

## Fish diversity in nature reserves of Jiangxi Province, China

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Keywords: freshwater fish, species diversity, nature reserves, Jiangxi Province

### Abstract

According to the fish checklist of 14 nature reserves in Jiangxi Province, a total of 146 species of 7 orders, 26 families were present. Nature reserves of Cypriniformes were the major components of the fish fauna, consisting of 101 species, accounting for 69.28% of the total. Nature reserves of Siluriformes, consisting of 23 species, accounted for 15.75% of the total. For the family diversity (DF), Poyang Lake Nature Reserve scored the highest value (10.72), Ganjiangyuan Nature Reserve was the lowest at just 2.022. The genus diversity (DG) in Poyang Lake Nature Reserve, Nanjishan Nature Reserve, Wuyishan Nature Reserve, Jiulingshan Nature Reserve, Jinggangshan Nature Reserve, Jiulianshan Nature Reserve and Matoushan Nature Reserve are 3.746, 3.707, 3.391, 3.379, 3.355, 3.352 and 3.169 respectively. The result shows that the G-F index (DG-F) in Poyang Lake Nature Reserve is 0.651. The DF-G in Ganjiangyuan Nature Reserve, Yunjushan Nature Reserve, Yangjifeng Nature Reserve, Lushan Nature Reserve was negative. The cluster analysis divides the 14 nature reserves into eight groups for their geographical positions and river types.

### Introduction

Jiangxi Province, the whole area covering almost 166900 km<sup>2</sup> (Figure 1), is located in the south of China and lies between 24° 29' 14"–30° 04' 41" N and 113° 34' 36"–118° 28' 58" E (Guo & Liu 1995). The north is relatively flat while the other sides are surrounded by mountains. More than 2400 rivers have been discovered in Jiangxi province. The main rivers are Ganjiang River, Fuhe River, Xinjiang River, Xiuhe River and Raohe River, which flow into Poyang Lake. And Poyang Lake, the largest body of freshwater in China, is interlaced with five rivers to form a complete riverine-lacustrine network (Huang et al. 2013). Influenced by the subtropical monsoon, with a mild climate and plenty of rainfall, the annual rainfall in the area ranges from 1341 mm to 1940 mm. Jinggangshan Nature Reserve (NR), the first national NR, was created in 1981, followed by Taohualing NR, Jiulianshan NR, Guanshan NR, Wuyishan NR in subsequent years. By 2012 there were almost 200 NRs of all levels and types, including 11 national NRs, 35 provincial NRs, 1 city-level NR and 153 county-level NRs (Ministry of Environmental Protection of The PRC 2013). Ganjiangyuan NR, Guanshan NR, Jinggangshan NR, Jiulianshan NR, Jiulingshan NR, Lushan NR, Matoushan NR, Nanjishan NR, Poyang Lake NR, Qiyunshan NR, Wuyishan NR, Yangjifeng NR, Yihuang NR, and Qiyunshan NR were investigated on freshwater fish. Except for provincial NRs Yihuang NR and Yunjushan NR, all the others are national. Nanjishan NR and Poyang Lake NR are a type of wetland, Yihuang NR and Yangjifeng NR belong to wildlife reserves and the others are forest ecological reserves (Table 1).

With the five rivers and one lake, Jiangxi Province lays a good foundation for the fishery resources. According to the previous studies, more than 1000 species of freshwater fish have been found in China and

229 of them in Jiangxi Province (Huang & Wu 2010a). Since the 20<sup>th</sup> century, many researchers have investigated the fish fauna in this area. In 1938, 64 species were discovered in Jiangxi Province, 108 species in Poyang Lake belonged to 12 orders, 24 families, 72 genera (Guo et al. 1964; Jiang 1985). Surveys from 2007 to 2009 suggest that there are 136 fish species in Poyang Lake and 118 in Ganjiang River (Huang & Gong 2007; Wu et al. 2009). Later, fish in the Fuhe River, Ganjiang River, northwest and northeast were investigated (Liu 1985; Zhang et al. 1996; Huang & Wu 2010a; Chen et al. 2011). Despite the research into fish biodiversity and composition and a number of articles published, a comprehensive study has not yet been done of fish biodiversity in the NRs in Jiangxi Province. In order to understand the fish distribution of NRs systematically, it is necessary to make a comprehensive analysis on the spatial distribution and composition in NRs. The purpose of this study is to: (1) characterize the species composition of the fish fauna and distribution in 14 NRs. (2) analyse the biodiversity and relationship of fish in 14 NRs.

### Materials and methods

A number of papers on the fish have studied them in the 14 NRs, a good opportunity to compile a list of fish species to discuss the biodiversity in the NRs of Jiangxi Province (Liu & Fang 2001; Liu et al. 2002; Hu et al. 2005; Liu & Fu 2006; Huang et al. 2008; Li et al. 2008; Hu et al. 2009; Huang & Wu 2010a, b; Guo et al. 2011; Hu et al. 2011; Zhou et al. 2013; Hu et al. 2014a,b; Yang et al. 2015).

G-F index was used to analyse the avian-mammalian species diversity, but now it is always used to study the fish diversity (Jiang & Ji 1999; Li & Wu 2006; Cai et al. 2009; Huang & Liu 2011). Computing the diversity indexes at the genus level (G-index) and the family level (F-index); then to calculate the ratio of

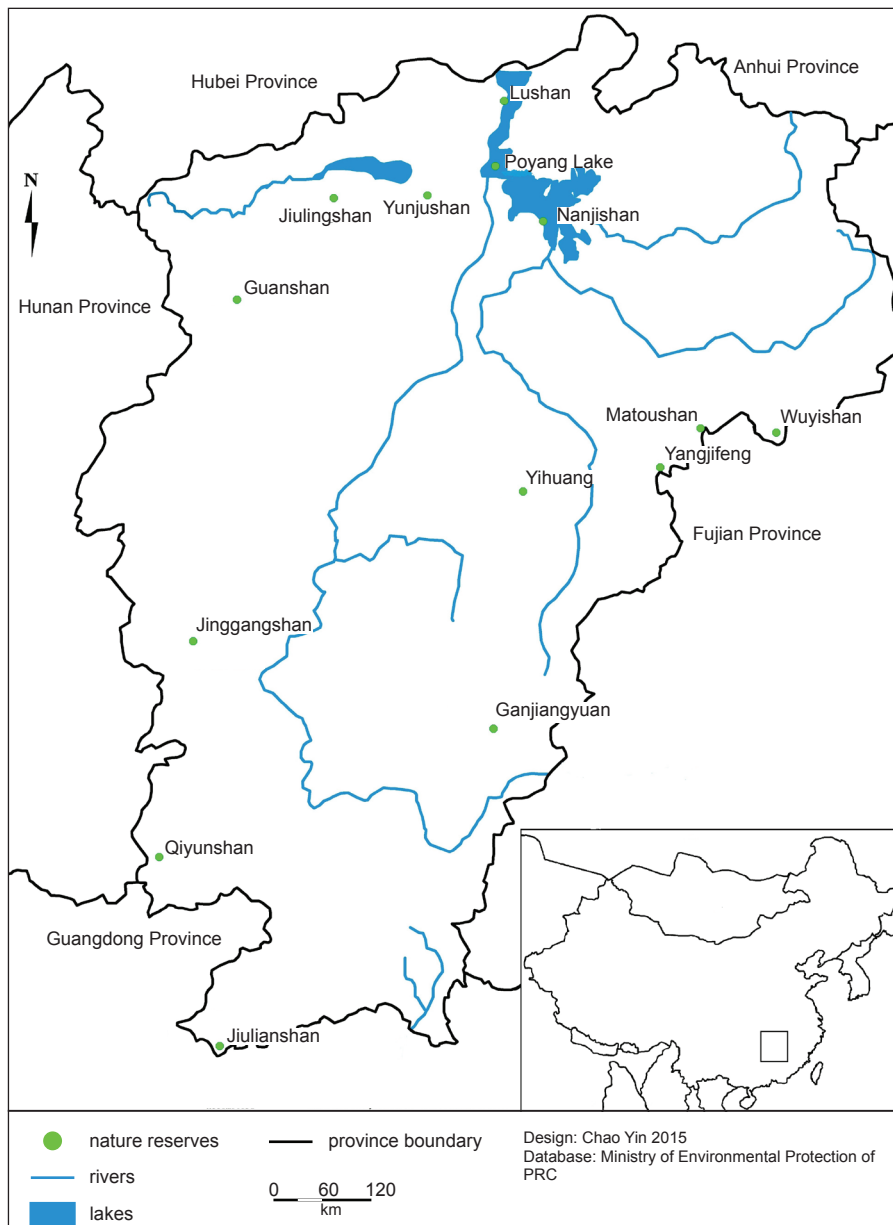


Figure 1 – Location of the 14 nature reserves in Jiangxi province, China.

G-index and F-index as G-F index, the values can be either positive or negative.

1. F-index,  $D_F$ :

$$D_F = -\sum_{k=1}^m D_{F_k} = -\sum_{k=1}^m \sum_{i=1}^n p_i \ln p_i$$

Where

$n$  = the number of genera in the family  $k$ ,

$p_i = S_k / S_k$ ,

$S_k$  the number of species in general,

$m$  = the total number of families in the class.

2. G-index,  $D_G$ :

$$D_G = -\sum_{j=1}^p D_{G_j} = -\sum_{j=1}^p q_j \ln q_j$$

Where  $q_j = S_j / S$ ,

$S_j$  = the number of species in genus  $j$ ,

$S$  = the total number of species in the class,

$p$  = the total number of genus in the class.

G-F index:  $D_{G-F} = 1 - D_G / D_F$

In the early years, the technology of clustering analysis was always applied to mathematics. Now, with the development of computer technology, clustering analysis has begun to be used for studying the community ecology. Although clustering analysis was apply to the fish fauna distribution in the 1960s and popular in China in 1980s, now more and more people applied it to the fish fauna (Pan et al. 1985; Su 2009; Lv et al. 2014). With the *like attracts like* principle, the mutual relationship of fish species will be analysed after cat-

Table 1 – Basic information of 14 nature reserves in Jiangxi Province, China.

Nature reserves (NR)	Area (km <sup>2</sup> )	Location	Protecting object	Rank
Ganjiangyuan NR (GJY)	161	116°03'–116°20'E 25°52'–26°06'N	Mid-subtropical broad-leaved evergreen forest	National
Guanshan NR (GN)	115.01	114°29'–114°45'E 28°30'–28°40'N	Mid-subtropical broad-leaved evergreen forest, <i>Syrmaticus ellioli</i> and other rare wild animals and plants	
Jinggangshan NR (JGS)	214.99	113°34'–118°28'E 24°29'–30°04'N	Subtropical broad-leaved evergreen forest and rare animals	
Jiulianshan NR (JLS)	134.12	114°27'–114°29'E 24°31'–24°39'N	Subtropical broad-leaved evergreen forest and wild animals and plants	
Jiulingshan NR (JLS1)	115.41	115°03'–115°24'E 28°49'–29°03'N	Mid-subtropical broad-leaved evergreen forest, rare wild animals and plants	
Lushan NR (LS)	304.52	115°52'–116°08'E 29°26'–29°41'N	The forest ecosystem of mid-subtropical areas	
Matoushan NR (MTS)	138.67	117°09'–119°9'E 27°40'–27°53'N	Subtropical broad-leaved evergreen forest and rare animals	
Nanjishan NR (NJS)	333	116°10'–116°25'E 28°52'–29°06'N	Swans and geese wetland habitat	
Poyang Lake NR (PYL)	224.00	115°47'–116°45'E 28°22'–29°45'N	Rare birds and wetland habitat	
Qiyunshan NR (QYS)	171.05	113°45'–114°07'E 25°41'–25°54'N	<i>Fokienia hodginsii</i> and other subtropical broad-leaved evergreen forests	
Wuyishan NR (WYS)	160.07	117°39'–117°55'E 27°48'–28°00'N	Mid-subtropical broad-leaved evergreen forest and rare animals and plants	
Yangjifeng NR (YJF)	109.46	117°11'–117°28'E 27°51'–28°2'N	<i>Amolops ricketti</i> and giant spiny frog and other amphibians, subtropical broad-leaved evergreen forest	
Yihuang NR (YH)	169.3	116°7'–116°10'E 27°9'–27°20'N	Chinese merganser	Provincial
Yunjushan NR (YJS)	248.0	115°33'–117°37'E 29°02'–29°07'N	The ecosystem of mid-subtropical broad-leaved evergreen forest	

egorizing the area. A similarity measure was conducted based on presence (1) or absence (0) of each species in each NR. All analyses were performed using PRIMER 5.0 software.

## Results

### Fish composition

146 freshwater fish species in the NRs were recorded, belonging to 7 orders, 26 families, accounting for 64.6% of the total species in Jiangxi Province (Huang & Wu 2010a), see Table 2. The Cyprinidae family was the most dominant family with 103 species (69.59%), followed by Siluriformes with 23 species (15.5%) and Perciformes with 18 species (12.33%). There was 1 species each in the orders of Beloniformes, Clupeiformes, Salmoniformes, Synbranchiformes. *Opsariichthys bidens* and *Pseudorasbora prava* were present in 13 nature reserves; *Misgurnus anguillicaudatus*, *Zacco platypus*, *Acrossocheilus parallens* and *Carassius auratus* were discovered in 12 nature reserves. However, about 59 fish species, such as *Neosalanx taihuensis*, *Oreonectes platycephalus*, appeared only in one of the 14 nature reserves (Table 3, see at the end of the article).

### Fish diversity in the NRs of Jiangxi Province

Data were obtained of F-index, G-index, G-F index data and the fish composition in the 14 nature reserves (Table 4). The table shows that the F-index, G-index and G-F index in Poyang Lake NR is the largest, 10.72, 3.746 and 0.651 respectively, followed

by the indices of Nanjishan NR at 9.466, 3.707 and 0.608. The fish fauna in Poyang Lake NR and Nanjishan NR owes much to migrating fish in the Yangtze River. For the family level, Guanshan NR and Lushan NR have a lower value; and Ganjiangyuan NR scored the lowest value (2.022). Guanshan NR has the lowest value (1.946) at the genus level and only 7 species (belonging to 7 genera) captured there. The number of fish species decides the family and genus diversity level, the more fish gained, the larger the change in F-index, G-index and G-F index (Shi et al. 2010). The G-F index of Yangjifeng NR is  $-0.014$ , that of Qiyunshan NR, Ganjiangyuan NR and Lushan NR is also negative ( $-0.036$ ,  $-0.0328$  and  $-0.363$ ). The main reason is that single genera and families make up a larger proportion in these four NRs. They failed to make a contribution to the F-index, which makes the  $F < G$ , leading to a negative G-F index value, and suggests that the diversity of family is greater than that of genus (Liu et al. 2004).

### Relationship between species, area and latitude

To analyse whether there is a similar discipline in the 14 NRs, we arranged Yihuang NR, Yunjushan NR, Yangjifeng NR, Guanshan NR, Jiulingshan NR, Jiulianshan NR, Matoushan NR, Wuyishan NR, Qiyunshan NR, Jinggangshan NR, Poyang Lake NR, Lushan NR and Nanjishan NR by area and obtained a scatter plot by comparing areas and species (Figure 2). The result shows that the fish species increased with the size of the area in the 14 NRs. However, there is

Table 2 – The fish composition of 14 nature reserves.

Nature reserves (NR)	Families	Genera	Species
Ganjiangyuan NR	8	15	16
Guanshan NR	2	7	7
Jinggangshan NR	12	31	38
Jiulianshan NR	6	14	36
Jiulingshan NR	12	33	39
Lushan NR	8	17	17
Matoushan NR	8	25	34
Nanjishan NR	14	43	58
Poyang Lake NR	14	46	72
Qiyunshan NR	9	19	20
Wuyishan NR	9	31	36
Yangjifeng NR	9	17	18
Yihuang NR	7	22	25
Yunjushan NR	5	15	17

a larger difference in the last three points. The water area of Poyang Lake NR and Nanjishan NR occupies a larger proportion than that of the other 11 NRs, whereas the land area of Lushan NR is a main part. There is a close relationship between fish species and water area.

In descending order of latitude, the 14 NRs can be ordered as follows: Lushan NR, Poyang Lake NR, Jiulingshan NR, Yunjushan NR, Nanjishan NR, Guanshan NR, Wuyishan NR, Yangjifeng NR, Matoushan NR, Yihuang NR, Jinggangshan NR, Ganjiangyuan NR, Qiyunshan NR and Jiulianshan NR (Figure 3). The graph shows that species numbers increase with latitude. The anomaly was caused by the area and the location of sample points.

### Clustering analysis

In the present study, the clustering shows that the fish fauna in the 14 NRs may be divided into five regions (Figure 4). The first region include Nanjishan NR and Poyang Lake NR: With Nanjishan NR located south of Poyang Lake NR, migratory fish account for 40% of all fish and the lakes taking in & sending out waters of Nanjishan NR belong to Poyang Lake NR (Hu et al. 2011). The second and third groups are Guanshan NR and Matoushan NR. In the division of the world zoogeography, China belongs to the

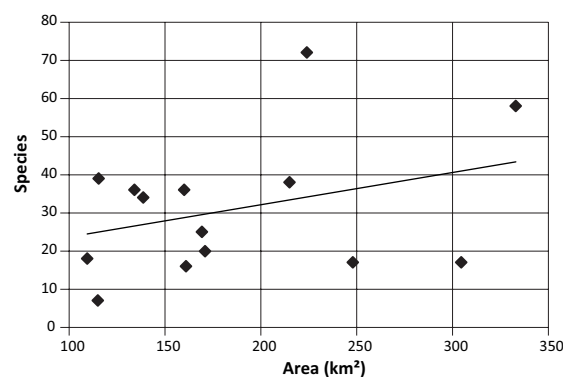


Figure 2 – The relation of fish species to area.

Table 4 – Fish diversity indices in the 14 nature reserves of Jiangxi Province.

Nature reserves (NR)	F-index	G-index	G-F index
Ganjiangyuan NR	2.022	2.686	-0.328
Guanshan NR	2.079	1.946	0.064
Jinggangshan NR	4.009	3.355	0.163
Jiulianshan NR	4.398	3.352	0.238
Jiulingshan NR	5.362	3.379	0.370
Lushan NR	2.079	2.833	-0.363
Matoushan NR	5.81	3.169	0.455
Nanjishan NR	9.466	3.707	0.608
Poyang Lake NR	10.72	3.746	0.651
Qiyunshan NR	2.715	2.813	-0.036
Wuyishan NR	6.75	3.391	0.498
Yangjifeng NR	2.773	2.813	-0.014
Yihuang NR	3.429	2.997	0.126
Yunjushan NR	2.773	2.588	0.067

Oriental and the Palearctic regions. The fourth region includes Jiulianshan NR and Wuyishan NR, which belong to a mixture of the Oriental and Palearctic regions. Jiulianshan NR lies at the source of Ganjiang River and Wuyishan NR lies upstream of Xinjiang River (Jiang & Ji 1999). Lushan NR, Yunjushan NR, Yihuang NR, Yangjifeng NR, Ganjiangyuan NR, Qiyunshan NR, Jinggangshan NR and Jiulingshan NR belong to the fifth region. Yunjushan NR and Lushan NR are located in the Mufu Mountains. Yihuang NR, Yangjifeng NR and Ganjiangyuan NR belong to the Wuyi Mountains. Qiyunshan NR, Jinggangshan NR and Jiulingshan NR belong to Luoxiao Mountains and those points belong to the Oriental region, the southeast Asiatic subregion and the East China area (Liu & Fang 2001; Liu & Fu 2006; Huang et al. 2008; Huang & Wu 2008; Li et al. 2008; Hu et al. 2009; Huang & Wu 20010b; Guo et al. 2011; Zhou et al. 2013; Hu et al. 2014a, b; Yang et al. 2015).

### Discussion

Contrary to the ecological diversity, the genus and family diversity can be evaluated by the catalogue of plants and animals and DG-F (Huang & Liu 2011).

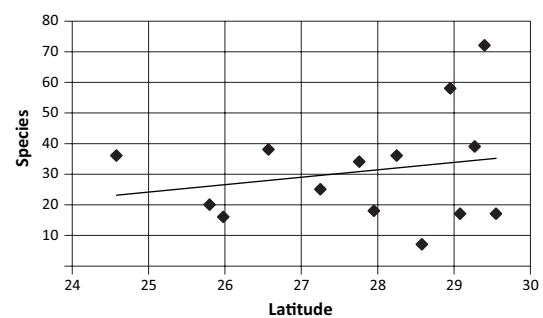


Figure 3 – The relation of fish species to latitude.

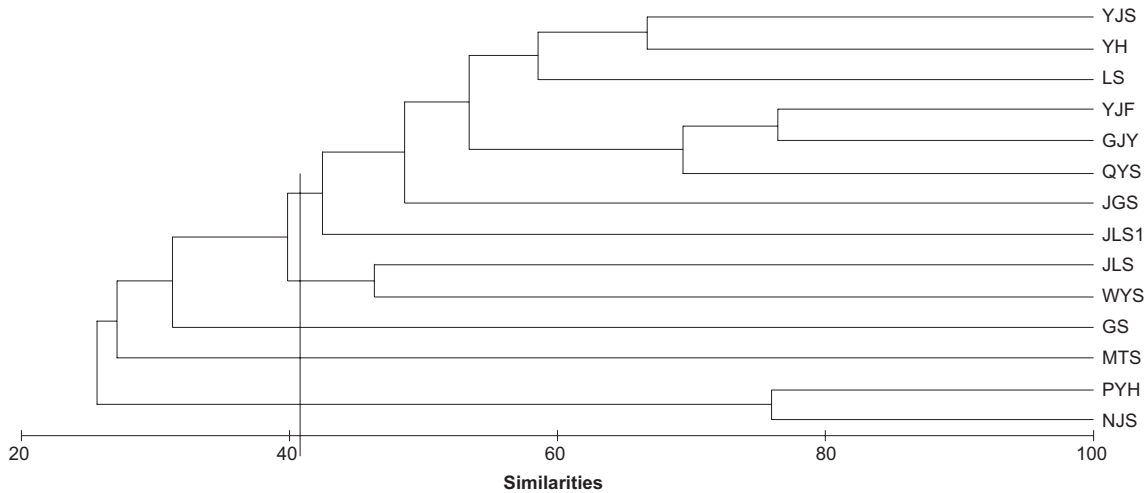


Figure 4 – The classification of the 14 nature reserves.

The study shows that the DG, DF and DG-F will score high with more fish species and distribute relatively evenly between genus and family (i. e. Nanjishan NR and Poyang Lake NR). The traditional biodiversity measure is embodied by the diversity of species, but the G-F index appears in the diversity of genus and family and reflects the overall level of diversity of any community (Zhang et al. 2002). The G-F index can be applied to study the biodiversity where there are no specific fish catches and a large working range.

Species-to-area is usually used to describe and evaluate the biodiversity (Amarasinghe & Welcomme 2002; Yao et al. 2013). The relationship between species and area has been used in fish ecology in recent years whereas it was at first used to study plant diversity. The similar relationship is that the species richness changes with the increase of habitat area and declines with increasing latitude (Fu et al. 2003). Existing studies for vertebrates in Asia, America, Africa and Europe show that species will be reduced by 2.7% with each added degree of altitude (Zhang 1995). In this study a significant interaction between area and species can be found in a small area but a completely opposite conclusion in the relationship of latitude and species.

In the division of the world zoogeography, China belongs to the Oriental and Palearctic regions. With the distribution of fish species, the Oriental Region can be divided into a south-east Asiatic subregion and a south Asiatic subregion. The south-east Asiatic subregion is divided into an East China area and a South China area. The unique geographical position and river system have a great effect on fish species in Jiangxi Province. In geographical terms, most NRs are located in the East China area of the south-east Asiatic subregion and in the Oriental Region and can be reduced to a group. The high similarity of species between Poyang Lake NRs and Nanjishan NRs is not only reflected in geographical positions and environment, but also embodied by the larger proportion of migratory fish and population and gene exchange. We attribute the

main reason for such abnormality of two points to the fact that the water areas of Poyang Lake NR and Nanjishan NR are much larger than others and connected to the Yangtze River.

Worldwide, freshwater fish are the most diverse of all vertebrate groups and there may be some difference between reserve and non-reserve (Jang et al. 2003; Lawrence et al. 2015; Kwick & Yeo 2015). Of a total of 229 freshwater fish species recorded throughout Jiangxi Province, about 146 species (63.7%) are found in the 14 NRs. The fish species of Guanshan NR, Lushan NR and Jiulingshan NR (44 species) make up 46.8% of the total of those in the north-west of Jiangxi Province (94 species). Wuyishan NR, Matoushan NR and Yangjifeng NR have 65 species and account for 50.8% of the species in the north-east of Jiangxi Province (128 species). Nanjishan NR and Poyang Lake NR have 80 species and account for 58.8% of the Poyang Lake. The NRs contain various freshwater types, including stream fish (*Opsariichthys bidens*, *Zacco platypus* et al.) and migratory fish (*Ctenopharyngodon idellus*, *Carassius auratus* et al). Those data suggest that the NRs in Jiangxi Province are very important for freshwater fish diversity and conservation in Jiangxi Province, especially for the endemic Chinese species: 131 endemic species were collected from Poyang Lake Basin (Huang et al. 2013).

We compared the fish of the 14 NRs and divided them into 3 types. In most NRs with many mountains, high altitude and rapid streams (Yunjushan NR, Yangjifeng NR, Guanshan NR, Jiulingshan NR, Jiulianshan NR, Matoushan NR, Wuyishan NR, Qiyunshan NR, Jinggangshan NR, Lushan NR), *Opsariichthys bidens*, *Zacco platypus* and *Acrossocheilus parallens* are the most dominant species. In Nanjishan NR and Poyang Lake NR, with many lakes and swift-moving streams, *Cyprinus carpio* and *Carassius auratus* (dominant species) were found. *Acanthorhodeus chankaensis* and *Abbottina rivularis* (common species) were found in Yihuang NR and are preyed on by Chinese merganser.

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Species	GJY	GN	JGS	JLS	JLS1	LS	MTS	NJS	PYL	QYS	WYS	YJF	YH	YJS
(5) Danioninae														
<i>Opsarichthys bidens</i>	+	+	+	+		+	+			+	+	+	+	+
<i>Zacco platypus</i>	+	+	+	+		+	+			+		+	+	+
(6) Gobioninae														
<i>Abbottina liaoningensis</i>														
<i>Abbottina rivularis</i>			+			+			+		+		+	+
<i>Coreius heterodon</i>									+					
<i>Gnathopogon taeniellus</i>				+										
<i>Gnathopogon imberbis</i>	+					+						+	+	
<i>Hemibarbus maculatus</i>		+		+		+			+		+			
<i>Hemibarbus umbrifer</i>														
<i>Hemibarbus laneo</i>			+	+							+			
<i>Huigobio chenhsienensis</i>							+							
<i>Huigobio chinssuensis</i>							+							
<i>Microphysogobio kiatingensis</i>				+							+			
<i>Microphysogobio fukiensis</i>				+										
<i>Paracanthobrama guichenoti</i>									+					
<i>Pseudorasbora parva</i>	+	+	+	+		+			+	+	+	+	+	+
<i>Pseudogobio guilinensis</i>				+										
<i>Pseudogobio vaillanti</i>							+				+		+	
<i>Rhinogobio typus</i>			+						+				+	
<i>Sarcocheilichthys sinensis</i>									+					
<i>Sarcocheilichthys kiangsiensis</i>			+										+	
<i>Sarcocheilichthys parvus</i>			+					+	+				+	
<i>Sarcocheilichthys nigripinnis</i>														
<i>Saurogobio gracilicaudatus</i>							+							
<i>Saurogobio gymnocheilus</i>									+					
<i>Saurogobio dumerili</i>									+					
<i>Saurogobio dabryi</i>			+						+				+	
<i>Squalidus argentatus</i>			+						+				+	
<i>Squalidus wolterstorffi</i>									+					
<i>Squalidus atromaculatus</i>														
(7) Gobiobotinae														
<i>Gobiobotia tungi</i>				+										
<i>Gobiobotia filifer</i>									+					
(8) Hypophthalmichthyinae														
<i>Aristichthys nobilis</i>									+		+			
<i>Hypophthalmichthys molitrix</i>									+		+			
(9) Leuciscinae														
<i>Ctenopharyngodon idellus</i>				+					+	+	+			+
<i>Elopichthys bambusa</i>									+					
<i>Mylopharyngodon piceus</i>									+		+			
<i>Rhynchocypris lagowskii</i>							+							
<i>Rhynchocypris oxycephalus</i>						+								+
<i>Squaliobarbus curriculus</i>									+					
(10) Xenocyprinae														
<i>Distoechodon tumirostris</i>											+			
<i>Pseudobrama simoni</i>									+					
<i>Xenocypris davidi</i>									+		+			
<i>Xenocypris argentea</i>									+					
5) Homalopteridae														
(1) Gastromyzoninae														
<i>Crossostoma stimata</i>	+													
<i>Liniparhomaloptera disparis</i>							+							
<i>Pseudogastromyzon changtingensis</i>										+				
<i>Pseudogastromyzon fasciatus</i>							+							
<i>Preaformosania lineata</i>				+										
<i>Pseudogastromyzon changtingensisitungpeiensis</i>			+	+							+			
<i>Vanmanenia pingchowensis</i>	+		+							+		+		
<i>Vanmanenia stenosoma</i>		+	+				+			+				
<i>Vanmanenia xinyiensis</i>	+													
<i>Vanmanenia hainanensis</i>				+										
<i>Vanmanenia caldwelli</i>			+											
<b>Perciformes</b>														
6) Belontiidae														
<i>Macropodus opercularis</i>				+										
<i>Macropodus chinensis</i>	+			+						+		+	+	

Species	GJY	GN	JGS	JLS	JLS1	LS	MTS	NJS	PYL	QYS	WYS	YJF	YH	YJS
7) Channidae														
<i>Channa maculate</i>				+										
<i>Channa argus</i>						+			+					
<i>Channa asiatica</i>				+										
8) Eleotridae														
<i>Odontobutis obscurus</i>			+						+					
9) Gobiidae														
<i>Rhinogobius giurinus</i>			+	+		+	+		+		+	+	+	+
<i>Rhinogobius duospilus</i>														
<i>Rhinogobius cliffordpopei</i>	+		+				+			+		+	+	+
10) Mastacembelidae														
<i>Mastacembelus armatus</i>				+										
<i>Mastacembelus sinensis</i>			+						+					
11) Odontobutidae														
<i>Micropercops cinctus</i>				+			+		+					
<i>Odontobutis sinensis</i>													+	
12) Serranidae														
<i>Coreosiniperca roulei</i>									+					
<i>Siniperca chuatsi</i>			+						+		+			
<i>Siniperca scherzeri</i>									+					
<i>Siniperca undulata</i>				+										
<i>Siniperca kneri</i>									+					
<b>Salmoniformes</b>														
13) Salangidae														
<i>Neosalanx taihuensis</i>									+					
<b>Siluriformes</b>														
14) Amblycipitidae														
<i>Liobagrus anguillicauda</i>			+			+						+		
<i>Liobagrus nigricauda</i>									+					
<i>Liobagrus marginatus</i>							+							
15) Bagridae														
<i>Mystus macropterus</i>			+				+				+			
<i>Leiocassis crassilabris</i>									+					
<i>Leiocassis truncatus</i>							+							
<i>Pelteobagrus fulvidraco</i>			+			+	+		+			+	+	
<i>Pelteobagrus eupogon</i>									+				+	
<i>Pelteobagrus nitidus</i>									+					
<i>Pelteobagrus vachelli</i>									+					
<i>Pelteobagrus ussuriensis</i>			+				+							
<i>Pseudobagrus tenuifurcatus</i>							+							
<i>Pseudobagrus pratti</i>			+				+							
<i>Pseudobagrus truncatus</i>				+			+							
<i>Pseudobagrus ondon</i>	+		+									+		
<i>Pseudobagrus tenuis</i>														
<i>Pseudobagrus emarginatus</i>														
16) Clariidae														
<i>Clarias fuscus</i>	+			+			+			+	+	+		
17) Sisoridae														
<i>Glyptothorax sinense</i>			+								+			
<i>Glyptothorax fokiensis</i>				+							+			
18) Siluridae														
<i>Silurus cochinchinensis</i>				+										
<i>Silurus asotus</i> Linnaeus			+	+		+			+	+	+	+		+
<i>Silurus meridionalis</i>									+					
<b>Synbranchiformes</b>														
19) Synbranchidae														
<i>Monopterus albus</i>	+		+	+		+			+	+	+		+	+