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金沙江流域鱼类

FISHES IN THE JINSHA JIANG RIVER BASIN, THE UPPER REACHES OF THE YANGTZE RIVER, CHINA

张春光　杨君兴　赵亚辉　潘晓赋　等◎编著

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金沙江上游玉树江段

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内 容 简 介

本书是金沙江下游乌东德水电站建设水生生态环境影响评价、国家科技基础性工作专项、中国长江三峡集团有限公司重点研究专项和生态环境部生物多样性调查评估等的综合研究成果。全书分为总论和各论两部分：总论部分主要论述了金沙江流域的基本概况，包括自然地理概况、鱼类物种多样性及其研究历史、鱼类多样性与区系分析、鱼类分布格局和资源现状及评价，以及鱼类物种多样性保护和恢复建议；各论部分共记述金沙江流域所产鱼类 200 种（包括 3 新种）或亚种，其中土著种 178 种，包括 7 目 17 科 79 属，外来种 22 种，按分类系统对区域内全部已知鱼类进行了详细论述，每种记述内容包括学名引证、实体照片、主要形态特征、生活习性及经济价值、资源现状和分布等。

本书适合从事相关研究的科研工作者和学生、从事渔业渔政管理和资源保护工作的人员，以及社会上对生物资源保育有兴趣的人士等阅读参考，也适合图书馆馆藏。

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具体分工

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总论　第八章

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鲟形目 Acipenseriformes
鳗鲡目 Anguilliformes
鲤形目 Cypriniformes 中的胭脂鱼科 Catostomidae 和鲤科 Cyprinidae
胡瓜鱼目 Osmeriformes
鳉形目 Cyprinodontiformes
颌针鱼目 Beloniformes
合鳃鱼目 Synbranchiformes
鲈形目 Perciformes

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鲤形目 Cypriniformes 条鳅科 Nemacheilidae 中的副鳅属 *Homatula*、南鳅属 *Schistura*（部分种）及沙鳅科 Botiidae 和花鳅科 Cobitidae

杜丽娜　杨君兴

鲤形目 Cypriniformes 条鳅科 Nemacheilidae 中的云南鳅属 *Yunnanilus*、高原鳅属 *Triplophysa* 和球鳔鳅属 *Sphaerophysa*

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条鳅科 Nemacheilidae 南鳅属 *Schistura* 中的牛栏江南鳅 *S. niulanjiangensis* 和似横纹南鳅 *S. pseudofasciolata*

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爬鳅科 Balitoridae 原缨口鳅属 *Vanmanenia* 中的拟横斑原缨口鳅新种 *V. pseudostriata* Zhu，Zhao，Liu *et* Niu，sp. nov.

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Acipenseriformes
Anguilliformes
Catostomidae and Cyprinidae in Cypriniformes
Osmeriformes
Cyprinodontiformes
Beloniformes
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Balitoridae in Cypriniformes

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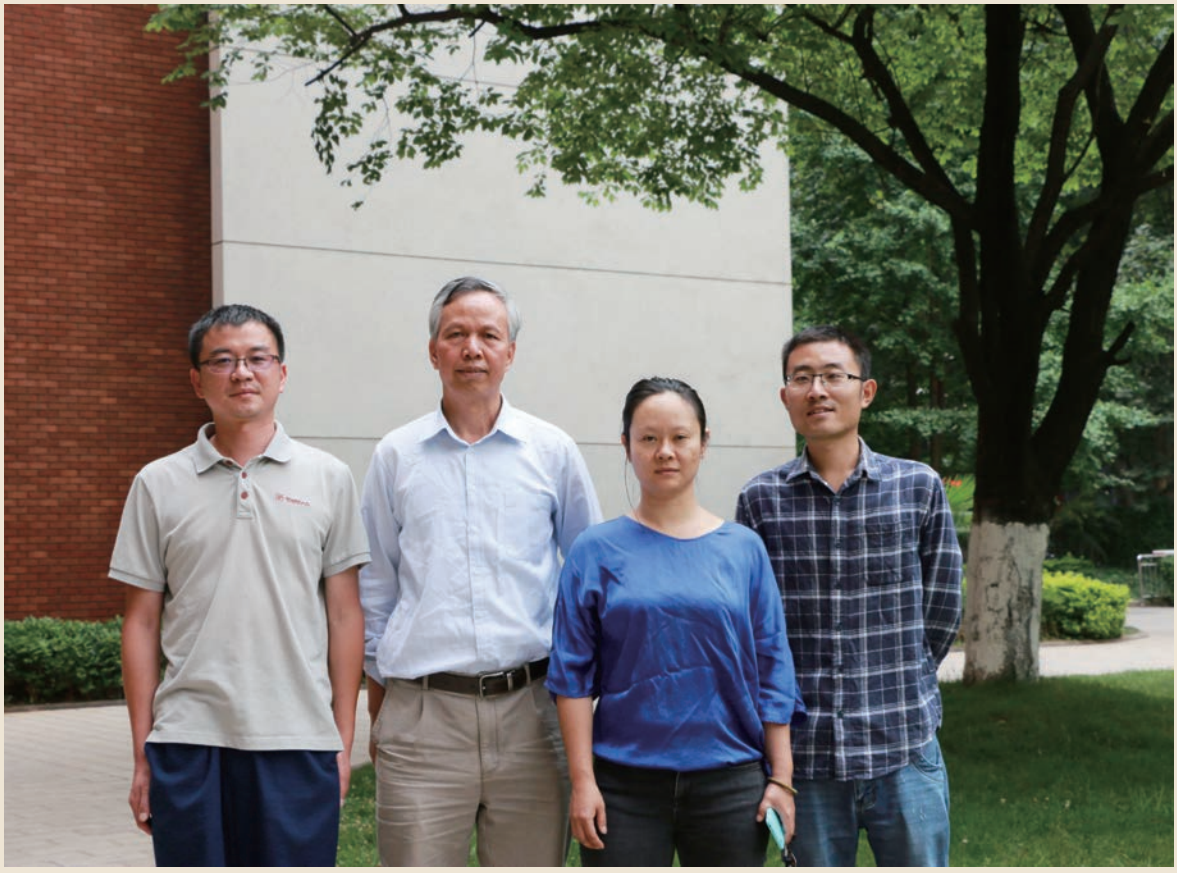

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前言

近几十年来，随着我国社会、经济的快速发展，人们的生活水平显著提高。但同时受生产、生活等水平急速提升的影响，自然资源也被不合理或过度地开发利用，导致在一些地区人们的生存环境急剧恶化，大量生物物种的生存受到威胁，或资源量显著下降，或面临灭绝的危险甚至已灭绝。因生物多样性丧失引发的生态危机，使人们越来越意识到在经济、社会的可持续发展中，生物多样性保护和生境维护的重要性，生物多样性保护目前已经是人们普遍关注的热点问题之一。

生物多样性包括物种多样性、遗传多样性与生态系统多样性三个层次，物种多样性既是遗传多样性的载体，又是生态系统多样性的组成部分，是生态系统中最关键的基础环节，所以对物种多样性的深入了解和认识具有最重要的意义。在保护物种多样性的过程中，我们通常选择生物多样性高的地区进行优先保护，因为这样可以以有限的资源保护更多的物种。

金沙江是我国第一大河长江的上游，人们通常将青海省玉树市直门达接纳巴塘河的汇口至四川省宜宾市接纳岷江的汇口之间的江段称为金沙江，并以石鼓和攀枝花为界将金沙江分为上游、中游和下游。金沙江全长约为 2300km，占长江总长度的 36.51%；总落差约为 3300m，占长江总落差的 56.90%，蕴藏着极为丰富的水能资源。

金沙江上游段位于我国横断山区，该区生物多样性特有程度高，且被认为是全球 34 个生物多样性热点地区之一（Myers et al.，2000）；中、下游段逐渐进入干热河谷地区，相对于上游来说落差较小、水流变缓，尤其在新市镇以下，原狭窄的江面陡变宽阔，水文条件发生明显变化。纵观整个金沙江流域，其地理位置特殊、地势地形复杂、江水流态多变、气候多样，如此的生境孕育了多样性的鱼类。鱼类与其他生物类群相比有明显的特殊性，它们的生存离不开水，严格按照水系分布，所以它们的分布格局通常也能反映历史上水生生境的变迁。

另外，我国的传统能源一直以来都是以煤、油、气为主。目前，煤、油、气产业在实际生产过程中带来严重污染，二氧化碳等“温室气体”排放量巨大。而我国水能资源蕴藏量丰富，且水能又是一种清洁的可再生的能源，所以近年来我国在能源结构调整过程中加大了对水能资源的利用。预计在未来的几十年内，水能资源开发在我国能源开发过程中将始终保持重中之重的地位。根据 2003 年《全国水力资源复查成果》，金沙江流域（含通天河）水力资源理论蕴藏量为 121 022.9MW，约占全国水力资源理论蕴藏量的 1/6，技术可开发容量为 119 647.5MW，年发电量

为 5926.78 亿 kW·h，经济可开发容量为 102 982.4MW，年发电量为 5130.57 亿 kW·h。

金沙江流域是国家规划的 13 个重要能源基地之一，在我国能源资源建设中具有重要的战略地位，但大规模的水电建设显著影响水生生态环境。河流作为一个完整的生态系统，最大的特点是连通性与流动性，水电建设中大坝的阻拦作用直接改变了这两大特征。大坝建成后，原始急流险滩的河流环境变成了水流趋缓的河道型水库环境，水生生态环境趋于单一，水体的透明度、温度等其他水文条件也会随之发生改变，同时特别在一些高坝下还会出现气体过饱和等问题。这些变化将使得原有的鱼类区系及分布格局发生明显甚或彻底的改变：适合急流生活、产漂流性卵等的鱼类资源量会减少甚至逐渐消失，如原来在干流中占据主导地位的圆口铜鱼 *Coreius guichenoti*、长鳍吻鮈 *Rhinogobio ventralis*、长薄鳅 *Leptobotia elongata*、中华金沙鳅 *Jinshaia sinensis*、白缘𩷶 *Liobagrus marginatus* 等种群数量将会明显下降，甚至可能在一些工程河段消失；而适应缓流或静水生活的鱼类可能逐渐取代原自然河流里的种类，如鲫 *Carassius auratus*、䱗 *Hemiculter leucisculus*，甚至一些外来物种如虾虎鱼类 Gobiidae、银鱼类 Salangidae、鳑鲏类 *Rhodeus*、棒花鱼 *Abbottina rivularis*、麦穗鱼 *Pseudorasbora parva* 等。在区域内水电开发如火如荼地进行的大背景下，鱼类资源特别是土著鱼类资源的持续衰退，外来鱼类资源量急剧增加等已成为不争的事实。在我国，对由水电开发造成的水生生物特别是鱼类资源的破坏也存在一定的补偿机制，最直接的是在拦河大坝工程中修建过鱼通道、在工程影响区域设立增殖放流站以补偿当地鱼类资源，以及建立自然保护区以保护栖息地环境及土著鱼类资源等。但目前在对金沙江流域鱼类物种多样性与分布格局了解认识尚不够清楚的情况下，可以说，对鱼类资源保护所采取的一些措施成效十分有限。

综上，金沙江流域原本就地处全球生物多样性研究热点之一的横断山区，加之目前全国大力进行水电开发，现在已成为热点研究区域。从目前收集的资料看，有关金沙江流域鱼类的研究多为 20 世纪 90 年代或以前的工作，尤其缺少近年来关于金沙江流域鱼类物种多样性和分布格局等较为深入或系统的研究。

本项工作立足于提供金沙江流域鱼类完整名录（编目）和较详尽的分布格局及资源状况等信息，为金沙江流域鱼类多样性研究提供重要的基础数据，对区域内鱼类资源保育及水电建设规划等具有现实意义。

2008 年以来，我们先后开展了至少 10 次涉及整个金沙江流域的系统的野外调查和标本采集，先后有近 40 人次参加野外工作。野外调查采集范围覆盖金沙江干流及主要支流，野外调查采集时间涵盖了丰水期、枯水期和平水期，总计设采样点近 200 个。在野外工作过程中根据不同水文环境特点选择不同的采集工具和采样方式，如挂网、手撒网、地笼等，干流深水区的采集主要依靠当地渔民或租赁船只协助；为了采集到更多的样品、获取相关信息等，工作过程中还走访了大量

当地渔民及鱼市场、餐馆等，先后到多家相关科研院所检视馆藏标本。综合上述工作，共计采集和整理馆藏涉及金沙江流域的鱼类标本实物超过 13 000 号。特别需要说明的是，由于金沙江流域绝大部分河段海拔为 3000~4000m 甚至更高，属于高山峡谷地形，以致很多地方交通不便，甚至人迹罕至，参加野外工作的人员经常会有缺氧和高山反应。野外工作期间，为了使野外调查采集更具有代表性，参加野外工作的人员克服重重困难，努力工作；尤其在深入藏区调查采集时，藏族群众保护水生生物的意识非常强烈，通常是绝对禁止捕鱼的，需要深入沟通。但也正是这些充满危险的大规模的野外实地调查和标本采集、整理、鉴定等，为我们完成好本项工作奠定了坚实的基础。

本项工作进行期间，先后得到了长江水资源保护科学研究所（2008~2014 年）、国家科技基础性工作专项（2012~2014 年）、中国长江三峡集团有限公司（2014~2016 年）和中国环境科学院（2016~2017 年）等单位的大力支持。特别是中国长江三峡集团有限公司科技与环境保护部孙志禹博士、陈永柏博士、李翀博士、李媛博士等对我们工作的完成给予了不可或缺的具体指导和帮助；云南省曲靖市水产站卢玉发站长、卢宗民副站长和卯卫宁高级工程师在我们野外调查期间给予了大量实际帮助，协助我们采集了大量标本，并具体参与了部分写作工作；四川省农业科学院水产研究所所长杜军研究员在我们野外工作期间，为我们检视鱼类标本提供方便，派人协助我们野外实地调查采集标本等；中国科学院水生生物研究所刘焕章研究员安排我们参观学习野外圆口铜鱼养殖基地，交流相关信息；中国科学院水生生物研究所谭德清先生提供了珍贵的石鼓大拐弯环境照和软刺裸裂尻鱼的生物学信息、资料等；中国科学院水生生物研究所曹亮博士协助我们拍摄鱼类标本照片；四川大学宋昭彬教授提供所在单位馆藏标本检视；西南林业大学周伟教授提供资料信息；集美大学康斌教授和台湾“清华大学”曾晴贤教授参加了我们的野外工作；四川农业大学、湖南省水产科学研究所和中国长江三峡集团有限公司中华鲟研究所等有关领导、同仁为我们进行标本检视提供方便；中国科学院动物研究所李高岩博士（现在广西壮族自治区贺州市发展和改革委员会工作）、邢迎春博士（现为中国水产科学研究院副研究员）、伍玉明女士、刘海波先生，以及陈熙、宋小晶、韩松林、张天赐、岳兰、李飞、马鸿毅等参加了部分野外工作。在野外调查期间，还得到很多地方县、乡、镇甚至村干部及群众特别是少数民族干部、群众、宗教界人士等对我们工作的理解和支持，使我们的野外调查得以比较顺利地开展。本项工作的完成离不开他们的支持和帮助，在此一并致以最诚挚的谢意！

本书由中国科学院动物研究所和中国科学院昆明动物研究所合作完成（具体分工见编写单位及人员分工）。分工编写完成后，由中国科学院动物研究所张春光研究员和赵亚辉副研究员负责统稿、修改、完善、定稿等，甚至包括一些前期编辑、排版等工作，牛诚祎同学协助做了大量基础

数据的核对、整理等。尽管我们有强烈意愿也付出了巨大努力，希望能把此项工作尽可能做到最好，但由于主、客观原因，难免会有不足之处。主观上，我们水平所限。客观上，在实际工作中，我们深刻体会到，尽管前人在区域鱼类资源调查研究方面做了不少工作，但一些区域代表类群 [裂腹鱼类、鳅类（高原鳅类和沙鳅类）、鲃类等] 的基础分类学研究仍存在着十分突出的问题，不少物种鉴定起来十分困难，我们也很希望能进行更深入的研究。由于多种原因，中国鱼类经典分类学日渐式微，尽管新手段、新方法和新学科的蓬勃发展有助于深入理解鱼类的分类、演化、分布规律、动物地理学等科学问题，但诚如本书所展示的中国鱼类资源和本底调查等的基础研究，对于鱼类资源现状及保护、资源利用等关乎国计民生的问题，仍有十分重要的价值和意义。我们在调查过程中亦收集了相当多数量的能够反映资源现状的珍贵标本，需要永久保存以备后查。较长时间以来，所在单位工作考核评价机制鼓励的是如分子生物学这样的微观方面的工作，而采用宏观手段进行研究的经典分类学这样的基础性工作，基本上少予绩效；鱼类标本馆也已多年缺少专职或专业对口的标本管理人员，大量野外调查采集的标本堆放在标本馆内，不能正常入馆进行科学保管，标本损坏很难避免，影响了标本采集、整理、鉴定等工作的深入开展。

由衷希望有关方面能够高度重视像鱼类分类学这样的基础性研究。同时，也真诚希望今后会有对此项工作感兴趣的同仁能做出更深入的研究，盼望能有更好的工作成果。

张春光

2017 年 10 月于中国科学院动物研究所

Preface

In recent decades, along with the rapid social and economic development of China, people's living standards have improved significantly. At the same time, natural resources are used improperly or exploited excessively. As a result, environment has deteriorated sharply, and resources have decreased dramatically in some regions. Meanwhile a large number of species have been threatened and some of them went extinct. The ecological crisis caused by loss of biodiversity has made people more and more aware of the importance of biodiversity conservation and environment maintenance during the sustainable development of economy and society. Biodiversity conservation has now become one of the hot issues of people's common concern.

Biodiversity includes species diversity, genetic diversity and ecosystem diversity. Species diversity is not only the carrier of genetic diversity, but also the part of ecosystem diversity. It is the most critical basis in ecosystem. Therefore, a thorough understanding and knowledge of species diversity is of most important significance. In the process of species diversity protection, areas with high biodiversity are usually chosen as priorities so we can protect more species with limited resources.

The Jinsha Jiang is the upstream of the Yangtze River, the longest river in China. It is generally considered the part from Zhimenda in Yushu City, Qinghai Province where the Batang River meets to Yibin City, Sichuan Province where Minjiang River joins the Yangtze River. The Jinsha Jiang is divided into the upper stream, middle stream and lower stream by Shigu Town and Panzhihua City. The Jinsha Jiang stretches approximately 2,300km, accounting for 36.51% of the total length of the Yangtze River, and the water drop is about 3,300m, accounting for 56.90% of the Yangtze River. This part contains abundant hydropower resources.

The upstream of the Jinsha Jiang is located in the Hengduan mountainous region in China, where is one of the global hotspot of biodiversity with high species endemism. The middle and lower streams are gradually into the dry-hot valley region where the water drop is getting smaller. Especially below Xinshi Town, the original narrow river abruptly becomes wide, and the hydrological conditions change significantly in accordance. Across the whole Jinsha Jiang, its special geographical location, complicated topography, variable river flow states and diverse climate make up such unique ecological environment that gives birth to the fish diversity. Compared with other organisms, fishes have obvious specialty. Their distribution is in strict accordance with water conditions. So their distribution patterns usually reflect the changes of the aquatic habitat in history.

In addition, our country's traditional energy has been mainly on coal, oil and gas. At present, the

coal, oil and gas industries have caused serious pollution in the process of practical production, and the emissions of greenhouse gases such as carbon dioxide are huge. At the same time, our country is rich in hydropower resources, and water energy is a kind of clean and renewable energy, so China has stepped up its use in the process of energy structure adjustment in recent years. It is expected that the development of hydropower resources will continuously remain a priority in the process of our country's energy development in the next few decades. According to the national "Water Resources Review Results" in 2003, the theoretical hydropower resource reserves of the Jinsha Jiang River Basin (including the Tongtian river) reaches 121, 022.9MW, which is about 1/6 of the national water resource reserves. The technical exploitation amount is 119, 647.5MW, and the annual generation capacity is 592.678 billion kW·h. The economic exploitation amount is 102, 982.4MW, with the annual generation amount is 513.057 billion kW·h.

The Jinsha Jiang River Basin is one of the 13 state planning important energy bases and it has an important strategic position in the energy resources construction of our country. However, the large-scale hydroelectric construction has significant effects on aquatic ecological environment. Rivers are a complete ecological system, whose greatest characteristics are connectivity and liquidity. But the blocking effect of the dams in hydroelectric construction has directly destroyed the characteristics. After the completion of the dam, the original environment of turbulent rivers and treacherous shoals has become the river-type reservoirs with slow-flowing channel type. The water ecological environment has become single. The transparency and temperature of the river, as well as other hydrological conditions will change accordingly. At the same time, especially in some high dams, there will cause problems like gas supersaturation. These changes will make the original fish fauna and distribution patterns change obviously or completely. The resources of the fishes that are suitable for turbulent life and lay floating eggs will be reduced or even disappear. For example, the populations of the predominant fishes in the original main stream, such as *Coreius guichenoti*, *Rhinogobio ventralis*, *Leptobotia elongata*, *Jinshaia sinensis*, *Liobagrus marginatus*, will decrease obviously, and will even vanish in the constructed river sections. And types of fishes such as *Carassius auratus, Hemiculter leucisculus*, and even including some alien species like Gobiidae, Salangidae, *Rhodeus, Abbottina rivularis, Pseudorasbora parva* which are adapted to slow water flow or still water life, may gradually replace those in the original natural rivers. Our country has a compensation system to reduce the damage to aquatic organisms, especially to fish resources, caused by hydropower development. The most direct way is to build the fish passages in the dam construction project, and establish the proliferation and flow discharging stations in the affected areas of the project to compensate the local fish resources. And nature reserves are also established to protect the habitats and indigenous fish resources. But at present, we can say, those measures to protect fish resources are ineffective on condition that our understanding of the fish species diversity and distribution pattern in the Jinsha Jiang River Basin is still unclear.

In conclusion, the Jinsha Jiang River Basin is located in Hengduan mountainous region, one of the global hotspots for biodiversity research. Combined with the large-scale national hydropower development,

it has now become a hot research area. According to the collected data, the fish research in the Jinsha Jiang River Basin was in the 1990s or before. And in recent years, there is insufficient research on the diversity and distribution of the fish species in the area.

This work is aimed at a complete list and detailed distribution pattern of the fishes in Jinsha Jiang River Basin. In order to provide important basic data for the study of fish diversity in the Jinsha Jiang River Basin, which is of practical significance for the protection of fish resources and the planning of hydropower construction in this region.

Since 2008, we have carried out field work and specimen collection at least 10 times in Jinsha Jiang Basin, and nearly 40 people have taken part in the field surveys. Our field work covers wet season, dry season and normal season. The nearly 200 sampling points cover stem stream and main tributaries of the Jinsha Jiang. In our field work, different collection tools and sampling methods are selected according to the different hydrological environment characteristics, such as hanging nets, casting nets, traps. In the stem stream deep-water areas, we mainly depend on local fishermen or rental vessels. In order to collect more samples and relevant information, we also visited local fishermen and fish markets. We constantly visited several related research institutes and reviewed their specimens. All together, over 13, 000 fish specimens were collected and processed. It is these large-scale fieldwork and a large quantity of specimens collected, processed, and identified that have laid a solid foundation for the completion of our work.

Duration of our research, we have gained great support in both project approval and funding from the Chang Jiang Water Resources Protection Institute (2008-2014), the State Science and Technology Basic Work Special Committee (2012-2014) and the Three Gorges Company (2014-2016). Especially Dr. Sun Zhiyu, Dr. Chen Yongbo and Dr. Li Chong as well as Dr. Li Yuan from the Science and Technology & Environmental Protection Department of the Three Gorges Company gave us guidance and help which is indispensable. Lu Yufa and Lu Zongmin, the directors of the Fishery Administration Station in Qujing City, Yunnan Province, and senior engineer Mao Weining gave a lot of practical help during our field research work, and helped us to collect a lot of fish specimens. During our fieldwork, Du Jun, the director and research professor at the Institute of Fisheries Research of Sichuan Province lent their precious fish specimens for us to study, and sent people to assist us in the field research and collecting fish specimens. Liu Huanzhang, the research professor at the Institute of Hydrobiology, Chinese Academy of Sciences, arranged for us to visit their *Coreius guichenoti* field base, and exchanged relevant information. Dr. Tan Deqing at the Institute of Hydrobiology, Chinese Academy of Sciences, offered us the rare photos of the environment at the first bending of the Yangtze River in Shigu Town and provided us the biological data and information of some indigenous fish. Professor Song Zhaobin of Sichuan University helped us to check the specimens deposited in their fish collection room; Our colleagues, Dr. Li Gaoyan (now deputy director of Hezhou Education Bureau, Guangxi Zhuang Autonomous Region), Dr. Xing Yingchun (now associate research professor at Chinese Aquatic Products Research Institute), Wu Yuming, Liu Haibo, and Chen Xi,

Song Xiaojing, Han Songlin, Zhang Tianci, Yue Lan, Li Fei, Ma Hongyi and Kang Bin (JiMei University in Xiamen) took part in the field works. Our work could not be completed without the contributions from the above units and leaders, colleagues, friends and students, and we would like to extend our heartfelt thanks to them all.

This book is a collaboration between the Institute of Zoology, Chinese Academy of Sciences and Kunming Institute of Zoology, Chinese Academy of Sciences (detailed division of writers attached). After the writing was completed, Zhang Chunguang, research professor and Dr. Zhao Yahui did the final summary, modification, polishing and finalization, etc.

Although we have a strong desire and made great efforts to do this work to our best, there may inevitably be mistakes or errors, due to our limited ability. We warmly welcome any comments and corrections from our colleagues and readers of this book.

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