Journal of Global Change Data & Discovery. 2021, 5(4): 385-398
www.geodoi.ac.cn

GIES Case Dataset on Summer Angling and Winter Fishing in Panshi Qiantang (Thousands Reservoirs), Jilin Province of China

Liu, C.[1*] Guo, X. Y.[2] Liu, Y. H.[3] Liu, T. G.[3] Qi, W.[4*] Wang, Z. W.[5] Qiao, Y. B.[5] Wu, F.[6] Chen, C. H.[5] Fu, J. Y.[1] Zhu, X. G.[7]

1. Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100010, China;
2. Key Laboratory of Geographical Processes and Ecological Security in Changbai Mountains, Ministry of Education, School of Geographical Sciences, Northeast Normal University, Changchun 130024, China;
3. Fisheries Research Institute of Jilin Province, Changchun 130024, China;
4. Panshi City People's Government, Panshi 132300, China;
5. Panshi City Agriculture and Rural Affairs Bureau, Panshi 132300, China;
6. Panshi Supply and Marketing Investment Group Co., Ltd., Panshi 132300, China;
7. Beijing Tian Hang Hua Chuang Technology Co., Ltd., Beijing 100085, China

Abstract: Panshi city is located in Jilin city, Jilin province, in the transition zone from Changbai Mountains to Songnen plain, a hilly region and the middle of the second Songhua river basin. The Huifa river and Yinma river are the main water systems; both are major tributaries of the second Songhua river. There are 2,410 reservoirs and ponds which are larger than 248 m^2. Heavy metal content of water body and other indicators all meet the national standard of Case I surface water. The water quality is better than the water quality standards of fishery aquaculture. Fishing-hunting culture has a history of more than thousands of years. Panshi city is a representative region with many reservoirs, good water quality and long fishing-hunting culture in China. The case area is characterized by a cool summer and a long ice period in winter. The case study dataset of ecogeographic environmental protection and sustainable development of summer angling and winter fishing in thousands of reservoirs and ponds in Panshi includes location data of case area, the characteristics of reservoirs and pond ecosystems in Huifa river and Yinma river basins, water quality data in 35 reservoirs and fish character data, management data and photos. The main fish stocks are *Hypophthalmichthys nobilis*, *Cyprinus carpio*, *Megalobrama skolkovii*, *Hypophthalmichthys molitrix*, *Siniperca chuatsi*, *Erythroculter ilishaeformis*, *Hemibarbus maculatus*. The case dataset was stored in .shp, .xlsx, .docx and .jpg formats, with a data size of 33 MB.

Keywords: Panshi; fishes from thousands of reservoirs and ponds; summer angling and winter fishing;

Received: 20-11-2021; **Accepted:** 15-12-2021; **Published:** 30-12-2021
Foundation: IGSNRR/CAS-Regional Cooperation Project
***Corresponding Author:** Liu, C. L-3684-2016, Chinese Academy of Sciences, lchuang@igsnrr.ac.cn,
Qi, W., Panshi City People's Government, qfs7500@qq.com
Data Citation: [1] Liu, C., Guo, X.Y., Liu, Y. H., *et al*. GIES case dataset on summer angling and winter fishing in Panshi Qiantang (Thousands Reservoirs), Jilin province of China [J]. *Journal of Global Change Data & Discovery*, 2021, 5(4): 385–398. https://doi.org/10.3974/geodp.2021.04.03. https://cstr.escience.org.cn/CSTR: 20146.14.2021.04.03.
[2] Liu, C., Guo, X.Y., Liu, Y. H., *et al*. Panshi Qiantang (Thousands Reservoirs) fishing life case dataset of ecosystem protection and sustainable development [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2021. https://doi.org/10.3974/geodb.2021.12.42.V1. https://cstr.escience.org.cn/CSTR:20146.11.2021.12.42.V1.

ecogeographic environmental protection; sustainable development; GIES Case 7

DOI: https://doi.org/10.3974/geodp.2021.04.03

CSTR: https://cstr.escience.org.cn/CSTR: 20146.14.2021.04.03

Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at https://doi.org/10.3974/geodb.2021.12.42.V1 or https://cstr.escience.org.cn/CSTR:20146.11.2021.12.42.V1.

1 Introduction

Panshi is a county-level city in Jilin prefecture, Jilin province of China, which governs 19 town-level units. Spanned between 42°39′58″N–43°27′13″N and 125°38′21″E–126°41′6″E, Panshi has an area of 3,861 km^2 (Figure 1). Panshi is located in the hilly area from Changbai Mountain to Songliao plain, with an altitude range of 230–1,049 m and a relative elevation difference of 819 m (Figure 2). The climate in Panshi is dominated by the monsoon, with mild-rainy summer and long-cold winter[1–3]. Thanks to abundant water, Panshi has a tradition of fishing in summer and winter[4]. Recently, summer and winter fishing as leisure has developed rapidly. The aquatic products yield is about 8400 tons, of which 8,310 tons are fish stocks. To promote the sustainability of Panshi fishery[5,6], we developed this dataset of 35 major reservoirs in Panshi[7].

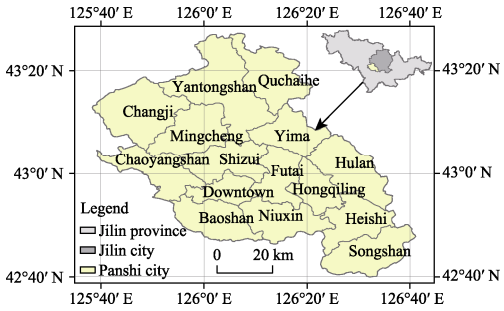

Figure 1 Geographical location of Panshi city

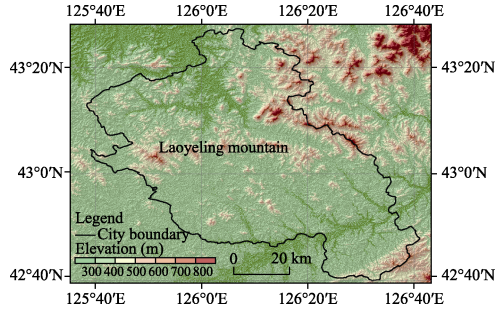

Figure 2 DEM classes of Panshi city

2 Metadata of the Dataset

The metadata of the Panshi Qiantang (Thousands Reservoirs) fishing life case dataset of ecosystem protection and sustainable development[7] is summarized in Table 1.

3 Physical Geography of Panshi City

3.1 Climate

Panshi is located in the middle temperate and humid zone, with a continental monsoon climate[1–3]. According to the annual average meteorological data from 2001 to 2020, the annual average temperature of Panshi is 5.2 °C, ranging from – 16.9 °C (January) to 22.7 °C (July). The annual precipitation is 743 mm, 60% of which from June to August (Figure 3). Moderate rainfall and comfortable temperature in summer make it suitable for leisure fishing. In winter, the freezing period on the water bodies exceeds 20 days, so it is good for winter fishing activities.

Table 1 Metadata of the dataset[7]

Items	Description
Dataset full name	Panshi Qiantang (Thousands Reservoirs) fishing life case dataset of ecosystem protection and sustainable development
Dataset short name	PanshiFishCase07
Authors information	Liu, C. L-3684-2016, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR/CAS), liuchuang@igsnrr.ac.cn Guo, X. Y. 0000-0002-8651-615X, Key Laboratory of Geographical Processes and Ecological Security in Changbai Mountains, Ministry of Education, School of Geographical Sciences, Northeast Normal University, guoxy914@nenu.edu.cn, orcid: Liu, Y. H., Fisheries Research Institute of Jilin Province, liuyanhui9@163.com Liu, T. G., Fisheries Research Institute of Jilin Province, ltg0322@163.com Qi, W., Panshi City People's Government, 931300049@qq.com Wang Zhengwen, Panshi City Agriculture and Rural Affairs Bureau, 1104335154@qq.com Qiao, Y. B., Panshi City Agriculture and Rural Affairs Bureau, pssnyj@163.com Wu, F., Panshi Supply and Marketing Investment Group Co., Ltd., 1055318092@qq.com Chen, C. H., Panshi City Agriculture and Rural Affairs Bureau, 294576808@qq.com Fu Jingying, IGSNRR/CAS, fujy@igsnrr.ac.cn Zhu, X. G., Beijing Tian Hang Hua Chuang Technology Co., Ltd., 18510867688@163.com
Geographical area	2410 reservoirs and ponds in Panshi city, Jilin city, Jilin province (minimum area 248 m^2)
Year	2001–2021
Data format	.shp, .xlsx, .docx, .jpg
Data size	33 MB
Data files	1_BND_StudyArea, 2_PhysicalGeoData, 3_CharacteristicsSpecies, 4_ManagementData, 5_Photos
Fundation	Cooperation Project between Chinese Academy of Sciences Local institutions
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	The data of the global change scientific research data publishing system include metadata (Chinese and English), entity data (Chinese and English) and data papers (Chinese and English) published through the *Journal of Global Change Data*. The sharing policies are as follows: (1) "Data" are free to the whole society through the internet system in the most convenient way, and users can browse and download it for free; (2) the end-user needs to indicate the data source in the reference or appropriate position according to the reference format when using "data"; (3) users of value-added services or users who distribute and disseminate "data" in any form (including through computer servers) need to sign a written agreement with the editorial department of *Journal of Global Change Data* (Chinese and English) and obtain permission; (4) the author who extracts some records from the "data" to create new data should follow the 10% citation principle; that is, the data records extracted from this data set are less than 10% of the total records of the new data set, and the data source of the extracted data records should be indicated[8]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS

3.2 Hydrological Characteristics and Watershed Division

Two major rivers—Huifa river and Yinma river are through the Panshi city. With the Hada Ridge as the divide crest, both rivers are the primary tributaries of the second Songhua river[9]. The Huifa river flows in the south of Panshi. It originates from Liaoning Province and flows from west to East. The length of its reach in Panshi is 51.46 km, with a drainage area of 2,291 km^2, accounting for 60% of the total area of Panshi city. In Panshi, 39 rivers flow into Huifa river, including 10 primary tributaries, 21 secondary tributaries and 8 tertiary tributaries [4]. On the other hand, Yinma river flows in the north of Panshi. Its reach in Panshi is 72.7 km, with a drainage area of 1,267 km^2. There are 12 primary and 12 secondary tributaries flowing into Yinma river[4]. The northeast part of Panshi belongs to Chalu river, which originates from Hadaling Mountains. It is an important tributary of Yinma river, with a drainage area of 257 km^2. Another small part in the east Panshi belongs to Badaohe river, and finally flows into Huifa river in Huadian city (Figure 4).

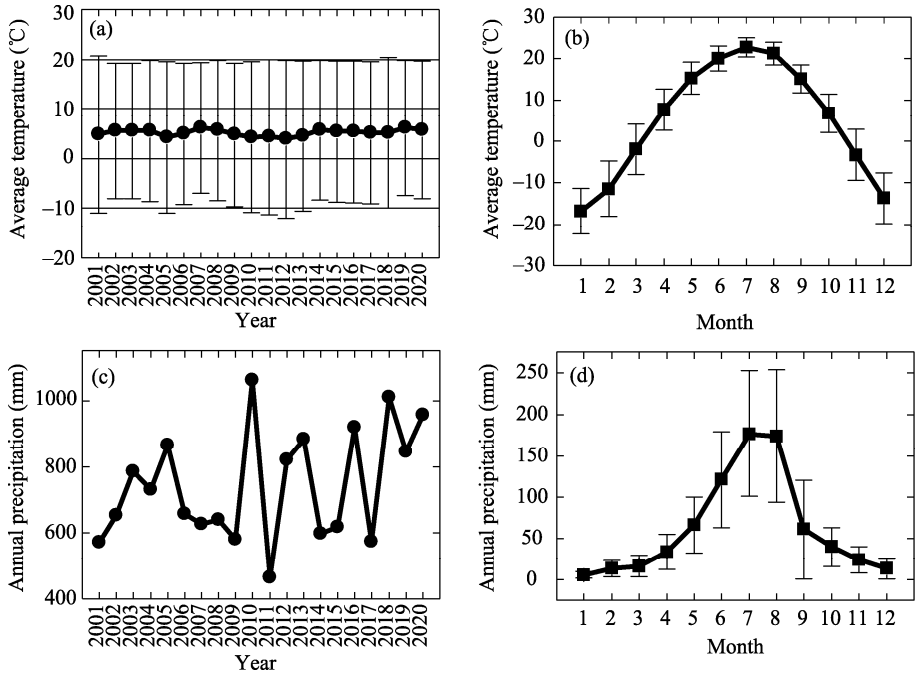

Figure 3 Climatic conditions in the case area

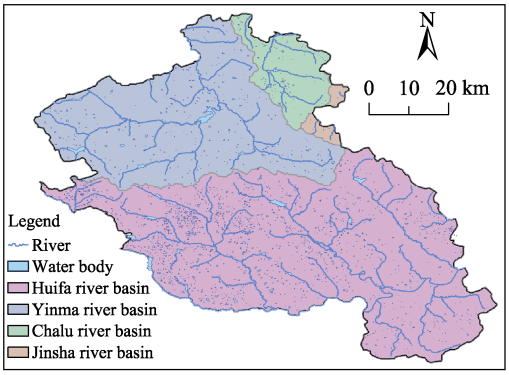

Figure 4 Map of hydrological system and water bodies in Panshi city

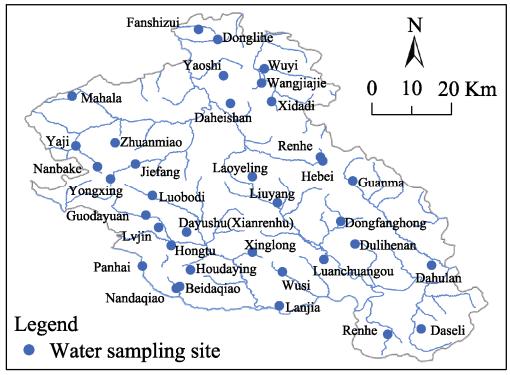

Figure 5 Map of water sampling sites in Panshi city

3.3 Water Resources and Water Quality

Panshi city is rich in water resources, of which 2,410 reservoirs and ponds are larger than 248 M^2 (Figure 4). Panshi has abundant water resources, and the average surface water runoff is 8.05×10^8 m^3, the groundwater resource is 2.02×10^8 m^3, and the annual average inflow is 1.83×10^9 m^3[9]。Panshi has 4 medium-sized reservoirs (Huanghe R., Yaji R., Liuyang R. and Guanma R.), which are suitable for fish culture[4]; There are 23 Small-I and 133 Small-II reservoirs respectively[10]. In 2020, Panshi was designated by the Ministry of Water Resources as the first batch of model counties to deepen the reform of small reservoir management.

According to the Fishery Zoning of Jilin Province, Panshi belongs to the hilly reservoir pond aquaculture area in the middle east of Jilin province: the water is rich in nutrients and plankton, and the water level is appropriate. Fish can survive the winter

safely, and a fish culture base based on reservoir fishery can be built[12]. Panshi water system originates from Changbai Mountain, which is the distribution area of natural mineral waters[13]. In order to further understanding the safety of water bodies to fisheries, the author collected water samples from 35 main reservoirs and ponds (Table 2 and Figure 5)[14–48], and the quality of water samples was tested by Jilin Huake Testing Co., Ltd. and the Physical and Chemical Analysis Center of the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (Table 3).

Compared with the National fishery water quality standard (GB 11607—89) and the Environmental quality standard for surface water (GB 3838—83), all the water quality indicators of the collected water samples meet the standards and the 8 elements such as, Cd, and Cr all meet the standards of Class I Surface Water (equivalent to that of the source water and the National Nature Reserve).

Table 2 Names and locations of water sampling sites in the case study area

No.	Name	Town	No.	Name	Town
1	Guanma reservoir	Hulan town	19	Lvjin reservoir	Changyangshan town
2	Xinglong reservoir	Niuxin town	20	Laoyeling reservoir	Shizui town
3	Wusi reservoir	Niuxin town	21	Luobodi reservoir	Shizui town
4	Lanjia reservoir	Niuxin town	22	Daseli reservoir	Songshan town
5	Luanchuangou reseroir	Niuxin town	23	Renhe reservoir	Songshan town
6	Donglihe reservoir	Yantongshan town	24	Dulihenan reservoir	Hongqiling town
7	Fanshizui reservoir	Yantongshan town	25	Dongfanghong reservoir	Hongqiling town
8	Daheishan reservoir	Yantongshan town	26	Hongtu reservoir	Fuan subdistrict
9	Yaoshi reservoir	Yantongshan town	27	Jiefang reservoir	Mingcheng town
10	Panhai reservoir	Baoshan village	28	Yongxing reservoir	Mingcheng town
11	Houdaying ponds	Baoshan village	29	Hebei reservoir	Yima town
12	Beidaqiao ponds	Baoshan village	30	Renhe reservoir	Yima town
13	Nandaqiao ponds	Baoshan village	31	Wangjiajie reservoir	Qucaihe town
14	Liuyang reservoir	Futai town	32	Wuyi reservoir	Qucaihe town
15	Malaha reservoir	Jichang town	33	Xidadi reservoir	Qucaihe town
16	Nanbake reservoir	Jichang town	34	Dahulan reservoir	Heshi town
17	Yaji reservoir	Jichang town	35	Xianrenhu reservoir	Panshi development zone
18	Zhuanmiao reservoir	Jichang town			

Table 3 Water quality of sample in the case study area (e.g., Guanma reservoir)

Indicator	Value	Indicator	Value	Indicator	Value
As	0	Zn	0	Ammonia Nitrogen (mg/L)	0.378
Cd	0	Hg	0.000,04%	BHC (mg/L)	0.000,004
Cr	0	Chromaticity (degree)	10	DDT (mg/L)	0.000,2
Cu	0.000,2%	Smell and taste	Without any smell	Nitrite Nitrogen (mg/L)	0.004,9
Ni	0.000,3%	Permanganate Index (mg/L)	4.2	Total Phosphorus (mg/L)	0.08
Pb	0	Total Coliform Bacteria (MPN/L)	＜20	pH	7.2

4 Species/Varieties and Quality of Fish Stocks

4.1 Species/Varieties of Fish Stocks

There are over 30 kinds of common fish in Panshi city: *Aristichthysnobilis* (Figure 6),

Cyprinuscarpio (Figure 7), *Hypophthalmichthys molitrix* (Figure 8), *Carassiusauratus* (Figure 9), *Megalobramaamblycephala* (Figure10), *Erythroculterilishaeformis* (Figure11), *Siniperca chuatsi* (Figure12), *Hemibarbus maculatus* (Figure 13), etc[4] [1].

Aristichthys nobilis, family Cyprinidae, genus Aristichthys, also known as bighead carp, is commonly known as fat head (Figure 6). *Aristichthys nobilis* is a common fish species in Panshi city, one of the four famous Chinese carp, and is a typical filter-feeding fish. It is warm-water fish, living in the upper middle layer of the reservoir. As a typical of zooplankton-feeding fish, from fry to adults, it feeds mainly on zooplankton and also on phytoplankton and organic matter in the water column.

Cyprinus carpio, family Cyprinidae, genus Cyprinus (Figure 7), is a typical omnivore. It is strongly adaptable to the living environment, inhabiting the bottom of the water, with a mild and vigorous temperament, resistant to both cold and hypoxia deprivation. Young *Cyprinus carpio* mainly feeds on rotifers, crustaceans and small invertebrates. It is mixed with *Ctenopharyngodon idellus*, *Megalobrama amblycephala*, *Carassius auratus* and *Hypophthalmichthys molitrix*.

Figure 6 *Aristichthysnobilis*

Figure 7 *Cyprinuscarpio*

Figure 8 *Hypophthalmichthys molitrix*

Figure 9 *Carassius auratus*

Figure 10 *Megalobrama amblycephala*

Figure 11 *Erythroclter illishaeformis*

Figure 12 *Siniperca chuatsi*

Figure 13 *Hemibarbus maculatus*

Figure 14 *Unionidae*

Hypophthalmichthys molitrix, family Cyprinidae, genus Hypophthalmichthys (Figure 8), is a typical filter-feeding fish. In the upper layers of the water, it feeds on diatoms, green algae and other phytoplankton. Mixed with *Megalobrama amblycephala*, *Cyprinus carpio*,

[1] Others including: *Ctenopharyngodonidellus*, *Mylopharyngodonpiceus*, *Hemibarbuslabeo*, *Silurusasotus*, *Ophiocephalusargus*, *Xenocyprismicrolepis*, *Brachymystaxlenok*, *Parabramispekinensis*, *Erythroculterdabryi*, *Sillagosihama*, *Pseudorasboraparva*, *Opsariichthysbidens*, *Leuciscus*, *Parabotiafasciata*, *Acanthobramasimoni*, *Lampetra japonica*, *Pelteobagrusfulvidraco*, *Misgurnusanguillicaudatus*, *Perccottusglenii*.

Ctenopharyngodon idellus, *Carassius auratus* and so on.

Carassius auratus, family Cyprinidae, genus Carassius (Figure 9), is a typical omnivore. The life level belongs to the bottom fish, mainly omnivorous fish that feeds on plants. In general, it swims, forages and inhabits underwater.

Megalobrama amblycephala, is a genus of Megalobrama in the family Cyprinidae, also known as Wuchang fish (Figure 10). It is herbivorous freshwater fish with a body length of 165-456mm, flat and high on the side, rhombic in shape, with a thick back and a wide and short tail stalk. The body is bluish gray, the base of the body sides scale is light color and the two sides are grayish black, forming several rows of longitudinal lines of intersecting depth on the body. The fins are grayish black. It is more suitable for hydrostatic life. Normally inhabits in the middle and lower layers of open water areas where the sediment is silt and submerged plants are growing. In winter, they prefer to overwinter in deep water.

Erythroculter ilishaeformis, family Cyprinidae, genus Culter (Figure 11), is a ferocious carnivorous fish that feeds on cladocerae, copepods and aquatic insects as juvenile fish, shrimp, snails, insects, larvae and cladocerae as adults.

Siniperca chuatsi, family Serranidae, genus Siniperca (Figure 12), is a carnivorous freshwater fish. The most prominent biological characteristic of Siniperca chuatsi is its ferocious carnivorous nature and its ability to discriminate between baits. It mainly feeds on live fish and shrimp throughout its life, and even newly opened fry feed on the fry of other fish. After growing up, in addition to eating live fish, but also eat shrimp and tadpoles and so on. It lives in the lower and middle waters of the muddy reservoirs, ponds and dams where Unionidae lives.

Hemibarbus maculatus, family Cyprinidae, genus Hemibarbus, commonly known as Jigou Fish (Figure 13), belongs to bottom fish, preferring the lower and middle layers of water, feeding on benthic animals, mainly aquatic mollusks, and also eating a variety of small fish. It's an omnivorous fish with a carnivorous bias.

In addition to fish, there are other aquatic organisms in the waters of Panshi city, including otter, muskrat, turtle, mussel (Figure 14), forest frog, frog, river shrimp, field snail, ear snail and cloth snail; Aquatic plants include reed, cattail and water chestnut [4].

4.2 Aquatic Habitat Types

In this case, 35 reservoirs and ponds are selected. The water depth of most of the water bodies is between 0.8–6 m, and the deepest reservoir can reach to 12 m. The water bodies are divided into two types: sand-bottom and mud-bottom.

Sand-bottom reservoirs (ponds): Panhai, Lvjin, Daseli, Dongfanghong, and Hebei (5).

Mud-bottom reservoirs (ponds): Houdaying, Beidaqiao, Nandaqiao, Xinglong, Wusi, Lanjia, Lanchuangou, Donglihe, Fanshizui, Daheishi, Yaoshi, Liuyang, Mahala, Nanbake, Yaji, Zhuanmiao, Laoyeling, Luosudi, Renhe, Dulihan, Hongtu, Jiefang Yongxing, Renhe, Guanma, Wangjiajie, Wuyi, Sidi, Dahulan, Xianrenhu (30).

4.3 Quality Inspection of Fish Products

We caught fish samples at the end of autumn of 2021 and tested the characteristics of samples. The testing items included pesticide residues, prohibited drug residues, heavy metals and nutrient ingredients. The testing was implemented by professional institute with CMA license. According to the testing reports (Table 4), all fish samples were free of pesticide and prohibited drug residues. The upper limits of Hg, Pb, Cd and Cr are 0.5, 0.1, 0.5 and 2 mg/kg in the Standard for food safety, respectively. As shown in Table 4, the heavy metal contents of all fish e from the case area were lower than limit values of the standard.

The nutrient result showed that the protein content of the fish in wet weight was

17.7%–23.6%, fat content was 0.7%–3.2%, and moisture content was less than 80%. The composition proportion of essential amino acids and umami amino acids were close to 40% which is ideal protein requirement, and the amino acid index was above 85 score. Fatty acid content was tested for *Aristichthys nobilis* and *Cyprinus carpio* because they had considerable bodies. The results showed that fatty acid content was 0.59% and 1.73% for both fishes, which could improve the utilization rate of protein in food. For these reasons, the fishes from the case area have high protein, low fat, low moisture content, delicious meat, rich nutrition and balanced proportion, and high ash content (4.5%–6%) (essential minerals and trace elements). The unsaturated fatty acid (EPA+DHA) content is 2.24% and 3.94% for *Cyprinus carpio* and *Aristichthys nobilis*, respectively. Quality of fishes from reservoirs of Panshi performs better than that from reservoirs of other ponds.

Table 4 Fish quality data

Indicator		Fish Species							
		Aristichthys-nobilis	Cyprinus-carpio	Hypophthal-michthys molitrix	Carassius-auratus	Megalobra-maambly-cephala	Siniperca chuatsi	Erythrocl-terillishae-formis	Hemibarbus maculatus
Pesticide residues	HCH (μg/kg)	0	0	0	0	0	0	0	0
	DDT (μg/kg)	0	0	0	0	0	0	0	0
	MG (μg/kg)	0	0	0	0	0	0	0	0
Prohibited drug residue	AOZ (μg/kg)	0	0	0	0	0	0	0	0
	SEM (μg/kg)	0	0	0	0	0	0	0	0
	AMOZ (μg/kg)	0	0	0	0	0	0	0	0
	AHD (μg/kg)	0	0	0	0	0	0	0	0
Heavy metal residue	Hg (mg/kg)	0	0	0	0	0	0	0.018	0
	Cd (mg/kg)	0	0.007	0	0	0	0	0	0
	Cr (mg/kg)	0.07	0.004	0.12	0.06	0.16	0.21	0.47	0.08
Nutritional ingredient	Protein (g/100g)	17.7	23	19.5	18.8	23.6	22.2	21.1	20.6
	Fat (g/100g)	2.2	0.7	1	3.2	1.6	2.2	1	1
	Moisture (g/100g)	77.8	74.9	75.9	71.4	78.6	71.1	73.6	78.1
	Ash (g/100g)	4.2	5.5	4.8	4.2	3.9	4.4	4.3	4.3
	WTAA (g/100g)	16.2	12.9	13.5	11.5	13.3	11.4	12	12.2
	WEAA (g/100g)	5.8	4.4	4.3	3.5	4.2	3.8	4	4
	TFA (g/100g)	2.24	3.94						
	SFA (g/100g)	1.16	1.97						
	MUFA (g/100g)	0.05	0.25						
	PUFA (g/100g)	0.59	1.73						

5 Management Data

5.1 General Management

There are 1,425 fishery households composed of 5,625 people, including 2,367 fishery employees in Panshi city. In recent years, 80 professionals and over 200 inspectors have been staffed to undertake daily maintenance of the water systems. Since 2019, the annual budget for water conservancy has been 2.57 million Yuan in Panshi, and the yearly revenue of fishery in Panshi is 168.93 million Yuan. Panshi provides fishermen with aquatic skill

services in a variety of ways: establishing demonstration households, holding training courses, on site observation, etc. In addition, Panshi also values aquatic animal epidemic prevention monitoring and aquatic seedling origin quarantine to ensure the fishery safety.

5.2 Product Marketing

The products of the case study are sold by Panshi Supply and Marketing Investment Group Co., Ltd., which was registered at Panshi Economic Development Zone on June 11, 2021. The main shareholders of the company include Panshi Supply and Marketing Cooperative Federation, Panshi Beiyou Rural Comprehensive Service Professional Cooperation Association, Panshi Huinong Accounting Service Co., Ltd., and Panshi Jigao Vocational Skills Training School. The major task of Panshi Supply and Marketing Investment Group Co., Ltd. is to increase farmers' (including fishermen's) income by improving the organizational level of farmers and agricultural restructuring.

5.3 Trademark

A trademark was registered in December, 2021: "Panshi Qiangtang (Thousands Reservoir) Fish" (Figure 15).

Figure 15 Trademark of "Panshi Qiantang (Thousands Reservoir) Fish"

5.4 Establishment of Ecological Monitoring System

In order to monitoring environment of reservoirs and ponds, 12 monitoring stations were fixed for medium and long-term monitoring, including 10 ecological stations (Figure 16), 1 water quality_station, and 1 video station. Monitoring items are real-time visible landscape photos, meteorological elements, automatic identification and recording of water quality.

5.5 The Tradition of Winter Fishing in the Second Songhua River

In the late Paleolithic period (40,000 to 70,000 years ago), the Northeast ancestors living by the second Songhua river began to use primitive tools to fish and shrimp. In the Neolithic Age (4,000 years ago), the Sushen (Panshi was part of Sushen in the Xia, Shang, Zhou and Qin Dynasties) tribe along the Songhua river began to use bone fish bladder, harpoon, hook and other fishing tools, evidenced by the Neolithic sites in the basin. During the Bohai State Period (698–926 A.D.), some fishing life in the Northeast became tribute to the Tang dynasty. In the Liao and Jin Dynasties, fishing was one of the popular activities of princes and nobles. In winter, the water surface in Northeast China is generally frozen, which promotes the development of fishing activities in winter. The Khitans began winter fishing very early. They dug small holes in the ice and hooked fish with bait. King Khitan and his princes and ministers also chiseled ice on the ice of the second Songhua river to get fish. During the reign of Emperor Kangxi of the Qing dynasty, immigrants from Shandong invented the "Liangzi" fishing method: wicker is woven into a network to block the outlet of the stream, allowing the water to pass through but keeping the fish behind the network. Fish can be caught when the water level drops after freezing. In addition, people can catch fish with nets in winter. The improvement of fishing technique has promoted winter fishing. In addition, the ice surface in winter is easy to pass, and the fish products are easy to be preserved, which has promoted the development of winter fishing in the upper reaches of the second Songhua river[50].

The fishing culture in the Songhua river basin reached its heyday in the Qing dynasty. In the early Qing dynasty, Jilin's fishery was regional and exclusive. In 1657, the Qing government set up a special organization in Jilin to catch rare fish and offer them to the royal family as a tribute. In the middle of the Qing dynasty, with a large number of immigrants moving to Jilin, the folk fishing increased day by day, resulting in fishing households all

year round. In the late Qing dynasty, as the exclusive fishery in Northeast China was gradually transformed into an ordinary livelihood, the fishery resources were more widely developed, which laid the foundation for the fishery in Jilin today[50]. According to incomplete statistics in 1908, there were 494 professional fishermen and 171 fishing boats in Jilin province, with an annual fish output of 931,077 kg[51]. A record in 1913 reported that Panshi and Huadian counties in Huifa river basin had an annual output of more than 6,000 kg of fish. With the continuous progress of modern fishery model, more fishery companies began to be established in the basin[52].

In the early 1950s, Panshi began to use various natural water bodies (small reservoirs and ponds) to develop fisheries and tried to raise fish in rice fields[12]. In the late 1950s, Jilin province began to study the artificial reproduction techniques of silver carp, bighead carp, carp and other fish, and achieved success in 1966[53]. In 1968, Yima town of Panshi raised 420,000 fish fry in a small reservoir and benefited fairly[12].

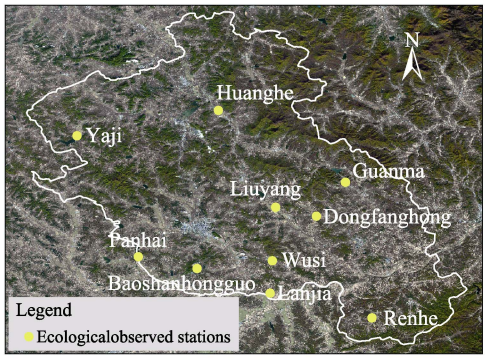

Figure 16 Map of the monitoring sites geo-location

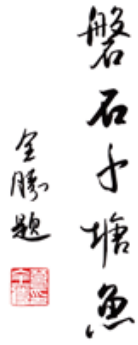

Figure 17 "Panshi Qiantang (Thousands Reservoir) Fish" inscribed by Prof. Ge, Q. S.

To further nurture fishing culture in Panshi, in December 2021, Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences, Chinese Geographical Society, and Global Change Research Data Publishing & Repository, jointly reviewed the GIES case dataset on summer angling and winter fishing in Thousands of Reservoirs and Ponds in Panshi, and awarded it a high-quality case. Prof. Ge, Q. S., General Director of the Institute of Geographic Sciences and Natural Resources Research, CAS, inscribed "Panshi Qiangtang (Thousands Reservoir) Fish" (Figure 17). The Panshi government also initiates to continuously promote the "Panshi winter fishing Cultural Festival". All these measures are expected to uplift the inheritance and development of Panshi fishing and hunting culture to a new level.

6 Discussion and Conclusion

Just as its name implies, "Panshi Qiangtang (Thousands Reservoir) Fish" is fish products from thousands of water bodies in Panshi, its unique natural endowments and long history of fishing have been two factors for the present achievements. However, in the context of the national strategy for "Rural Modernization", more efforts need to be made to protect environment and develop the economy. While Panshi "Thousands Reservoir Fish" has made phased progress in brand lift, management and ecological monitoring, there is still much room for improvement.

6.1 Management Standardization

At present, there are already some national standards for aquaculture, yet more detailed and

specific standards closely related to the daily management of Panshi fish are still absent, such as water quality inspection standards, stocking standards for different fish species, fishing standards, fishing management specifications, classification standards for fresh and living fish (freshness of fish products), and control standards for aquatic plants in reservoirs of different sizes, the standard of combining intensive and coarse cultivation in medium-sized reservoirs, and the standard for feeding and fertilization in small-sized waters.

6.2 Keeping the Fishing Environment

At present, Panshi fish mainly grow under natural conditions. With the increase of market demand, it is more important that to keep the fish environment and ecosystem health and sustainability. The water size of reservoir has a great impact on fishery management. In reservoirs with a water area of over 3.33ha, filter-feeding and herbivorous fish can be raised, which can reduce algae and aquatic plants and purify the water body. We also need to further study the technique of raising silver carp and bighead carp in large reservoir, explore the mechanism of fish-water-aquatic ecosystem balance, and find an effective way to convert the eutrophic substances in the reservoir into high-quality fish protein through fish culture.

6.3 Combination of Fishing Culture and Ecotourism

The fishing-hunting of summer angling and winter fishing in Panshi dates back to thousands of years, which has become popular in the Qing dynasty and becomes even more welcome recently. In the future, the integration of fishing and hunting culture, eco-tourism, and ice and snow culture in Panshi city will contribute more to the regional sustainable development.

Acknowledgments
The authors sincerely thank the following people for their lasting cooperation and support for this case study: Yu, J. Q., Secretary of the CPC Panshi City Committee and member of the Standing Committee of the CPC Jilin city of Jilin province of China; Mrs. Wang, P. P., Mayor of Panshi city; and Dr. Wang, Z. B., Director of Cooperation, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR/CAS). Prof. Ge, Q. S., Director General of IGSNRR/CAS.

The authors also sincerely thank the following individuals for their contributions to this case study: Mr. Mu, C., Associate Director of Futai town; Mr. Liu, H. Q., Chief of Niuxin town; Mr. Duan, X. L., Associate Director of Shizui town; Mr. Song, J., Associate Director of Baoshan town; Mr. Jia, S. J., chairman of People's Congress of Songshan town; Mr. Yang, Y. H., Associate Director of Hulan town; Mr. Huang, F. J., Associate Director of Yantongshan Town; Mr. Yang, K. J., Chief of Quchaihe Town; Mr. Zhou, N., Associate Director of Jichang town; Mr. Sun, Z., Associate Director of of Chaoyangshan town; Mr. Yang, S. Y., Associate Director of Fuan subdistrict; Mr. Sun, H. F., Associate Director of Mingcheng town; Mr. Jiang, H. T., Chief of Hongqiling town; Mr. Zhang, Z. X., Associate Director of Management Committee of Panshi Economic Development Zone; Mr. Wang, Y. M., Chairman of People's Congress of Yima town; and Mr. Zhang, L., Associate Director of Heishi town.

Author Contributions
Liu, C. designed the development of dataset; Guo, X. Y. wrote the paper manuscript; Liu, Y. H. and Liu, T. G. analyzed fish characteristic data; Qi, W. and Wang, Z. W. are responsible for the water quality, fish quality specifications, organization and coordination of each reservoir; Qiao, Y. B., Chen, C. H. and Fu, J. Y. are responsible for field water sampling; Wu, F.is responsible for collecting management data; Zhu, X. G. provided key real-time monitoring data; and Liu, C. reviewed the data and paper.

Conflicts of Interest

The authors declare no conflict of interest.

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