

## SPECIES COMPOSITION AND DISTRIBUTION OF FISH IN NAM XUAN LAC SPECIES AND HABITAT CONSERVATION AREA, BAC KAN PROVINCE

Ta Thi Thuy<sup>1,\*</sup>, Duong Thi Huyen<sup>2</sup>, Dang Thi Thanh Huong<sup>2</sup>,  
Nguyen Quang Huy<sup>2</sup> and Nguyen Tran Ngoc Mai<sup>2</sup>

<sup>1</sup>Faculty of Education, Hanoi Metropolitan University, Hanoi city, Vietnam

<sup>2</sup>Faculty of Biology, Hanoi National University of Education, Hanoi city, Vietnam

\*Corresponding author: Ta Thi Thuy, e-mail: [tthuy@daihocthudo.edu.vn](mailto:tthuy@daihocthudo.edu.vn)

Received February 1, 2024. Revised March 21, 2024. Accepted March 28, 2024.

**Abstract.** Nam Xuan Lac Species and Habitat Conservation Area has high biodiversity potential with many precious, rare, and endangered plant and animal species. However, the diversity of fish species in this reserve area has been limited information until now. In order to provide information on the species composition and distribution of fishes in the study site, two surveys were conducted in July and December 2021 at 11 stations (altitude from 118 m to 760 m) of the Lo and Thai Binh river basins. Based on morphological characteristics, this study reported the first list of species composition of the Nature Reserve, with 22 species from 20 genera, 16 families, and 7 orders. Of which, Cypriniformes was the most diverse order, consisting of 6 families, 10 genera and 11 species, and Cyprinidae was the most dominant family (3 genera, 4 species). Besides, the present study also updated and added two new records for the Red River ichthyofauna, two species listed in the IUCN Red List and three species in the Government's Decree 26/2019/NĐ-CP. Of the 22 species collected, *Neolissochilus benasi* has the widest distribution range in the study area. The number of species collected at sampling sites ranged from 2 to 17 species. The present results are important data for the exploitation, conservation, and sustainable development of local fish resources.

**Keywords:** fish diversity, Lo River, nature reserve, northern Vietnam, Thai Binh River.

### 1. Introduction

Nam Xuan Lac Species and Habitat Conservation Area (SHCA) was established under Decision No. 342/QĐ-UB, issued on March 17<sup>th</sup>, 2004 by the People's Committee of Bac Kan province. It has a total natural area of 1,788 hectares located in two villages, Na Da and Ban Khang. It belongs to Xuan Lac commune, Cho Don district, Bac Kan province. This area is considered an important corridor connecting Ba Be National Park,

Bac Kan province, and Na Hang Nature Reserve, Tuyen Quang province. Also, it possesses a large area of abundant specialized forests and diverse ecosystems, typical of forests on limestone mountains, humid tropical and subtropical broad-leaved trees in northern Vietnam [1], and impressive natural scenery, that creates a suitable area with diverse habitats and water bodies for many rare on animal and plant species which listed in the Vietnam Red Data Book and IUCN Red List.

The waterbody system of Nam Xuan Lac SHCA belongs to the Lo and Thai Binh river basins. In detail, the Lo River is a first-level tributary on the left bank of the Red River, originating from Yunnan province, China. Thai Binh River (upstream of the Cau River basin) originates from Phia Booc peak (Bac Kan province) along with the Red River system. These are the two main river systems of the northern delta. Due to the diversity of terrain and bodies of water, many new records or new species for science have been discovered in northern Vietnam, such as *Euchiloglanis nami* [2], or species with diversity in morphological characteristics compared to previously recorded species: *Pareuchiloglanis* sp. [3] or *Parazacco* sp. [4]. Until now, some information about ichthyofauna in the two river basins has been carried out. For instance, several works have been conducted by Nguyen Huu Duc et al. in the Gam and Lo river basins [5], the Thai Binh river basin by Phung Thi Tuyen [6], or in the Gam River in Bac Me Nature Reserve [7]. In contrast, there has been no research on the fish fauna in the two river basins within the territory of the Nam Xuan Lac SHCA.

Therefore, this article publishes the first list of fish species in Nam Xuan Lac SHCA to provide more biodiversity data on this animal group in the river basins of northern Vietnam. The results of this study will provide important data for the conservation and sustainable development of fish resources in the study area.

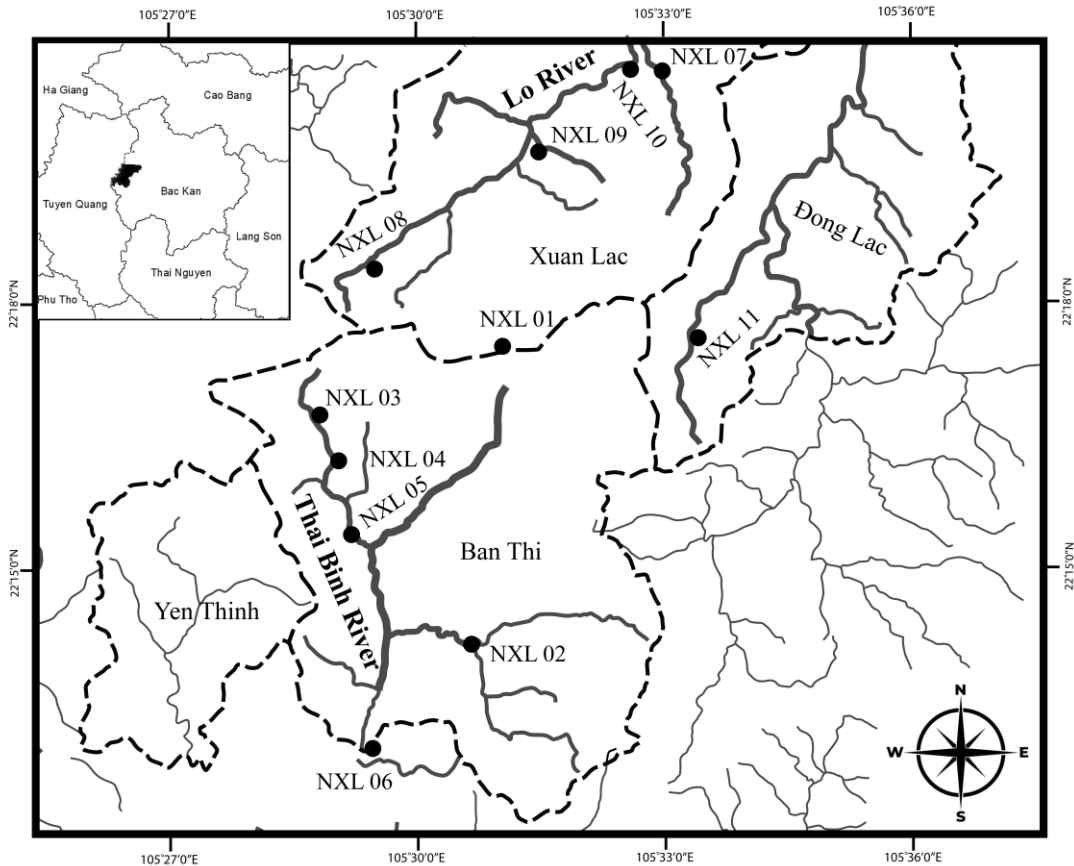
## **2. Content**

### **2.1. Materials and methods**

Specimens were collected from two surveys from July 23<sup>rd</sup> to 30<sup>th</sup>, and from November 5<sup>th</sup> to 12<sup>th</sup>, 2021 at 11 sampling sites from NXL.01 to NXL.11 in Nam Xuan Lac SHCA, Bac Kan province (Figure 1). In particular, NXL.07 to NXL.11 belong to the Lo river basin (a tributary of the Red River) and the other stations belong to the Thai Binh river basin (Figure 1).

Specimens were collected using casting nets, and hand nets, and fixed in 10% formalin solution in the field. After that, samples were transferred to 70% ethanol, and stored at the laboratory of the Department of Zoology, Faculty of Biology, Ha Noi National University of Education.

Specimens were analyzed and identified based on external morphological characteristics according to the following main documents: Chen et al. [8], Yue et al. [9], Kottelat [10], [11], Nguyen Van Hao and Ngo Sy Van [12], Nguyen Van Hao [13], [14], Kottelat [15]. The endangered status of fish was determined based on the Vietnam Red Data Book [16], IUCN Red List [17], and Decree No. 26/2019/NĐ-CP [18]. Scientific names of taxonomic levels and organizations of orders and families followed Fricke et al. [19].



**Figure 1. Map of sampling sites where fish were collected in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province**

## 2.2. Results and discussion

### 2.2.1. Species composition

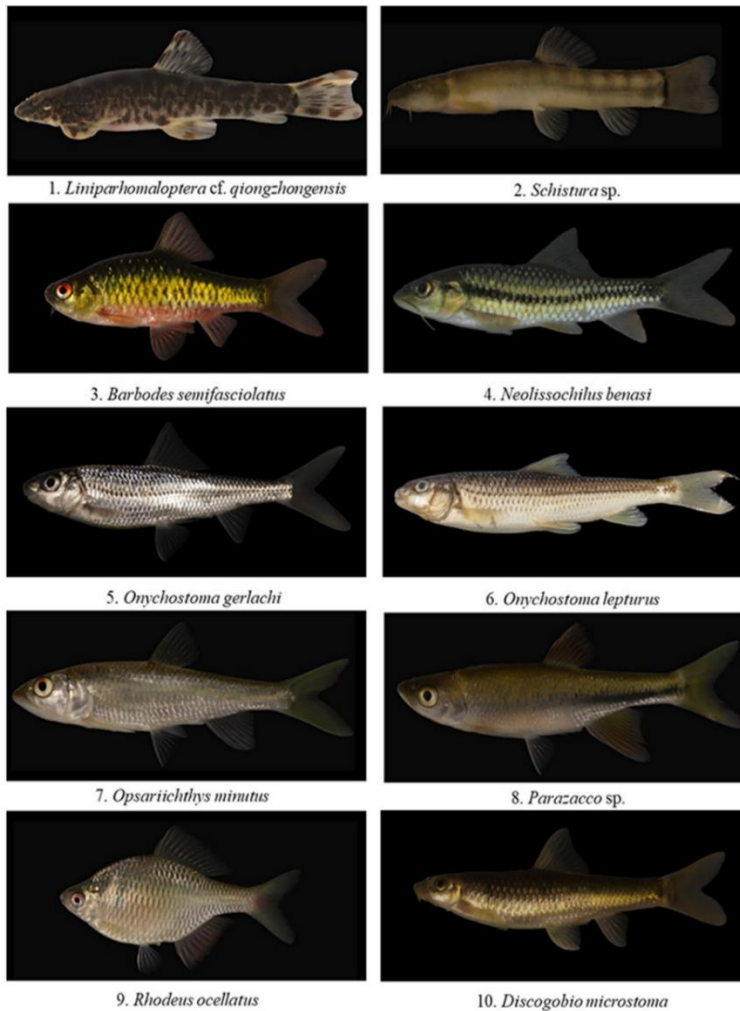
The list of fish species composition of Nam Xuan Lac SHCA is presented in Table 1 and Figure 2. Based on 783 specimens collected, this study has identified 22 species belonging to 20 genera, 16 families, and 7 orders. This is the first list of fish species composition of Nam Xuan Lac SHCA, Bac Kan province. Compared to the study of Nguyen Huu Duc et al. [5], the present study has updated and added two species that are new records for the ichthyofauna in the Red River basin system, i.e., *Opsariichthys minutus* and *Rhinogobius lineatus*. Moreover, there are more than 6 unidentified species since they have differences in morphological characteristics compared to previous descriptions [8], [12], [14]. They are *Liniparhomaloptera* cf. *qionghongensis*, *Schistura* sp., *Parazacco* sp., *Placogobio* sp., *Rhinogobius* sp. The two types, *Liniparhomaloptera* cf. *qionghongensis* and *Schistura* sp. were also recorded by Ta Thi Thuy et al., who investigated the ichthyofauna in Bac Me Nature Reserve [7]. Consequently, expanding investigation and research is necessary to have a full database of morphology and molecular biology to clarify the taxonomy of these fish species.

**Table 1. List of fish species composition in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province**

No.	Scientific name	Number of specimens	
		Trip 1	Trip 2
	<b>I. Cypriniformes</b>		
	<b>1. Gastromyzontidae</b>		
1	<i>Liniparhomaloptera</i> cf. <i>qiongzhongensis</i> Zheng & Chen, 1980	33	27
	<b>2. Nemacheilidae</b>		
2	<i>Schistura</i> sp.	82	94
	<b>3. Cyprinidae</b>		
3	<i>Barbodes semifasciolatus</i> (Günther, 1868)	48	11
4	<i>Neolissochilus benasi</i> (Pellegrin & Chevey, 1936) <sup>I</sup>	19	12
5	<i>Onychostoma gerlachi</i> (Peters, 1881) <sup>NT, II</sup>	18	1
6	<i>Onychostoma lepturus</i> (Boulenger, 1900)	5	
	<b>4. Xenocyprididae</b>		
7	<i>Opsariichthys minutus</i> Nichols, 1926	17	25
8	<i>Parazacco</i> sp.	14	9
	<b>5. Acheilognathidae</b>		
9	<i>Rhodeus ocellatus</i> (Kner, 1866)	2	
	<b>6. Gobionidae</b>		
10	<i>Discogobio microstoma</i> (Mai, 1978)	3	10
11	<i>Placogobio</i> sp.	40	18
	<b>II. Siluriformes</b>		
	<b>1. Bagridae</b>		
12	<i>Hemibagrus pluriradiatus</i> (Vaillant, 1892) <sup>II</sup>	1	
	<b>2. Sisoridae</b>		
13	<i>Glyptothorax honghensis</i> Li, 1984	11	5
	<b>3. Clariidae</b>		
14	<i>Clarias fuscus</i> (Lacepède, 1803)		1
	<b>III. Gobiiformes</b>		
	<b>1. Gobiidae</b>		
15	<i>Rhinogobius lineatus</i> Chen, Kottelat & Miller, 1999 <sub>EN</sub>	3	3
16	<i>Rhinogobius</i> sp.	64	84
	<b>IV. Synbranchiformes</b>		
	<b>1. Mastacembelidae</b>		
17	<i>Mastacembelus armatus</i> (Lacepède, 1800)	9	2
	<b>2. Synbranchidae</b>		
18	<i>Monopterus albus</i> Zuiew, 1793		1
	<b>V. Anabantiformes</b>		
	<b>1. Osphronemidae</b>		

19	<i>Macropodus opercularis</i> (Linnaeus, 1758)	23	1
	<b>2. Channidae</b>		
20	<i>Channa gachua</i> (Hamilton, 1822)	1	
	<b>VI. Cichliformes</b>		
	<b>1. Cichlidae</b>		
21	<i>Oreochromis niloticus</i> (Linnaeus, 1758)		8
	<b>VII. Cyprinodontiformes</b>		
	<b>1. Poeciliidae</b>		
22	<i>Gambusia affinis</i> (Baird & Girard, 1853)	78	
	<b>Total specimens</b>	<b>471</b>	<b>312</b>
	<b>Total species</b>	<b>20</b>	<b>18</b>

\* Note: EN: Endangered, NT: Near Threatened in the IUCN Red List [17], I: Group I, II: Group II, in Appendix II - List of endangered, precious, and rare aquatic species according to Decree No. 26/2019/ND-CP [18].



**Figure 2. Photos of fish collected in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province in 2021**



11. *Placogobio* sp.



12. *Hemibagrus pluriradiatus*



13. *Glyptothorax honghensis*



14. *Clarias fucus*



15. *Rhinogobius lineatus*



16. *Rhinogobius* sp.



17. *Mastacembelus armatus*



18. *Monopterus albus*



19. *Macropodus opercularis*



20. *Channa gachua*



21. *Oreochromis niloticus*



22. *Gambusia affinis*

**Figure 3. Photos of fish collected in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province in 2021 (Continued)**

Among the 7 orders, Cypriniformes was the most diverse in the number of families, genera, and species (accounting for 37.50%, 50.00%, and 50.00%, respectively) (Table 2). The next diverse order was Siluriformes, followed by Synbranchiformes and Anabantiformes. Gobiiformes had one family, one genus, and two species, accounting for 6.25%, 5.0%, and 9.09%, respectively. The least diverse orders were Cichliformes and Cyprinodontiformes, which had one family, one genus, and one species (Table 2).

Of the 16 families, Cyprinidae was the most dominant, including 3 genera and 5 species, followed by Xenocyprididae and Gobionidae (two genera and two species). The Gobiidae family had one genus and two species. The remaining families consist of one genus and one species (Table 3). Among the 20 genera, *Onychostoma* and *Rhinogobius* had two species (accounting for 9.09%), and the remaining genera had only 1 species for each (accounting for 4.55%) (Table 1).

The species composition structure of fish in the present study is similar to that in Bac Me Nature Reserve reported by Ta Thi Thuy et al. [7] since Cypriniformes, Cyprinidae, and *Onychostoma* are the most diverse taxa in the two mountainous areas in northern Vietnam. The most diverse order (Cypriniformes) is also observed by Nguyen Huu Duc et al. [5], who reviewed the fish diversity in the Red River system. The number of species in Nam Xuan Lac SHCA, Bac Kan province is less diverse than that in Bac me Nature Reserve when the study effort was similar, e.g., two field trip surveys, days for field trips, and sample collection methods. A possible reason for this differentiation is that the habitats are more diverse in Bac Me Nature Reserve than those in Nam Xuan Lac SHCA (Ta Thi Thuy et al. [7], Table 4). Also, the altitudes of sampling sites in Bac Me Nature Reserve were generally lower than those in the present study, which seem suitable for species of Xenocyprididae and Gobionidae (7 vs. 1 and 5 vs. 2) (Ta Thi Thuy et al. [7], Table 1).

**Table 2. Proportion of species composition structure according to orders in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province**

No.	Order	Family	%	Genus	%	Species	%
1	Cypriniformes	6	37.50	10	50.00	11	50.00
2	Siluriformes	3	18.75	3	15.00	3	13.64
3	Gobiiformes	1	6.25	1	5.00	2	9.09
4	Synbranchiformes	2	12.50	2	10.00	2	9.09
5	Anabantiformes	2	12.50	2	10.00	2	9.09
6	Cichliformes	1	6.25	1	5.00	1	4.55
7	Cyprinodontiformes	1	6.25	1	5.00	1	4.55
<b>Total</b>		<b>16</b>	<b>100</b>	<b>20</b>	<b>100</b>	<b>22</b>	<b>100</b>

Out of the 22 fish species found in the study area, *Rhinogobius lineatus* was listed as endangered level (EN) and *Onychostoma gerlachi* as near-threatened level (NT) in the IUCN Red List [17]. According to Decree 26/ 2019/NĐ-CP of the Vietnam Government [18], three species were on the list of endangered, precious, and rare aquatic organisms. They are *Neolissochilus benasi* in Group I, *Onychostoma gerlachi* and *Hemibagrus pluriradiatus* in Group II of the decree.

**Table 1. Species composition structure according to families Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province**

No.	Family	Genus	%	Species	%
1	Gastromyzontidae	1	5.00	1	4.55
2	Nemacheilidae	1	5.00	1	4.55
3	Cyprinidae	3	15.00	4	18.18
4	Xenocyprididae	2	10.00	2	9.09
5	Acheilognathidae	1	5.00	1	4.55
6	Gobionidae	2	10.00	2	9.09
7	Bagridae	1	5.00	1	4.55
8	Sisoridae	1	5.00	1	4.55
9	Clariidae	1	5.00	1	4.55
10	Gobiidae	1	5.00	2	9.09
11	Mastacembelidae	1	5.00	1	4.55
12	Synbranchidae	1	5.00	1	4.55
13	Osphronemidae	1	5.00	1	4.55
14	Channidae	1	5.00	1	4.55
15	Cichlidae	1	5.00	1	4.55
16	Poeciliidae	1	5.00	1	4.55
<b>Total</b>		<b>20</b>	<b>100</b>	<b>22</b>	<b>100</b>

### 2.2.2. Distribution

*Neolissochilus benasi* had the widest distribution range, occurring in 7/11 sampling sites in the study area. They were mainly found in stations with rocky bottoms, flowing water, and forests (Table 4, Figure 3). The *Liniparhomaloptera* cf. *qionghongensis* was collected at 6 sampling sites, and it is also a species adapted to fast speed current water, with rocky bottoms. The next were *Parazacco* sp., *Placogobio* sp., and *Macropodus opercularis*, recorded at 5/11 stations, and then *O. gerlachi* at 4 sampling sites. They are species that prefer living in stagnant waters, slow speed flow, and muddy bottoms (Table 4, Figure 3). Besides, species of the genus *Schistura* were recorded at almost all sampling sites (9/11 sampling sites), indicating their ability to adapt to different habitats. Species collected at only 1 sampling site were *R. lineatus* (NXL.06) and *H. pluriradiatus* (NXL.07). The distribution range of these rare species is relatively narrow, thus it is necessary to conduct a conservation program to protect them in the study site.

At 11 sampling sites, NXL.06 (altitude of 277 m) had the highest number of species (16 species), followed by station NXL.10 (altitude of 181 m), where 12 species were captured. The station NXL.01 had the highest altitude among the sampling sites (760 m), but the number of species collected was the lowest (only 3 species). The sampling sites that had a larger number of individuals and species presented common habitat features, such as narrow streams, next to the local community, and surrounded by agricultural land with average speed current, sandy bottom, and graves. In sampling sites, where habitat is characterized, such as steep, high, muddy waterfalls, swamps, turbid water, and far from residential households, fewer species were obtained (Table 4, Figure 3).



The distribution patterns of fish species according to the above habitat types have also been recorded in several previous studies [10]-[12], [20], [21].

**Table 4. Habitat characteristics and occurrence of fish species in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province**

Sampling site	Altitude (m)	Habitat characteristics	Species
NXL.01	760	Ponds in valleys, swamps, next to ricefield.	<i>B. semifasciatus</i> , <i>M. opercularis</i> , <i>G. affinis</i>
NXL.02	342	Narrow stream with, a slow current, many rocks and stones, muddy bottom.	<i>Liniparhomaloptera</i> cf. <i>qiongzhongensis</i> , <i>Schistura</i> sp., <i>B. semifasciatus</i> , <i>O. gerlachi</i> , <i>O. lepturus</i> , <i>Parazacco</i> sp., <i>Placogobio</i> sp., <i>M. opercularis</i>
NXL.03	531	Narrow stream in the forest, medium flow, gravel, sandy bottom.	<i>Schistura</i> spp., <i>N. benasi</i> , <i>O. lepturus</i> , <i>O. niloticus</i>
NXL.04	514	Narrow stream, next to the ricefield; average speed current, and much gravel and sand in the bottom.	<i>Schistura</i> spp., <i>N. benasi</i>
NXL.05	466	Narrow stream next to agricultural land; a swift current; the bottom has gravel and rocks.	<i>Liniparhomaloptera</i> cf. <i>qiongzhongensis</i> , <i>Schistura</i> spp., <i>N. benasi</i> , <i>R. ocellatus</i> , <i>Placogobio</i> sp.
NXL.06	277	Wide stream next to local houses, a steep waterfall, a rocky bottom, and some places with calm and turbid water.	<i>Liniparhomaloptera</i> cf. <i>qiongzhongensis</i> , <i>Schistura</i> sp., <i>B. semifasciatus</i> , <i>N. benasi</i> , <i>O. gerlachi</i> , <i>O. minutus</i> , <i>Parazacco</i> sp., <i>Placogobio</i> sp., <i>G. honghensis</i> , <i>R. lineatus</i> , <i>M. opercularis</i> , <i>C. gachua</i> , <i>M. armatus</i> , <i>M. albus</i> , <i>M. opercularis</i> , <i>O. niloticus</i>
NXL.07	307	Narrow stream, next to residential areas and agricultural land, medium speed current.	<i>Liniparhomaloptera</i> cf. <i>qiongzhongensis</i> , <i>Schistura</i> sp., <i>B. semifasciatus</i> , <i>O. minutus</i> , <i>Parazacco</i> sp., <i>H. pluriradiatus</i> , <i>Rhinogobius</i> sp., <i>M. armatus</i> , <i>M. opercularis</i> , <i>O. niloticus</i>
NXL.08	-	Narrow stream in the core area of the reserve, calm water with a sandy and muddy bottom.	<i>Schistura</i> spp., <i>N. benasi</i>

NXL.09	281	Wide stream in the forest, medium flow, and rocky bottom.	<i>Liniparhomaloptera qiongzhongensis</i> , <i>Schistura</i> sp., <i>N. benasi</i> , <i>O. gerlachi</i> , <i>O. minutus</i> , <i>Parazacco</i> sp., <i>Placogobio</i> sp., <i>Rhinogobius</i> sp.
NXL.10	181	Narrow stream with, medium speed of water flows, and many gravel and sand at the bottom.	<i>Liniparhomaloptera qiongzhongensis</i> , <i>Schistura</i> sp., <i>N. benasi</i> , <i>O. gerlachi</i> , <i>O. lepturus</i> , <i>O. minutus</i> , <i>Parazacco</i> sp., <i>Placogobio</i> sp., <i>G. honghensis</i> , <i>C. fucus</i> , <i>Rhinogobius</i> sp., <i>M. armatus</i>
NXL.11	306	Wide stream, rainy, fast flow, and gravel and sand in the bottom.	<i>D. microstoma</i> , <i>Rhinogobius</i> sp., <i>M. opercularis</i> , <i>O. niloticus</i>



NXL.01



NXL.02



NXL.03



NXL.04



NXL.05



NXL.06

**Figure 3. Photos of sampling sites in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province**



**Figure 3. Photos of sampling sites in Nam Xuan Lac Species and Habitat Conservation Area, Bac Kan province**

### **3. Conclusions**

The research contributed to the first list of fish species of the Nam Xuan Lac SHCA, with 22 species belonging to 20 genera, 16 families, and 7 orders. In detail, Cypriniformes is the most diverse, with 6 families, 10 genera and 11 species, and the Cyprinidae family is the most dominant in a number of genera and species (3 genera, 4 species). Besides, the present study updated and added two species as new records for the ichthyofauna, one endangered species, one near threatened species on the Red List IUCN and 3 species in groups I and II, according to Decree 26/2019/NĐ-CP. Among 22 species collected, *Neolissochilus benasi* has the widest distribution range (7/11 sampling sites).

A higher number of species was recorded at sampling sites heightening between 277 m and 181 m above sea level (16 and 12 species).

**Acknowledgments:** The authors received financial support from the NEF Bio-ecological Nature Conservation Project in the Mountainous Region of Northern Vietnam. We appreciate the project members for their assistance with sample processing and collecting in the field.

## REFERENCES

- [1] Forest Protection Department, Department of Agriculture and Rural Development of Bac Kan province, (2023, March). *Report on conservation planning and sustainable development of Nam Xuan Lac Species and Habitat conservation area, Cho Don district, Bac Kan province for the period 2013-2020*, (in Vietnamese). <https://backan.gov.vn/DocumentLibrary/7aab54b38c548203>.
- [2] Tran DH, Nguyen HD, Dang TTH, Nguyen QH & Nguyen TN, (2023). A new species of *Euchiloglanis* Regan, 1907 (Actinopterygii: Sisoridae) from Vietnam. *ACTA Zoologica Bulgarica*, 75(1), 3-11.
- [3] Tran DH, Dang TTH, Ta TT & Ngo TX, (2021). Description of *Pareuchiloglanis* sp. (Siluriformes: Sisoridae) in the Da River basin belonging to Phong Tho district, Lai Chau province. *HNUE Journal of Science*, 66(4F), 103-115, (in Vietnamese). DOI: 10.18173/2354-1059.2021-0073.
- [4] Duong TH, Tran DH, Dang TTH & Nguyen QH, (2023). Description of specimens of genus *Parazacco* (Cypriniformes: Cyprinidae) collected in Northern Vietnam. *TNU Journal of Science and Technology*, 228(01), 144-152, (in Vietnamese).
- [5] Nguyen HD, Ngo TMH & Tran DH, (2019). List of fish in the Hong River, Viet Nam. *Proceedings of the First National Conference on Ichthyology in Vietnam*. Publishing House for Science and Technology, 22-39.
- [6] Phung TT, (2017). *Study on species composition and distribution characteristics of Thai Binh River*. Master Thesis in Biology, Hanoi National University of Education, (in Vietnamese). <https://123docz.net/document/4304176-nghien-cuu-thanh-phan-loai-va-dac-diem-phan-bo-khu-he-ca-luu-vuc-song-thai-binh.htm>.
- [7] Ta TT, Dang TTH, Nguyen QH, Tran TT, Chu HN & Ngo SV, (2023). Fish species composition in Bac Me Nature Reserve, Ha Giang province. *TNU Journal of Science and Technology*, 228(09), 242-250, (in Vietnamese). DOI: <https://doi.org/10.34238/tnu-jst.7708>.
- [8] Chen YY, Chu XL, Luo YL, Chen YR & Liu HZ, (1998). *Fauna Sinica, Osteichthyes, Cypriniformes II*. Beijing, China: Science Fresh, (in Chinese).
- [9] Nguyen VH & Vo VB, (1999). Research results on species composition and distribution of fishes in Lo and Gam rivers in 1999. *Proceedings of Scientific Report in 1999*. Research Institute for Aquaculture, 1, 3-20, (in Vietnamese).
- [10] Kottelat M, (2001). *Fishes of Laos*. Colombo, Sri Lanka: WHT Publications (Pte.) Ltd.

- [11] Kottelat M, (2001). *Freshwater Fishes of northern Vietnam*. Environment and Social Development sector unit, East Asia and Pacific region, The World Bank.
- [12] Nguyen VH & Ngo SV, (2001). *Freshwater Fish of Vietnam*, Vol. 1. Agricultural Publishing House, Ha Noi, p. 622, (in Vietnamese).
- [13] Nguyen VH, (2005). *Freshwater Fish of Vietnam*, Vol. 2. Agricultural Publishing House, Hanoi, p. 759, (in Vietnamese).
- [14] Nguyen VH, (2005). *Freshwater Fish of Vietnam*, Vol. 3. Agricultural Publishing House, Ha Noi, p. 755, (in Vietnamese).
- [15] Kottelat M, (2012). Conspectus cobitidum: An inventory of the loaches of the world (Teleostei: Cypriniformes: Cobitoidei). *The Raffles Bulletin of Zoology*, Suppl, 26(Suppl. 26), 1-199.
- [16] Ministry of Science and Technology of Vietnam, (2007). *Vietnam's Red Data Book, Part I. Animals*. Natural Science and Technology Publishing House, (in Vietnamese).
- [17] IUCN, (2023, March). *The IUCN Red List of Threatened Species*. Version 2023-1. <http://www.iucnredlist.org>.
- [18] The Vietnam Government, (2023, March). *Decree No 26/2019/ND-CP regulates a number of articles and measures to implement the Fisheries* (in Vietnamese). <https://vanban.chinhphu.vn/default.aspx?pageid=27160&docid=196438>.
- [19] Fricke R, Eschmeyer WN & R. Van der Laan (eds), (2023, March). *Eschmeyer's Catalog of Fishes, California Academy of Sciences, Fricke, R., Eschmeyer, W. N. & R. Van der Laan*. <https://www.calacademy.org/scientists/projects/eschmeyers-catalog-of-fishes>.
- [20] Ou C, Montaña CG, Winemiller KO & Conway KW, (2011). *Schistura diminuta*, a new miniature loach from the Mekong River drainage of Cambodia (Teleostei: Nemacheilidae). *Ichthyological Exploration of Freshwaters*, 22 (3), 193-200.
- [21] Bohlen J & Šlechtová V, (2013). Two new species of *Schistura* from Myanmar (Teleostei: Nemacheilidae). *Ichthyological Exploration of Freshwaters*, 24(1), 21-30.