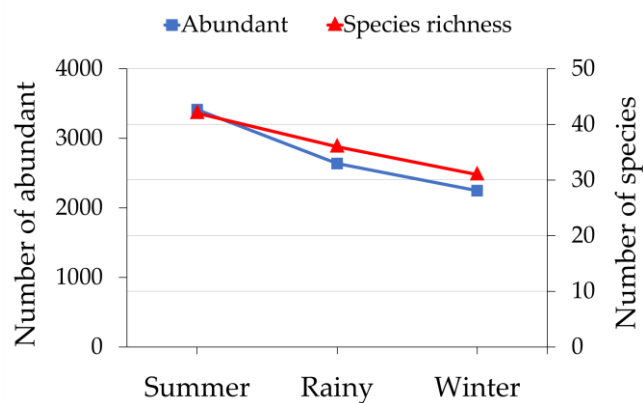


Figure 4. Fish abundance and species richness in Wang Nong Reservoir, Nakhon Phanom Province, Thailand.

Table 5. Pearson's correlation coefficients between physicochemical parameters and diversity index, species richness index, and evenness index in Wang Nong Reservoir, Nakhon Phanom Province, Thailand.

Parameters	Shannon-Wiener diversity index (H')	Species richness index (R)	Evenness index (E)
Temperature (°C)	0.864**	0.950**	0.949**
Transparency (cm)	-0.820**	-0.840**	-0.800**
Total dissolved solids (TDS, mg/L)	0.439	0.392	0.507
pH	0.642	0.693	0.599
Dissolved oxygen (DO, mg/L)	0.740**	0.760**	0.730**
Ammonia (NH ₃ , mg/L)	-0.570	-0.590	-0.550
Nitrite (NO ₂ , mg/L)	-0.520	-0.540	-0.500
Nitrate (NO ₃ , mg/L)	0.440	0.460	0.420

Note: Pearson correlation coefficients were calculated using monthly data (n = 12). ** indicates significant correlations at $p < 0.01$.

3.2 Discussion

This study represents the first attempt to investigate the fish diversity and community structure of Wang Nong Reservoir. A total of 47 species from 14 families were recorded, with Cyprinidae being the dominant family (24 species, 51.06%). Due to the absence of previous studies in this reservoir, direct historical comparisons are unavailable. However, the results are comparable to those of other northeastern Thai reservoirs. For example, Bung Klua Reservoir in Roi Et Province was reported to have 53 species, including 26 Cyprinidae (49.06%) [6]. Ubolratana Reservoir in Khon Kaen Province contained 62 species, also with 26 Cyprinidae (41.93%) [7], while Lam Pao Reservoir in Kalasin Province harbored 57 species, with 26 Cyprinidae (45.61%) [8]. These reservoirs exhibited higher species richness than Wang Nong. Conversely, Nam Oun Reservoir in Sakon Nakhon Province had 44 species, including 18 Cyprinidae (40.90%) [9], while Huay Huat Reservoir, also in Sakon Nakhon, had only 23 species, of which 13 were Cyprinids (56.52%) [10]. In Maha Sarakham Province, Huai Kao Reservoir supported 22 species, dominated by 8 Cyprinids (36.36%) [11], indicating lower diversity than Wang Nong. Overall, fish diversity in Wang Nong Reservoir is moderate within the regional context, with Cyprinidae consistently dominating across sites. The high species diversity of Cyprinidae throughout Southeast Asia [17, 18, 24] and their adaptability to lentic habitats help explain their dominance in Thai reservoirs [25].

In this study, the most dominant species were small cyprinids, including *Rasbora borapetensis* (17.36%), *Esomus metallicus* (11.35%), *Thynnichthys thynnoides* (5.57%), *Cyclocheilichthys repasson* (4.77%), and *Puntius brevis* (4.46%). The dominance of small cyprinid species, particularly *Rasbora borapetensis* and *Esomus metallicus*, may be related to their ecological adaptability to reservoir environments. These species are small-bodied pelagic fishes that often form large schools and efficiently exploit planktonic food resources in open-water habitats. Their planktivorous feeding habits, rapid reproduction, and tolerance to a wide range of environmental conditions enable them to thrive in lentic or slow-flowing waters, which are typical characteristics of reservoir ecosystems [13, 18, 26]. Similarly, Panchan [9] reported *Puntius brevis* (31.70%), *C. repasson* (17.70%), *Parambassis siamensis* (16.00%), *Labiobarbus leptocheila* (8.59%), and *Pristolepis fasciata* (4.77%) as dominant species in Nam Oun Reservoir. Jutagate *et al.* [26] found that *Clupeichthys aesarnensis* (19.00%), *R. borapetensis* (10.60%), *Barbonymus gonionotus* (10.20%), *E. metallicus* (9.60%), and *Oreochromis niloticus* (4.20%) were the most abundant species in Sirindhorn Reservoir. In contrast, Khowhit *et al.* [11] reported *Hampala dispar* (28.72%), *Cyclocheilichthys armatus* (14.09%), *Henicorhynchus caudimaculatus* (10.38%), *Oxyeleotris marmorata* (7.69%), and *Notopterus notopterus* (7.13%) as dominant species in Huai Kao Reservoir. These differences in dominant species among reservoirs may reflect variations in topography, habitat complexity, water quality, food availability, and resource utilization [26–28].

The exotic species *O. niloticus* is native to Africa and was introduced to Thailand in the mid-20th century for aquaculture purposes. Following successful breeding, it was widely distributed by the Department of Fisheries and extensively used in aquaculture and reservoir stocking [29]. As a result, this species is now well established in natural aquatic ecosystems throughout Thailand [30]. In the present study, *O. niloticus* was the only non-native species recorded in Wang Nong Reservoir, consistent with several reservoir studies in northeastern Thailand where Nile tilapia is typically reported as the predominant non-native species [8–11]. The occurrence of additional non-native or translocated species in reservoir systems is context-dependent, influenced by environmental conditions, introduction history, and species-specific ecological traits. Species with broad environmental tolerance, opportunistic feeding strategies, and high reproductive capacity are more likely to establish and persist, and they may also form self-sustaining populations in lentic environments [31].

From a conservation perspective, the majority of fish species in Wang Nong Reservoir are classified as Least Concern (LC, 93.62%) according to the IUCN Red List, whereas two species, *Scaphognathops bandanensis* and *Mystus bocourti*, are categorized as Vulnerable (VU) [19]. These species are of particular concern, as they may be more sensitive to environmental changes and habitat disturbances. Potential threats include habitat alteration associated with water level regulation, reduced water quality, and fishing pressure, which are common stressors in managed reservoirs and may disproportionately affect vulnerable populations. In addition, seasonal water retention and fluctuations in water level in Wang Nong Reservoir may alter littoral and benthic habitats that are essential for feeding, shelter, and reproduction. Such changes could negatively

impact these species, particularly if suitable microhabitats are reduced or degraded. Therefore, targeted management actions are recommended to mitigate these pressures, including maintaining suitable water quality, minimizing abrupt water level fluctuations, protecting critical habitats, particularly structurally complex areas such as littoral vegetation and submerged substrates, and regulating fishing pressure on vulnerable species [32, 33].

The highest fish species diversity was observed at Station 1 (36 species, 76.60%), likely due to its upstream location and complex habitats, including riparian forests, submerged roots, deadwood, and aquatic vegetation. These features provide effective shelter, feeding grounds, and spawning sites. Deadwood plays crucial ecological roles by providing protection for small fish and serving as ambush spots for predators, while algae and microbial communities on woody surfaces act as important food sources [34–36]. In contrast, Station 4 exhibited the lowest species richness (30 species, 63.83%), likely due to its proximity to sluice gates and the limited availability of refuge and aquatic vegetation. Sluice gates can disrupt hydrological connectivity, degrade habitat quality, and impede fish migration, thereby contributing to reduced biodiversity [37, 38].

In the summer, fish abundance peaked (3,409 individuals, 41.10%) along with the highest species diversity (42 species, 89.36%). This pattern may reflect ecological conditions during the warmer period; however, it may also be influenced by sampling conditions. Lower water levels during the dry season can concentrate fish in smaller areas, potentially increasing their vulnerability to capture by gill nets and beach seines. Therefore, the higher abundance observed in summer should be interpreted with caution, as it may reflect increased catchability rather than a true increase in fish population size. In contrast, winter exhibited the lowest abundance (2,246 individuals, 27.08%) and species richness (31 species, 65.96%). During this period, water release is restricted from October to retain water for dry-season agriculture [1], resulting in higher water levels and lower temperatures (24.21°C). Reduced temperature may suppress fish metabolic activity and movement, potentially leading to lower catch rates and reduced species detection [39]. In addition, dissolved oxygen (DO) reached its seasonal minimum (4.67 mg/L), approaching hypoxic thresholds that may impose physiological stress on freshwater fishes [40, 41]. These conditions are likely associated with the observed decline in abundance and diversity during winter. Consistently, Pearson's correlation analysis indicated that water temperature and dissolved oxygen were significantly positively correlated with fish diversity indices (H' , R , and E ; $p < 0.01$), suggesting that these factors play an important role in shaping fish assemblages. In contrast, transparency showed a negative relationship with diversity indices, possibly reflecting increased turbidity and productivity that favor certain dominant species over a more even community structure. Other physicochemical parameters showed no significant correlations, likely because their values remained relatively stable within suitable ranges. These findings are consistent with previous studies highlighting the importance of temperature and dissolved oxygen as key factors influencing fish diversity in tropical freshwater systems [42, 43].

In this context, the relatively low frequency of occurrence observed for some species may be associated with species-specific habitat preferences, seasonal environmental variation, and differences in detectability. Species in the genera *Trichopodus*, *Mystus*, and *Hemibagrus* are typically associated with structurally complex habitats, such as vegetated littoral zones or deeper benthic areas. Their occurrence in the present study was therefore likely influenced by seasonal changes in water level, habitat availability, and water quality, which can affect their spatial distribution and local activity patterns. Although these species are not considered long-distance migrants, they may exhibit limited movement or localized habitat use, leading to temporal variation in their detectability across sampling periods. In addition to these ecological factors, the sampling gears used in this study exhibit inherent selectivity for fish size and habitat. Gill nets (2.0, 4.0, and 6.0 cm mesh) and a beach seine (0.5 × 0.5 cm mesh) may be less effective in capturing large-bodied species and fish inhabiting deeper or mid-water zones, and these groups may therefore be encountered less frequently in the samples. However, the use of gill nets with three mesh sizes, combined with a fine-mesh beach seine, represents a well-established and rigorous approach that enhances coverage across a wide range of fish size classes and habitats, providing a robust basis for assessing species composition and diversity in the reservoir [44, 45].

The Wang Nong Reservoir exhibited relatively high fish biodiversity, as indicated by the mean H' of 3.12, suggesting that the reservoir provides a favorable environment for aquatic life [46]. While no significant

differences were observed among sampling stations, clear seasonal variations were evident, with diversity peaking during the summer season, followed by the rainy and winter seasons, consistent with prior studies [39, 47]. R followed a similar seasonal trend, and the consistently high E across seasons [48] indicates a well-balanced species distribution within the community. Notably, these patterns provide novel insights into the temporal dynamics of fish communities in Wang Nong Reservoir, emphasizing the summer season as a period of peak ecological productivity. Integrating these findings with physicochemical parameters and potential anthropogenic impacts can inform evidence-based management and targeted conservation strategies. Ongoing ecological monitoring and proactive conservation measures are recommended to maintain this balance and mitigate potential threats from human activities, thereby safeguarding the integrity of this aquatic ecosystem.

4. Conclusions

This study confirmed that Wang Nong Reservoir supports a highly diverse fish community, identifying 47 species from 14 families, with Cyprinidae being the most abundant (24 species, 51.06%). The dominant species included *Rasbora borapetensis*, *Esomus metallicus*, *Thynnichthys thynnoides*, *Cyclocheilichthys repasson*, and *Puntius brevis*, with twelve species exhibiting 100% occurrence. Conservation assessment revealed two vulnerable species, *Scaphognathops bandanensis* and *Mystus bocourti*. Fish abundance and species richness were higher in summer than in winter. The mean Shannon-Wiener diversity (H'), richness (R), and evenness (E) indices were 3.12, 4.46, and 0.87, respectively, indicating a well-balanced and diverse fish community. Water temperature and dissolved oxygen showed significant positive correlations with fish diversity indices (H' , R , and E ; $p < 0.01$), whereas transparency was negatively associated with these indices, highlighting the importance of key environmental drivers in shaping fish assemblages. These findings fill a critical knowledge gap in inland fisheries ecology in northeastern Thailand by providing the first baseline dataset for this reservoir. The results provide a scientific foundation for site-specific conservation planning, water-level management, and evidence-based fisheries management to maintain fish diversity and ecosystem sustainability. Future research should investigate long-term seasonal variations, habitat quality, and anthropogenic impacts to further inform sustainable management strategies and conservation planning in the region.

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References

- [1] Water Crisis Prevention Center (WCPC). *Criteria for Management of Medium Sized Reservoirs*; Department of Water Resources: Bangkok, Thailand, 2022.
- [2] Hayes, N. M.; Deemer, B. R.; Corman, J. R.; Razavi, N. R.; Strock, K. E. Key differences between lakes and reservoirs modify climate signals: A case for a new conceptual model. *Limnol. Oceanogr. Lett.* **2017**, *2*, 47–62. <https://doi.org/10.1002/lol2.10036>
- [3] Abobi, S. M.; Kluger, L. C.; Wolff, M. Comparative assessment of food web structure and fisheries productivity of three reservoirs in Ghana. *Fish. Manag. Ecol.* **2021**, *28*, 573–591. <https://doi.org/10.1111/fme.12506>

- [4] Sarkar, U. K.; Sandhya, K. M.; Mishal, P.; Karnatak, G.; Lianthuamluaia; Kumari, S.; Das, B. K. Status, prospects, threats, and the way forward for sustainable management and enhancement of the tropical Indian reservoir fisheries: An overview. *Rev. Fish. Sci. Aquac.* **2018**, *26*, 155–175.
- [5] Sricharoendham, B.; Leelapatra, W.; Ratanachamnong, D.; Kaewjaroon, P.; Aimsab, M. *Variation on Fish Community and Catch of Sirindhorn Reservoir, Ubon Ratchathani Province*; Technical Paper No. 206; National Inland Fisheries Institute, Department of Fisheries: Thailand, **2000**.
- [6] Jantharachit, P.; Sanitchon, A.; Chunchom, C.; Jaengkij, M.; Phomisawat, R. *Water Quality and Fish Community in Bung Klua Reservoir, Roi Et Province*; Technical Paper No. 14; National Inland Fisheries Institute, Department of Fisheries: Thailand, **2006**.
- [7] Nachaipherm, J.; Musikaew, B. *Structure and Distribution of Fish Community in Ubolratana Reservoir*; Technical Paper No. 59; National Inland Fisheries Institute, Department of Fisheries: Thailand, **2006**.
- [8] Nachaipherm, J.; Chunchom, C. *Fish Community Distribution and Gillnet Efficiency in Lam Pao Reservoir*; Technical Paper No. 84; National Inland Fisheries Institute, Department of Fisheries: Thailand, **2008**.
- [9] Panchan, R. Fish assemblage patterns in littoral zone of Nam Oun Reservoir, Sakon Nakhon Province, Thailand. *J. Fish. Environ.* **2010**, *34*, 27–39.
- [10] Rayan, S.; Rungsiwiwat, A.; Chartchumni, B.; Rayan, W. Structure of fish community in Huay Huat Reservoir, Sakon Nakhon Province. *Burapha Sci. J.* **2017**, *34*, 340–352.
- [11] Khowhit, S.; Tanee, T.; Khowhit, D. Species diversity and distribution of fish in Huai Kao Reservoir, Na Chauk District, Maha Sarakham Province, Thailand. *J. Surv. Fish. Sci.* **2023**, *10*, 2363–2377. <https://doi.org/10.53555/sfs.v10i1.214>
- [12] Smith, H. M. *The Freshwater Fishes of Siam, or Thailand*; Bulletin of the United States National Museum, No. 188; Smithsonian Institution: Washington, DC, **1945**.
- [13] Rainboth, W. J. *FAO Species Identification Field Guide for Fishery Purposes: Fishes of the Cambodian Mekong*; FAO: Rome, Italy, **1996**.
- [14] Doi, A. A review of taxonomic studies of cypriniform fishes in Southeast Asia. *Jpn. J. Ichthyol.* **1997**, *44*, 1–33. <https://doi.org/10.11369/jji1950.44.1>
- [15] Kottelat, M. *Fishes of Laos*; WHT Publications: Colombo, Sri Lanka, **2001**.
- [16] Vidthayanon, C. *Field Guide to Fishes of the Mekong Delta*; Mekong River Commission: Vientiane, Lao PDR, **2008**.
- [17] Nelson, J. S.; Grande, T. C.; Wilson, M. V. H. *Fishes of the World*, 5th ed.; John Wiley & Sons: New Jersey, USA, **2016**.
- [18] Taki, Y.; Ohtsuka, R.; Komodo, M.; Natori, Y.; Utsugi, K.; Shibukawa, K.; Tran, L. X. *Fishes of the Indochinese Mekong*; Nagao Natural Environment Foundation: Tokyo, Japan, **2021**.
- [19] International Union for Conservation of Nature (IUCN). *The IUCN Red List of Threatened Species*; **2025**. <https://www.iucnredlist.org> (accessed May 16, 2025).
- [20] American Public Health Association (APHA); American Water Works Association (AWWA); Water Environment Federation (WEF). *Standard Methods for the Examination of Water and Wastewater*, 21st ed.; APHA: Washington, DC, **1998**.
- [21] Shannon, C. E.; Wiener, W. *The Mathematical Theory of Communication*; University of Illinois Press: Urbana, USA, **1963**.
- [22] Margalef, R. Information theory in ecology. *Gen. Syst.* **1958**, *3*, 36–71.
- [23] Pielou, E. C. *Mathematical Ecology*; Wiley: New York, USA, **1977**.
- [24] Berra, T. M. *Freshwater Fish Distribution*; Academic Press: California, USA, **2001**.
- [25] Jutagate, T.; Srichareondham, B.; Lek, S.; Amarasinghe, U. S.; De Silva, S. S. Variations, trends and patterns of fish landings in large tropical reservoirs. *Lakes Reserv.: Res. Manag.* **2012**, *17*, 35–53.
- [26] Jutagate, T.; Rattanachai, A.; Udduang, S.; Lek-Ang, S.; Lek, S. Spatio-temporal variations in abundance and assemblage patterns of fish larvae and their relationships to environmental variables in Sirindhron Reservoir of the Lower Mekong Basin, Thailand. *Indian J. Fish.* **2016**, *63*, 11–23.
- [27] Mishra, A.; Chakraborty, S. K.; Jaiswar, A. K.; Sharma, A. P. Comparative biodiversity of two medium reservoirs of North India. *Natl. Acad. Sci. Lett.* **2014**, *37*, 423–430.

- [28] Zare-Shahraki, M.; Ebrahimi-Dorche, E.; Bruder, A.; Flotemersch, J.; Blocksom, K.; Bănăduc, D. Fish species composition, distribution and community structure in relation to environmental variation in a semi-arid mountainous river basin, Iran. *Water* **2022**, *14*, 2226. <https://doi.org/10.3390/w14142226>
- [29] Welcomme, R.; Vidthayanon, C. *The Impacts of Introductions and Stocking of Exotic Species in the Mekong Basin and Policies for Their Control*; MRC Technical Paper No. 9; Mekong River Commission: Cambodia, **2003**.
- [30] Yakupitiyage, A.; Bhujel, R. C. Role of exotic species in aquaculture: Problems and prospects in Indochina. In *International Mechanisms for the Control and Responsible Use of Alien Species in Aquaculture Ecosystems*; Bartley, D. M.; Bhujel, R. C.; Funge-Smith, S.; Olin, P. G.; Phillips, M. J., Eds.; FAO: Rome, **2005**.
- [31] Copp, G. H.; Fox, M. G. Can invasiveness in freshwater fishes be predicted from life-history traits? *Front. Ecol. Evol.* **2020**, *8*, 605287.
- [32] Bunn, S. E.; Arthington, A. H. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. *Environ. Manage.* **2002**, *30*, 492–507.
- [33] Arthington, A. H.; Bunn, S. E.; Poff, N. L.; Naiman, R. J. The challenge of providing environmental flow rules to sustain river ecosystems. *Ecol. Appl.* **2006**, *16*, 1311–1318.
- [34] Dolloff, C. A.; Warren, M. L., Jr. Fish relationships with large wood in small streams. *Am. Fish. Soc. Symp.* **2003**, *37*, 179–193.
- [35] Maday, A.; Matern, S.; Monk, C. T.; Klefoth, T.; Wolter, C.; Arlinghaus, R. Seasonal and diurnal patterns of littoral microhabitat use by fish in gravel pit lakes, with special reference to supplemented deadwood brush piles. *Hydrobiologia* **2023**, *850*, 1557–1581. <https://doi.org/10.1007/s10750-023-05152-3>
- [36] Pechsiri, J.; Chainapong, T.; Yooyen, T.; Manksang, N. The restoration of freshwater fish in the Papayom Canal by community participation. *ASEAN J. Sci. Technol. Rep.* **2018**, *21*, 59–68.
- [37] Seifert, R. E.; Moore, J. W. Floodgate operations and fish communities in tidal creeks of the Lower Fraser River (British Columbia, Canada). *Estuaries Coasts* **2018**, *41*, 1206–1221. <https://doi.org/10.1007/s12237-017-0313-3>
- [38] Bouchard, C.; Boutron, O.; Lambremon, J.; Drouineau, H.; Lambert, P.; Nicolas, D. Impacts of environmental conditions and management of sluice gates on glass eel migration. *Estuar. Coast. Shelf Sci.* **2022**, *279*, 108139. <https://doi.org/10.1016/j.ecss.2022.108139>
- [39] Shuter, B. J.; Finstad, A. G.; Helland, I. P.; Zweimüller, I.; Hölker, F. The role of winter phenology in shaping the ecology of freshwater fish and their sensitivities to climate change. *Aquat. Sci.* **2012**, *74*, 637–657. <https://doi.org/10.1007/s00027-012-0274-3>
- [40] Patel, P. A study on the relationship between water quality parameters and fish diversity in freshwater bodies in Chhattisgarh, Central India. *Asian J. Res. Biosci.* **2025**, *7*, 86–98. <https://doi.org/10.56557/ajorib/2025/v7i1113>
- [41] Setyono, P.; Himawan, W. Analyses of bioindicators and physicochemical parameters of water of Lake Tondano, North Sulawesi Province, Indonesia. *Biodiversitas* **2018**, *19*, 867–874. <https://doi.org/10.13057/biodiv/d190315>
- [42] Bayemi, O. E.; Komolafe, O. O.; Ayodeji, O. A.; Ajayi, O.; Adewumi, P. O.; Adeniran, I. I.; Oladimeji, T. K. Assessment of climatic and environmental parameters on fish abundance of an Afro-tropical reservoir. *Sci. Rep.* **2024**, *14*, 23991. <https://doi.org/10.1038/s41598-024-75181-y>
- [43] Alam, A.; Kumar, J.; Sarkar, U. K.; Jha, D. N.; Sahu, S. K.; Sukla Das, S. C.; Das, B. K. Linking ecological characteristics with fish diversity, assemblage patterns and feeding guilds, and GIS applications along temporal and spatial gradients in a large subtropical reservoir, India, for sustainable management. *J. Water Clim. Change* **2024**, *15*, 607–627. <https://doi.org/10.2166/wcc.2023.513>
- [44] Fischer, J. R.; Quist, M. C. Gear and seasonal bias associated with abundance and size structure estimates for lentic freshwater fishes. *J. Fish Wildl. Manag.* **2014**, *5*, 394–412.
- [45] Mehdi, H.; Lau, S. C.; Synyshyn, C.; Salena, M. G.; Morphet, M. E.; Hamilton, J.; Balshine, S. A comparison of passive and active gear in fish community assessments in summer versus winter. *Fish. Res.* **2021**, *242*, 106016.

-
- [46] Magurran, A. E.; McGill, B. J. *Biological Diversity: Frontiers in Measurement and Assessment*; Oxford University Press: New York, USA, **2011**.
 - [47] Shengchun, Z.; Zhiqiang, W.; Liangliang, H.; Wenli, F.; Ruidan, S.; Yang, D.; Xianzhi, C. Species composition and diversity of fish in Qingshitan Reservoir in Guilin, Guangxi. *South China Fish. Sci.* **2017**, *13*, 36–42. <https://doi.org/10.3969/j.issn.2095-0780.2017.02.005>
 - [48] Das, S. K.; Srinivasan, N. T.; Sarang, N.; Das, S. K.; Jawahar, A. T.; Canciyal, J.; Panda, K. Effect of environmental drivers on fish assemblage and diversity patterns in temporal scale in Mongra Reservoir. *Ecohydrology* **2023**, *16*, e2599. <https://doi.org/10.1002/eco.2599>