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Zoological Research

Distribution and Length-weight Relationships of Glyptosternoid Fishes in the Drung River Basin, Yunnan

KONG De-ping[1,2], PAN Xiao-fu[1], YANG Jun-xing[1,*], CHEN Zi-ming[1]

(1. *Department of Systematic Zoology, Kunming Institute of Zoology, the Chinese Academy of Sciences, Kunming, Yunnan* 650223, *China*;
2. *Graduate School of Chinese Academy of Sciences, Beijing* 100039, *China*)

Abstract: Glyptosternoid fishes are a group of sisorid catfishes living in torrents of rivers mainly originating from the Qinghai-Tibet Plateau. Based on our survey in the Drung River Basin, seven collecting sites were investigated and 271 glyptosternoid fishes caught belong to three species (*Pareuchiloglanis kamengensis*, *Exostoma labiatum* and *Oreoglanis macropterus*). Features of the distribution of the three catfishes were assessed. More individuals of *E. labiatum* were caught in the lower reaches of the Drung River with fast water velocity and it might be more adapted to a torrent habitat. The relationships between standard length (L) and weight (W) for *P. kamengensis*, *E. labiatum* and *O. macropterus* were also studied, and the parameter b of the L-W relationship ($W = aL^b$) ranged between 2.8201 and 3.0131. From the present study, all the three catfish species grow allometrically and the growth type of *E. labiatum* is the closest to a symmetrical one.

Key words: Catfish; Drung River Basin; Distribution feature; Length; Weight

独龙江流域鳅鮀鱼类分布特征及其体长与体重的关系

孔德平[1,2], 潘晓赋[1], 杨君兴[1,*], 陈自明[1]

(1. 中国科学院昆明动物研究所 系统动物学研究室, 云南 昆明 650223;
2. 中国科学院研究生院, 北京 100039)

摘要: 鳅鮀鱼类主要分布于青藏高原周边, 是一群适合于急流生活的鮀科鱼类。在独龙江流域 7 个点共采集 271 号鳅鮀鱼类标本(隶属鮀属、鳅属和异齿鳅属), 结合各采集点数据绘制大鳍异齿鳅、藏鳅和扁头鮀的分布直方图, 结果显示, 藏鳅(*E. labiatum*)在流速较快的独龙江下游各采集点的种群数量较上游高, 更适应急流生境。同时研究了这 3 种鳅鮀鱼类的体长与体重的关系, 参数 b ($W = aL^b$)的范围在 2.8201 和 3.0131 之间, 均为异速生长; 藏鳅的生长类型最接近等速生长。

关键词: 鳅鮀鱼类; 独龙江流域; 分布特征; 体长; 体重
中图分类号: Q959.4 **文献标识码**: A **文章编号**: 0254 – 5853(2005)06 – 0632 – 06

The Drung River lies in Northwest Yunnan, China, where the three Parallel Rivers (Salween, Mekong and Yangtse) flow southwards through a mountainous region. Due to its unique location at the junction of the

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* Corresponding author (通讯作者), E-mail: yangjx@mail.kiz.ac.cn

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Hengduan Mountains and the Qinghai-Tibet Plateau, the Drung River Basin is rich in flora and fauna, which promise much for ichthyological research. However, little knowledge is available on its ichthyofauna due to its remote location and poor access. A comprehensive expedition organized by Kunming Institute of Zoology was undertaken from Oct. 18th to Nov. 17th, 2004, focusing on clarifying the diversity status of birds, mammals and fishes in the Drung River Basin. Hundreds of fish specimens were collected in the survey including a group of catfishes, glyptosternoid fishes.

Glyptosternoid fishes are successful dwellers in torrents and distribute mainly in Southeast Asia with some species extending to central Asia. At present, 9 genera and 41 species and subspecies are known (Chu, 1979; Ding et al, 1991; Chu & Mo, 1999; Ng & Kottelat, 1999, 2000; Ng & Freyhof, 2001; Ng & Rainboth, 2001; Ng, 2004a, b). Speciation of the glyptosternoid fishes may have been a direct result of uplift of the Qinghai-Tibet Plateau according to morphological, phylogenetic and biogeographical evidence (Hora & Silas, 1952; He, 1995; He et al, 2001). This study aimed to elucidate the present status of this group of catfishes in the Drung River Basin, providing distribution data for biogeography research.

1 Materials and Methods

1.1 Study site

The Drung River originates from southeast Tibet and flows between Mt. Gaoligong and Mt. Dandanglika before diverting west to merge into the Nmai Kha River (a tributary of the Irrawaddy River) in North Myanmar (Fig. 1a). Its drainage basin covers about 4 327 km^2, extending from N 27°40′ to 28°50′ and from E 97°45′ to 98°23′ E (Zhao & He, 1993). Being strongly affected by warm and humid southwest monsoon winds from the Bay of Bengal, the climate here is typically subtropical, characterized by abundant rainfall and rare occurrence of frost (Zhang et al, 1992). The Drung River Basin was divided into seven segments according to its topography (Li, 1996). Our expedition covered two of them from south to north: Qinglangdang to Gamulin and Gamulin to Siyong (Fig. 1b). The former is characterized by a high gradient river and swift currents, while the latter is not so steep. This can be seen from the trend of altitude curve in Fig. 2.

1.2 Materials and Methods

Fish were caught by a small portable back-pack electric shocker LR-24 Electrofisher (Smith-Root, Inc) and fixed directly in 5% formaldehyde. Both the main

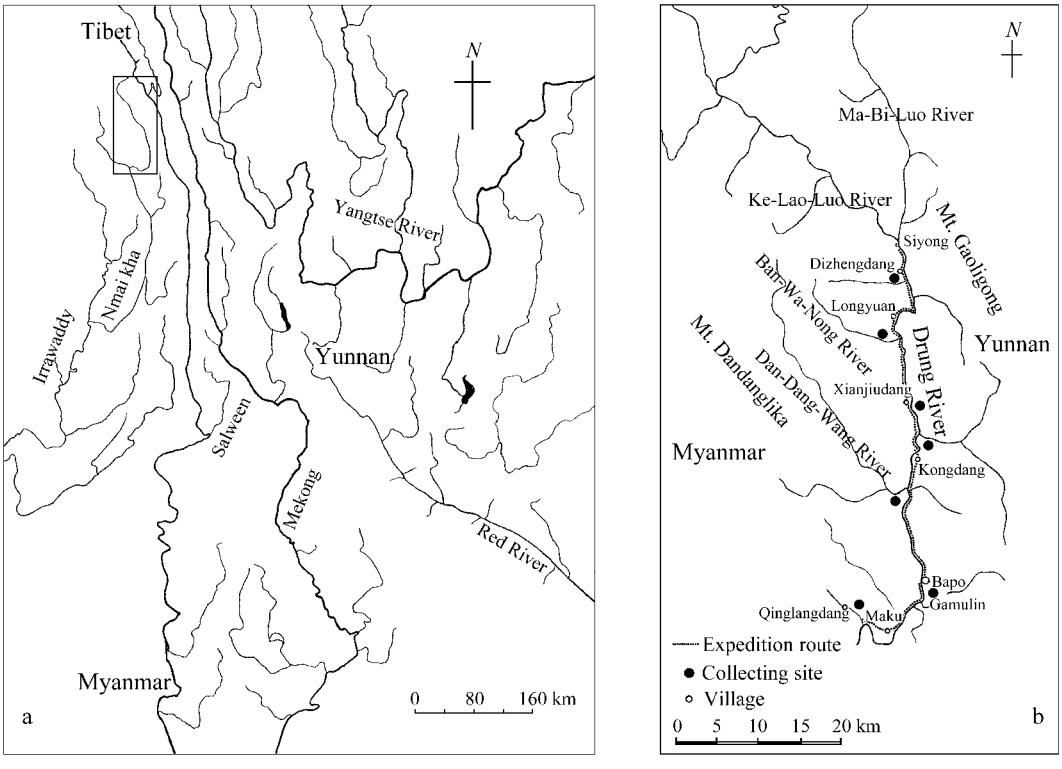

Fig. 1　Location (a) and map of the seven collecting sites (b) along the Drung Drung River Basin

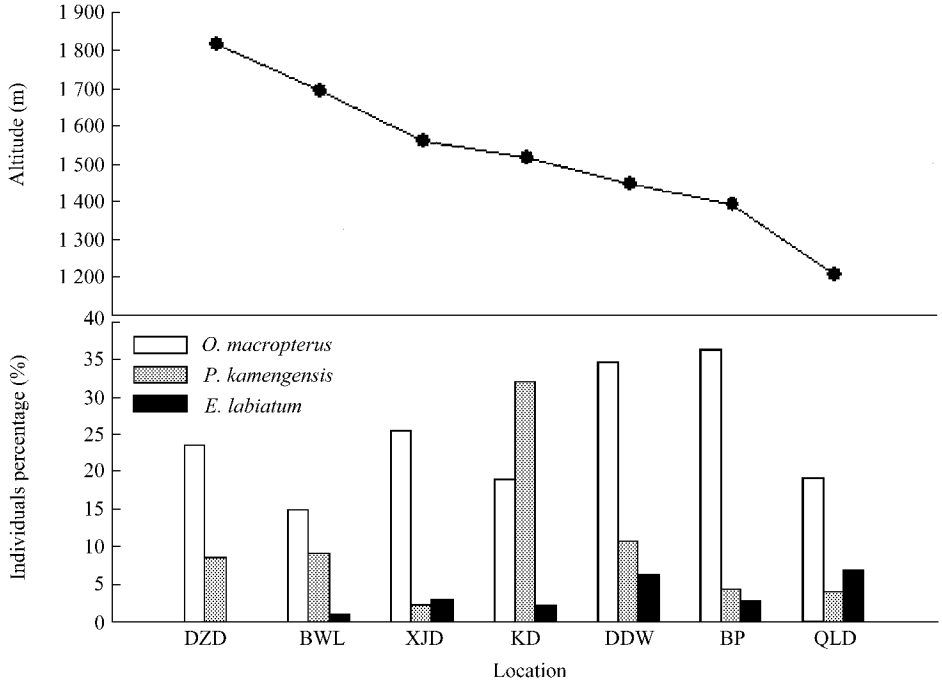

Fig. 2 Percentage of glyptosternoid fishes in the total fish caught at each collecting site in relation to altitude
Abbreviations of location see Tab. 1.

channel and tributaries were sampled with the shocker set at 400 – 500 and 700 – 900 volts respectively, depending on stream size and conductivity. Some fishes were caught by local villagers using drift nets. Individuals of glyptosternoid fishes caught at similar altitude formed a group, and the coordinates of each collecting site were recorded with a Garmin™ SUMMIT Global Positioning System (GPS). The seven sites with abbreviations were listed in Tab.1. Nomenclature of fish species follows Chu & Mo (1999) and Yue (2000). A histogram was used to identify differences in distribution of the three glyptosternoid species that was attributed to altitude. Measurement of standard length was made with a digital dial caliper and data recorded to 0.1 mm. Fish weight was read from a digital balance and data recorded to 0.1 g. The length-weight relationship for glyptosternoid fishes was determined by the equation $W = aL^b$ (Huang, 2000), where W is weight of the fish (g), L is standard length (cm), and a and b are two parameters. The degree of association between the variables W and L was evaluated by the coefficient of determination (r^2).

2 Results and Analyses

2.1 Distribution patterns of glyptosternoid fishes

Overall, 771 individuals analyzed representing 7 species belong to 2 families, 3 species of which were glyptosternoid fishes. 271 Glyptosternoid fishes were caught, comprising 34.8% of all individuals caught and 11.2% of total biomass. The ichthyofauna of the Drung River is composed of 4 Sisorid fishes, 2 *Schizothorax* species and 1 species of cyprinid (Tab. 2). Distribution features analysis was focused on the glyptosternoid fishes.

In the range of altitudes investigated from1 213 m to 1 816 m above sea level (ASL), the three catfishes showed different responses according to the histogram. The numbers of *E. labiatum* caught were related to the decreasing altitude, as more of them were caught in lower reaches of the river. As for *P. kamengensis*,

Tab. 1 Altitudes and abbreviations of seven collecting sites along the Drung River valley

Collecting site	Dizhengdang Village	Ban-Wa-Nong River	Xianjiudang Village	Kongdang Village	Dan-Dang-Wang River	Bapo Village	Qinglangdang Village
Abbreviations	DZD	BWN	XJD	KD	DDW	BP	QLD
Altitude(m)	1 816	1 695	1 561	1 520	1 449	1 397	1 213
Longitude(E)	98°19′45.1″	98°19′17.41″	98°20′0.02″	98°20′37.1″	98°19′39.3″	98°20′44.3″	98°16′37.8″
Latitude(N)	28°04′40.2″	28°00′48.1″	27°56′24.8″	27°53′28.5″	27°50′37.1″	27°45′42.2″	27°41′14.5″

Tab. 2 Fish catch components at each collecting sites along the Drung River valley

Location	1		2		3		4		5		6		7		Total	
	n/n%	w/w%	n/n%	w/w%	n/n%	w/w%	n/n%	w/w%	n/n%	w/w%	n/n%	w/w%	n/n%	w/w%	n	w
DZD	0/0.0	0/0.0	15/71.4	573.0/87.1	0/0.0	0/0.0	0/0.0	0/0.0	6/19.0	23.1/3.3	2/9.5	63.2/9.6	0/0.0	0/0.0	23	659.3
BWN	0/0.0	0/0.0	65/74.7	1 116.4/92.3	0/0.0	0/0.0	0/0.0	0/0.0	13/14.9	70.9/5.9	8/9.2	21.1/1.7	1/1.1	1.1/0.1	87	1 209.5
XJD	0/0.0	0/0.0	89/69.0	1 142.2/93.5	0/0.0	0/0.0	0/0.0	0/0.0	33/25.6	55.2/4.5	3/2.3	17.0/1.4	4/3.1	7.4/0.6	129	1 221.8
KD	1/1.2	53.0/3.2	38/45.2	1 114.0/66.3	0/0.0	0/0.0	0/0.0	0/0.0	16/19.0	27.3/1.6	27/32.1	480.5/28.6	2/2.4	4.9/0.3	84	1 679.7
DDW	0/0.0	0/0.0	22/47.8	570.0/69.0	0/0.0	0/0.0	0/0.0	0/0.0	16/34.8	61.6/7.5	5/10.9	185.6/22.5	3/6.5	8.4/1.0	46	825.6
BP	2/3.0	129.0/10.5	35/53.0	959.0/78.1	0/0.0	0/0.0	0/0.0	0/0.0	24/36.4	91.6/7.5	3/4.5	47.6/3.9	2/3.0	1.2/0.1	66	1 228.4
QLD	9/2.7	1 662.0/15.6	200/59.5	7 749.8/72.6	1/0.3	33.5/0.3	23/6.8	396.0/3.7	65/19.3	258.8/2.4	14/4.2	502.7/4.7	24/7.1	78.2/0.7	336	10 681.0
Total	12/1.6	1 844.0/10.5	464/60.2	13 224.4/75.5	1/0.1	33.5/0.2	23/3.0	396.0/2.3	173/22.4	588.5/3.4	62/8.0	1 317.7/7.5	36/4.7	101.2/0.6	771	17 505.3

n: individuals caught; n%: percentage of each species' individuals in total catches; w: weight of each species' individuals; w%: percentage of each species' individuals' weight in total weight of catches.
1: *Schizothorax* (*S.*) *myzostomus*; 2: *Schizothorax* (*S.*) *dulongensis*; 3: *Pseudecheneis sulcatus*; 4: *Placocheilus* sp. (suspected new species); 5: *Oreoglanis macropterus*; 6: *Pareuchiloglanis kamengensis*; 7: *Exostoma labiatum*.
Abbreviations of location see Tab. 1.

Tab. 3 Descriptive statistics and L-W relationship parameters for 3 glyptosternoid fishes caught in the Drung River Basin

Species	*n*	Size (cm SL)		Weight (g)		*a*	*b*	r^2	Growth type
		Minimum	Maximum	Minimum	Maximum				
Oreoglanis macropterus	173	0.235	1.018	0.1	13.8	0.017 8	2.820 1	0.965 1	Allometric negative
Pareuchiloglanis kamengensis	62	0.287	2.070	0.2	108.6	0.015 2	2.924 7	0.975 7	Allometric negative
Exostoma labiabum	36	0.281	0.945	0.2	12.2	0.012 1	3.013 1	0.958 8	Allometric positive

most individuals occurred at Kongdang where seems to be the most suitable habitat for them. In contrast, individuals of *O. macropterus* occurred all along the river and this species is the dominant catfish species at most sites (Fig. 2).

2.2 L-W relationships of glyptosternoid fishes

The sample size and minimum and maximum of length and weight for each glyptosternoid species were presented in Tab. 3, as well as the L-W relationships, the coefficient of determination (r^2) and the growth type. The Length-weight relationships were highly significant ($P < 0.01$) for the 3 analyzed species with r^2 values > 0.95. The parameter b of the L-W relationship ($W = aL^b$) ranged between 2.8201 and 3.0131. The value of the parameter b being 3 indicates the fish grows symmetrically; other than 3 indicates a allometric growth (Tesch, 1971). All the three species grow allometrically and the growth type of *E. labiatum* is most close to a symmetrical one.

3 Discussion

Glyptosternoid fishes inhabit the bottom in torrents, characterized by strongly depressed heads and bodies with greatly enlarged pectoral and pelvic fins forming an adhesive apparatus. Analyzed a series of morphological and ecological adaptive characteristics, Chu (1979) outlined the evolutionary pedigree of this group of catfishes, and indicated its evolutionary trend was proceeding towards bottom dwelling and crevice crawling. In the present study, it was observed that lips of *O. macropterus* and *E. labiatum* form an adhesive apparatus which gives them a stronger attachment to the bottom substrate than *P. kamengensis*. More individuals of *E. labiatum* were caught in the lower reaches of the Drung River with fast water velocity (Li, 1996). Compared to the other two species, it might be more adapted to a torrent habitat. The result is accordance with Chu's (1979), in which *Exostoma* species were more specialized than *Pareuchiloglanis* species and more successful torrents dwellers. The distribution features vary with season, year, water depth, turbidity, presence of other fish species and other factors. A more accurate picture should be acquired based on multiple collections with different fishing gears at different seasons.

Concerning L-W relationships in fishes, many factors are known to influence it including season, habitat, gonad maturity, sex, diet and stomach fullness, health and preservation techniques (Tesch, 1971). This study is the first references on Length-weight relationship for glyptosternoid fishes.

Being in north part of Mt. Gaoligong National Nature Reserve and difficulty of access, the flora and fauna of the Drung River Basin have been little disturbed. However, because of slash-and-burn agriculture, the typical usage of land by the Drung people, has an unfavorable impact on the environment especially around clusters of villages below 2 000 m ASL (He DM et al, 1995). Furthermore, with construction of a road through the Drung River valley, fish communities are now subject to more anthropogenic disturbances. Two major threats, destructive fishing gears and road construction are discussed below.

Electrofishing is usually considered as a good method for fish sampling in small rivers and streams especially for quantitative analysis of fish populations (Mazzoni et al, 2000). However, many studies have shown that electrofishing have negative effects on fish including spinal injuries, hemorrhages, bleeding at gills or vent, and excessive physiological stress. Electrofishing over spawning grounds can also harm embryos (Snyder, 2003). The Drung people mainly use drift nets for fishing and usually big individuals were caught from our observations. Given that the electrofishing gear is widely introduced and used without control, as in the case in streams of the Shiwan Dashan Mountains of Guangxi Province (Zhao et al, 2002), fish populations here would suffer badly. Therefore the introduction of electrofishing gear to the Drung River Basin should be prevented.

A road from Maku upstream to Xianjiudang was being built during our survey. The construction will not only strip the mountain slope of vegetation, causing severe erosion, but also cause siltation in the river. Rocks, stones and surface soil, together with fragments of plants are slipping down to the river with the extension of the road, leading to increased turbidity and bank destruction along some parts of the river. Environmental protection measures are urgently needed to minimize these adverse impacts of the road construction along Drung River.

As a part of the Hengduan Moutain Region, the Drung River Basin is of great value to biogeography research. Glyptosternoid fishes are mainly distributed around the Qinghai-Tibet Plateau, and Yunnan is considered as their centre (Hora & Silas, 1952). Further studies on phylogenetics and biogeography of these fishes will provide useful insights into the understanding of their origin and speciation in relation to the uplift of the Qinghai-Tibet plateau and formation of the Hengduan

Mountain Region.

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