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拉萨河鱼类调查及保护

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摘要: 拉萨河是雅鲁藏布江最大的支流, 其鱼类区系为隶属于裂腹鱼亚科、条鳅亚科和鲴科的 13 种鱼类以及裂腹鱼属的一个自然杂交种。最近十几年, 由于人类活动的影响, 导致了大量的外来鱼类进入拉萨河水体。文章介绍了 2004 年至 2006 年对拉萨河鱼类进行采样调查的情况。目前在拉萨河, 鱼类组成包括以往记录的 14 种鱼类: 拉萨裂腹鱼 *Schizothorax waltoni* (Regan)、异齿裂腹鱼 *S. o'connori* (Lloyd)、巨须裂腹鱼 *S. macropogon* (Regan)、双须叶须鱼 *Ptychobarbus dipogon* (Regan)、尖裸鲤 *Oxygymnocypris stewartii* (Lloyd)、拉萨裸裂尻鱼 *Schizopygopsis younghusbandi younghusbandi* Regan、异齿裂腹鱼和拉萨裂腹鱼的一个自然杂交种、异尾高原鳅 *Triplophysa stewartii* (Hora)、细尾高原鳅 *T. stenura* (Herzenstein)、西藏高原鳅 *T. tibetana* (Regan)、东方高原鳅 *T. orientalis* (Herzenstein)、斯氏高原鳅 *T. stoliczkae* (Steindachner)、短尾高原鳅 *T. brevicauda* (Herzenstein)、黑斑原鲴 *Glyptosternum maculatum* (Regan); 8 种外来鱼类: 鲫 *Carassius auratus* (Linnaeus)、麦穗鱼 *Pseudorasbora parva* (Temminck et Schlegel)、泥鳅 *Misgurnus anguillicaudatus* (Cantor)、黄魮鱼 *Hypseleotris swinhonis* (Gunther)、鲤 *Cyprinus (C.) caupio* Linnaeus、草鱼 *Ctenopharyngodon idellus* (Cuvier et Valenciennes)、银鲫 *Carassius auratus gibelio* (Bloch)、鲇 *Silurus asotus* Linnaeus; 2 个未定种。调查结果表明拉萨河鱼类资源面临的两个主要问题是过度捕捞导致鱼类资源的减少和小型化以及外来鱼类入侵。文章针对这些情况作了分析和探讨, 并对土著鱼类的保护与合理利用提出了一些建议: 合理捕捞、严格禁渔期、控制外来鱼类、保护栖息地等。

关键词: 拉萨河; 鱼类资源; 外来鱼类; 保护

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拉萨河是雅鲁藏布江最大的支流, 位于雅鲁藏布江中游的左岸, 流域位于北纬 29°20'—30°15'和东经 90°05'—91°09'之间, 全长 551 km。河源海拔约 5200 m, 汇入口海拔 3580 m, 水流湍急, 水温较低。拉萨河流域是西藏主要的农牧业生产地区之一^[1]。

关于拉萨河鱼类全面系统的资料至今还未见报道。从现有的资料来看, 有关拉萨河鱼类的研究也仅限于分类学方面, 且文献资料均来自十几年前或更早的调查结果^[2-4], 从前人的工作中可以总结出, 拉萨河鱼类为隶属于裂腹鱼亚科、条鳅亚科和鲴科的 13 种鱼类以及裂腹鱼属的一个自然杂交种^[2-4]。

然而最近十几年来, 由于人类活动的加剧, 拉

萨河鱼类组成和资源状况发生了很大变化。由于高原地区水温很低, 鱼类生长缓慢、性成熟晚、繁殖力低^[3,5], 其种群一旦受到破坏, 将很难恢复, 而且大多数鱼类都是当地的特有种, 因此对这些鱼类资源的调查和保护显得尤为重要和紧迫。本文介绍了对拉萨河现有鱼类状况进行调查的结果, 并对当地鱼类资源的保护策略进行了探讨。

1 材料与方法

2004 年 4—7 月、2004 年 9 月至 2005 年 1 月、2005 年 3—4 月、2006 年 5—9 月, 采用三层流刺网、定置刺网和地笼对拉萨河全流域的鱼类进行了全面

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的采样调查(刺网网目 2—8 cm, 高 1.2 m, 长 20 m; 地笼开口 40 cm×40 cm, 长 5 m), 同时走访了当地部分渔民。渔获物测量体长(精确到 0.1 mm)和体重(精确到 0.1 g), 然后用 8%的福尔马林溶液保存。标本的鉴定依据文献[2—6]。标本现保存于中国科学院水生生物研究所标本馆。

2 结 果

2.1 拉萨河鱼类区系组成与变动

经过我们多年的采样调查, 渔获物应包括了拉萨河现有的所有鱼类。采样结果发现, 在拉萨河共采集到隶属于 3 目 5 科 14 属的鱼类 24 种(表 1), 通过查阅文献可知^[2—6], 其中的 14 种鱼类在拉萨河有

分布: 裂腹鱼亚科的拉萨裂腹鱼 *Schizothorax waltoni* (Regan) (俗称尖嘴鱼)、异齿裂腹鱼 *S. o'connori* (Lloyd) (俗称棒棒鱼)、巨须裂腹鱼 *S. macropogon* (Regan) (俗称胡子鱼)、双须叶须鱼 *Ptychobarbus dipogon* (Regan) (俗称花鱼)、尖裸鲤 *Oxygymnocypris stewartii* (Lloyd) (俗称白鱼)、拉萨裸裂尻鱼 *Schizopygopsis younghusbandi younghusbandi* Regan (俗称土鱼), 条鳅亚科的异尾高原鳅 *Triplophysa stewartii* (Hora)、细尾高原鳅 *T. stenura* (Herzenstein)、西藏高原鳅 *T. tibetana* (Regan)、东方高原鳅 *T. orientalis* (Herzenstein)、斯氏高原鳅 *T. stoliczkae* (Steindachner)、短尾高原鳅 *T. brevicauda* (Herzenstein), 鲢科的黑斑原鲢 *Glyptosternum macu-*

表 1 拉萨河鱼类调查结果
Tab. 1 Result of investigation of fish resources of Lhasa River

目 Order	科 Family	亚科 Subfamily	属 Genera	种 Species	记录 Record	
鲤形目 Cypriniformes	鲤科 Cyprinidae	裂腹鱼亚科 Schizothoracinae	裂腹鱼属 <i>Schizothorax</i>	异齿裂腹鱼 <i>S. o'connori</i>	+	
				拉萨裂腹鱼 <i>S. waltoni</i>	+	
				巨须裂腹鱼 <i>S. macropogon</i>	+	
				异齿裂腹鱼×拉萨裂腹鱼 <i>S. o'connori</i> × <i>S. waltoni</i>	+	
			尖裸鲤属 <i>Oxygymnocypris</i>	尖裸鲤 <i>O. stewartii</i>	+	
			裸裂尻鱼属 <i>Schizopygopsis</i>	拉萨裸裂尻鱼 <i>S. y. younghusbandi</i>	+	
			叶须鱼属 <i>Ptychobarbus</i>	双须叶须鱼 <i>P. dipogon</i>	+	
			裸鲤属 <i>Gymnocypris</i>	未定种 A Species indeterminata A 未定种 B Species indeterminata B		
		鲤亚科 Cyprinus	鲫属 <i>Carassius</i>	鲫 <i>C. auratus</i>		
				银鲫 <i>C. auratus gibelio</i>		
			鲤属 <i>Cyprinus</i>	鲤 <i>C. (Cyp.) caupio</i>		
			草鱼属 <i>Ctenopharyngodon</i>	草鱼 <i>C. idellus</i>		
			雅罗鱼亚科 Gymnodanio	麦穗鱼属 <i>Pseudorasbora</i>	麦穗鱼 <i>P. parva</i>	
			鲇亚科 Gobioninae	高原鳅属 <i>Triplophysa</i>	异尾高原鳅 <i>T. stewartii</i>	+
	鳅科 Cobitidae	条鳅亚科 Nemacheilinae	细尾高原鳅 <i>T. stenura</i>		+	
			东方高原鳅 <i>T. orientalis</i>		+	
			西藏高原鳅 <i>T. tibetana</i>		+	
			斯氏高原鳅 <i>T. stoliczkae</i>		+	
			短尾高原鳅 <i>T. brevicauda</i>		+	
			花鳅亚科 Cobitinae	泥鳅属 <i>Misgurnus</i>	泥鳅 <i>M. anguillicaudatus</i>	
	鲇形目 Siluriformes	鲇科 Sisoridea	鲇科 Siluridae	原鲇属 <i>Glyptosternum</i>	黑斑原鲇 <i>G. maculatum</i>	+
鲇属 <i>Silurus</i>				鲇 <i>S. asotus</i>		
鲈形目 Perciformes	塘鳢科 Eleotridae		黄魮鱼属 <i>Hypseleotris</i>	黄魮鱼 <i>H. swinhonis</i>		

注: +: 表示以往有记录; : 表示外来种
Note: +: the presence of previous record; : the exotic species

latum (Regan) (俗称拉萨鲢鱼), 异齿裂腹鱼和拉萨裂腹鱼的一个自然杂交种; 有 8 种外来鱼类: 鲫 *Carassius auratus* (Linnaeus)、麦穗鱼 *Pseudorasbora parva* (Temminck et Schlegel)、泥鳅 *Misgurnus anguillicaudatus* (Cantor)、黄魮鱼 *Hypseleotris swinhonis* (Gunther)、鲇 *Silurus asotus* Linnaeus、鲤 *Cyprinus* (C.) *caupio* Linnaeus、草鱼 *Ctenopharyngodon idellus* (Cuvier et Valenciennes)、银鲫 *Carassius auratus gibelio* (Bloch); 另外还有 2 个未定种。

2.2 拉萨河鱼类资源现状

目前拉萨河的经济鱼类主要是裂腹鱼和黑斑原鲌, 其中拉萨裸裂尻鱼、双须叶须鱼、异齿裂腹鱼是优势种, 它们占渔获物的绝大部分(图 1); 拉萨裂腹鱼、巨须裂腹鱼在拉萨河的数量较少, 它们主要分布在雅鲁藏布江中游; 尖裸鲤数量很少, 且渔获物个体较小, 其中绝大部分个体未达到性成熟; 黑斑原鲌由于其肉味鲜美, 深受人们喜爱, 市场上供不应求, 价格高昂(目前在拉萨市场其价格为 300—400 元/kg), 因此, 人们对其的捕捞强度非常大, 种群数量正急剧减少。表 2 中列出了拉萨河主要经济鱼类的流刺网渔获物体长及体重的情况。

2.3 拉萨河主要经济鱼类的时空分布特点

由于黑斑原鲌目前在拉萨河中下游很难捕到, 只在上游存在一定的种群数量, 因此本部分未对其进行讨论。从图 1a 可以看出, 拉萨裸裂尻鱼和双须叶须鱼都是优势种, 特别是在上游两种鱼占到了渔获物的 80%多。在上游除了拉萨裸裂尻鱼、双须叶须鱼和异齿裂腹鱼外, 其他几种鱼极少, 特别是尖裸鲤在中下游都存在一定种群, 但在上游数量极

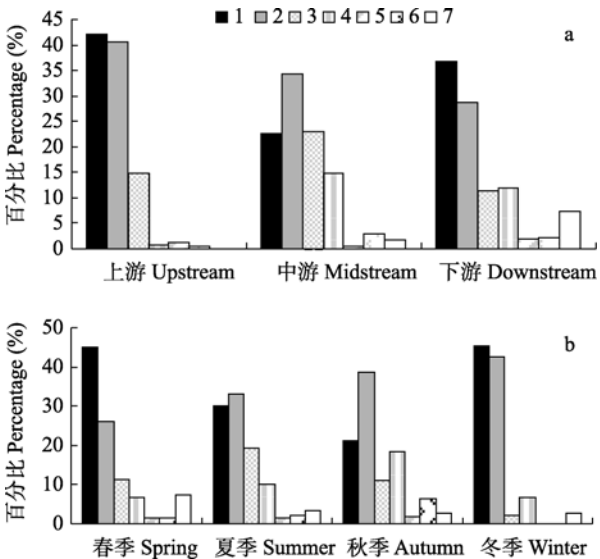


图 1 拉萨河主要经济鱼类在渔获物中所占比例随采样地点(a)和采样季节(b)的变化

Fig. 1 Variations of proportions of main economical fish species with different sampling spots (a) and different seasons (b) in Lhasa River
鱼的种类: 1. 拉萨裸裂尻鱼; 2. 双须叶须鱼; 3. 异齿裂腹鱼; 4. 尖裸鲤; 5. 拉萨裂腹鱼; 6. 巨须裂腹鱼; 7. 未定种 A
Fish species: 1. *S. y. younghusbandi*; 2. *P. dipogon*; 3. *S. o'connori*; 4. *O. stewartii*; 5. *S. waltoni*; 6. *S. macropogon*; 7. Species indeterminata A

少。上游渔获物中没有未定种 A, 且未定种 A 在中游也较少, 而在下游较多。从整个河段来看, 拉萨裂腹鱼和巨须裂腹鱼在渔获物数量中都很少, 而且从图 1b 中可以看出, 这两种鱼没有出现在冬季渔获物中, 异齿裂腹鱼在冬季的渔获物中所占比例也较少, 结合我们对雅鲁藏布江中游的采样情况分析, 我们认为裂腹鱼属的这 3 种鱼(特别是拉萨裂腹鱼和巨须裂腹鱼)的主要栖息地是在雅鲁藏布江中游, 它们在

表 2 采用流刺网捕获的拉萨河经济鱼类的体长与体重
Tab. 2 Standard length and total weight of commercial fishes of Lhasa River captured by floating gill net

种 Species	样本量 Sample size	体长 Standard length (mm)			体重 Total weight (g)		
		最小值 Mix	最大值 Max	平均值 Average	最小值 Mix	最大值 Max	平均值 Average
拉萨裸裂尻鱼 <i>S. y. younghusbandi</i>	501	120.3	420.0	272.7	27.95	1190.0	228.2
双须叶须鱼 <i>P. dipogon</i>	526	110.0	492.0	277.6	14.6	1442.0	305.3
异齿裂腹鱼 <i>S. o'connori</i>	297	132.0	493.0	277.6	34.0	1733.0	394.8
尖裸鲤 <i>O. stewartii</i>	140	209.0	546.0	272.5	113.0	1976.0	300.4
拉萨裂腹鱼 <i>S. waltoni</i>	29	204.9	569.0	391.4	119.0	3365.0	971.5
巨须裂腹鱼 <i>S. macropogon</i>	45	147.0	423.0	229.1	66.0	1201.1	231.1
未定种 A Species indeterminata A	70	186.4	486.0	281.8	100.0	1499.0	246.0
黑斑原鲌 <i>G. maculatum</i>	73	149.2	254.0	183.8	60.9	261.6	112.2

繁殖季节一部分上溯到拉萨河产卵繁殖, 冬季又回到雅鲁藏布江干流。

2.4 拉萨河外来鱼类现状

目前拉萨河外来鱼类中数量最多的是鲫鱼、麦穗鱼、泥鳅, 鲤鱼和黄魮鱼的数量也增长很快, 草

鱼、银鲫、鲃极少捕获到, 在拉萨河是偶见种。表 3 是在拉萨河及附近静水河汉中地笼的渔获物情况, 外来鱼类麦穗鱼、鲫、泥鳅、黄魮鱼、鲃、草鱼、鲤所占比例分别为 15.8%、15.6%、5.0%、4.5%、0.6%、0.5%、0.5%, 外来鱼类总计达到 42.5%。

表 3 拉萨河地笼渔获物数量统计(括号内为百分比)
Tab. 3 Amounts and percentages of fishes captured by fishing cage in Lhasa River (percentage in brackets)

采样时间 Time of sampling	采样 地点 Site of sampling	渔获物种类 Species of captures									
		高原鳅 <i>Triplo- physa</i>	麦穗鱼 <i>P. parva</i>	鲫 <i>C. aura- tus</i>	拉萨裸裂尻鱼 <i>S. y. younghus- bandi</i>	泥鳅 <i>M. anguil- licaudatus</i>	黄魮鱼 <i>H. swinhonis</i>	鲃 <i>S. asotus</i>	尖裸鲤 <i>O. stewar- tii</i>	草鱼 <i>C. idellus</i>	鲤 <i>C. (Cyp.) caupio</i>
20040930	拉萨	50(35.5)	37(26.2)	9(6.4)	19(13.5)	0	19(13.5)	5(3.5)	0	2(1.4)	0
20041124	采纳乡	31(36.5)	34(40.0)	0	0	0	15(17.6)	0	1(1.2)	2(2.4)	2(2.4)
20041205	柳梧	117(66.1)	25(14.1)	15(8.5)	6(3.4)	12(6.8)	1(0.6)	0	0	0	1(0.6)
20041214	柳梧	91(44.1)	28(13.6)	72(35.0)	14(6.8)	0	0	0	0	0	1(0.5)
20060518	拉萨	113(54.6)	5(2.4)	31(15.0)	24 (11.6)	29(14.0)	2(1.0)	0	3(1.4)	0	0
总计 Total		402(49.3)	129(15.8)	127(15.6)	63(7.7)	41(5.0)	37(4.5)	5(0.6)	4(0.5)	4(0.5)	4(0.5)

拉萨河外来鱼类主要分布在拉萨河下游的达孜至曲水河段, 仅鲫鱼在拉萨河中上游有少量分布。主要是因为该河段人口稠密, 受人类活动影响较大。鲫鱼、麦穗鱼、泥鳅、黄魮鱼等喜静水的鱼类主要分布在该河段的静水河汉中(在靠近主河道岸边的水体也有少量分布), 鲤鱼和草鱼在主河道中偶尔能捕获到。

在拉萨河的静水河汉中原本生活的是裂腹鱼的幼鱼和高原鳅, 但目前有的是外来鱼类与土著鱼类共存, 有的则几乎完全被外来鱼类占领, 难觅土著鱼类的踪影。目前在拉萨市水产品市场上已有大量采自拉萨河的外来鱼类如鲫鱼、泥鳅、麦穗鱼等作为野杂鱼出售。

3 讨 论

3.1 拉萨河鱼类区系组成与变化原因分析

从本次调查来看, 拉萨河的土著鱼类的种数没有减少, 主要是出现了许多的外来鱼类, 这其中除了两种高原鳅外, 其余都是我国青藏高原广泛分布的鱼类或我国广泛养殖的鱼类, 它们都对环境的适应能力很强。这些外来鱼类是由于人类活动而从青藏高原以外地区有意或无意引入的。

对于 2 个未定种, 未定种 A 外形与尖裸鲤较相似, 俗称假白鱼, 两者的区别主要是前者背鳍第一

根鳍条较细, 后者背鳍第一根鳍棘粗大、锯齿锋利; 前者的背鳍起点相对于腹鳍起点靠前, 而后者的靠后; 前者的腹膜为黑色, 后者腹膜为银灰色; 后者较前者体色更白, 头更尖。未定种 B 在外形特征上酷似未定种 A, 但腹膜颜色呈深灰色, 且肠的形状差异显著。这两个未定种的分类学特征将另文详述。未定种 A 在拉萨河中有一定种群数量, 其在渔获物个体数量上约占 5%, 在前期的采样工作中, 根据检索资料, 我们把它记录为高原裸鲤 *Gymnocypris waddelli*。但高原裸鲤的分布记录主要是羊卓雍错等西藏的河流和湖泊中^[2,3,6], 其分布记录没有拉萨河。后来我们在羊卓雍错采集到了高原裸鲤, 经过对比鉴定, 拉萨河的未定种 A 并不是高原裸鲤。由于未定种 A 的外形与尖裸鲤比较相似, 且与拉萨裸裂尻鱼也比较相似, 特别是经过福尔马林保存过的标本从外形上看很难与拉萨裸裂尻鱼的标本区分, 因此我们推断以前的调查有所遗漏。对于未定种 B, 由于其数量较少, 我们认为可能是以前调查的遗漏, 也有可能是裂腹鱼类中出现的新的自然杂交种。

3.2 外来鱼类的危害

世界上大多数水生生态系统(包括淡水生态系统和海洋生态系统)都或多或少地受到生物入侵的影响^[7]。鱼类入侵已成为一个全球性的问题^[8]。许多文献报道, 外来鱼类的入侵导致了土著物种的衰落

或绝灭^[9-11]。以云南高原湖泊抚仙湖为例,由于过度捕捞、外来鱼类的引入、水环境的变化等原因,2004—2005 年对抚仙湖的调查显示土著鱼类只有 14 种,而非土著鱼类 19 种,与 1995 年的调查资料相比,有 11 种土著鱼类未采到,而外来鱼类新增 5 种^[12]。因此拉萨河外来鱼类应引起当地相关部门的高度重视。

从目前拉萨河所发现的这些外来鱼类的食性来看,除了数量极少的鲇外,还没有捕食鱼类的凶猛鱼类,他们主要是在食物和空间生态位与土著鱼类存在竞争,还可能吞食土著鱼类的鱼卵。由于这些外来鱼类生命力较强,繁殖力较高,因此将对土著鱼类产生极大的影响。

3.3 拉萨河鱼类资源及其保护措施

由于宗教、历史、生活习俗等因素的影响,藏族同胞极少食用鱼类。改革开放前,西藏的绝大部分水体都没有进行渔业开发,自然鱼类资源长期处于自生自灭的自然调节状态^[13]。通过走访拉萨河周边的渔民,我们得知对拉萨河鱼类大规模的捕捞始于 20 世纪 90 年代初。至 90 年代中后期,拉萨河鱼类资源已开始锐减^[13]。高原鱼类普遍生长缓慢、性成熟晚、繁殖力低,其种群一旦遭到破坏将很难恢复。拉萨河鱼类也不例外,尖裸鲤已被列入《中国濒危动物红皮书(鱼类)》^[14]。当前拉萨河鱼类面临的两大威胁是对鱼类资源过度捕捞导致的鱼类资源的减少和小型化以及外来鱼类的入侵,对此我们建议采取如下措施:

合理捕捞 第一要禁止酷渔滥捕,如毒鱼、电鱼等。由于利益的驱使,拉萨河存在酷渔滥捕的现象。据我们所知,由于黑斑原鲮栖息在急流底部的石缝中,一般方法很难捕获,一些渔民采用毒鱼或电鱼的方式将其弄晕浮上水面后再用刺网将其捕捞。这些捕捞方式不仅对幼鱼伤害很大,对水体中的其他生物也有影响,毒鱼还会污染水体,因此要严格禁止。

第二要适当增加网目,捕大留小。在拉萨河渔业捕捞中渔民比较常用的是三层刺网,最小网目约 2 cm。生长拐点常被用来作为制定渔业捕捞规格指标^[15-19]。拉萨河的拉萨裸裂尻鱼和双须叶须鱼的平均捕捞年龄均小于其拐点年龄^[20,21]。以拉萨裸裂尻鱼为例,其达到生长拐点时的体重为 242.1 g(雄性)和 328.9 g(雌性)^①。按照文献^[22]确定刺网网目

大小(α)的公式 $\alpha = K_1 \sqrt[3]{P}$ (K_1 为常数,由于拉萨裸裂尻鱼与青海湖裸鲤体形相仿, K_1 大致等于 5.50, P 为鱼体全重,单位为 kg)^[19,23],计算出的拉萨裸裂尻鱼达到生长拐点时相对应的最小网目为 3.4 cm(雄性)和 3.8 cm(雌性)。拉萨裸裂尻鱼是拉萨河中个体较小的裂腹鱼,对于其他个体较大的裂腹鱼,最小网目应更大。因此我们建议捕捞拉萨河鱼类的最小网目应至少控制在 5 cm。

禁止在繁殖期捕捞,制定休渔期 根据我们多年长期采样发现,拉萨河鱼类的繁殖期主要在 4—7 月份,而且在此期间可能有大量的雅鲁藏布江干流的鱼类上溯到拉萨河进行繁殖。因此我们建议将每年的 4—7 月确定为休渔期。

控制外来鱼类 由于我们的前期的采样目的的重点是为了研究拉萨河经济鱼类的生物学,忽视了对外来鱼类的一些定量数据的收集。因此建议将来的工作要把监控外来鱼类的种群动态作为重点之一,这对于研究外来鱼类以及对其的控制有着重要的作用。

目前对外来鱼类的控制,除了人工捕杀之外,尚无理想的方法。对于拉萨河的外来鱼类,一方面要严格禁止外来鱼类的再次引入,另一方面号召人们对拉萨河外来鱼类进行捕杀。藏族同胞对野生动物有很强的保护意识,但是他们对外来种的危害却不甚了解,普及这方面的知识对于控制外来鱼类的再次引入将起到十分重要的作用。

另外还需要特别注意的一点是要保持拉萨河的水文环境。随着青藏铁路的全线贯通,拉萨的发展也进入了新的发展时期,对拉萨河水资源的开发利用也会随之加强。根据我们的采样情况来看,目前在拉萨河所发现的绝大部分外来鱼类都是采自拉萨河河边与主河道连通的河汉中,即它们都喜欢静水环境。而裂腹鱼喜流水环境,因此它们在生态位上没有太大竞争。但是在拉萨河上建水电站等大型的水利工程,破坏拉萨河的急流环境,外来鱼类与土著鱼类的竞争将更加激烈,其危害将是无法估量的。

保护鱼类栖息地 水污染和栖息地破坏是导致鱼类资源衰退的重要原因,保护鱼类栖息地是保护鱼类资源和可持续利用的重要途径^[24,25]。目前拉萨河基本上处于原生态状态,但是由于人口增长和经

济发展, 生活污水、采矿等工业污水以及水利工程建设等对拉萨河生态环境的破坏日益明显, 应引起相关部门的注意。

建立土著鱼类种质资源库和基因库 采用现代超低温技术保存其精液、胚胎或组织培养物, 随着细胞生物学和发育生物学的发展, 有朝一日我们通过细胞培养或核移植之类的技术, 有可能利用细胞库冻存物, 重建当时地球上已绝灭的物种^[27,28]。西藏的土著鱼类大多都是当地特有的鱼类, 其一旦遭受毁灭性的破坏, 将直接导致这些物种的绝灭, 因此采取这种保护措施将有很强的实际价值和意义。

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INVESTIGATION AND PROTECTION STRATEGIES OF FISHES OF LHASA RIVER

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Abstract: Lhasa River is the biggest tributary of Yarlung Zangbo River. Its fish fauna comprise 13 fish species and a natural bastard, belonging to Schizothoracinae, Nemacheilinae and Sisoridae. Disturbed by human activities, plenty of exotic fishes have been found in Lhasa River in recent decades. Moreover, the fish resources of Lhasa River are under overfishing. Most of the endemic fishes grow slowly and mature late, so they are very vulnerable to invasions of the exotic fishes and overfishing, and the populations can not be replenished easily if depleted. So the investigation and protection strategies of fishes of Lhasa River are very important and urgent works. We roundly investigated the fish resources of Lhasa River with floating net, gill net and set net during Apr. to Jun. in 2004, Sep. in 2004 to Jan. in 2005, Mar to Apr. in 2005, May to Sep. in 2006. This paper introduced the result of our investigation. It was found that there were 8 exotic fish species (*Carassius auratus* (Linnaeus), *Pseudorasbora parva* (Temminck et Schlegel), *Misgurnus anguillicaudatus* (Cantor), *Hypseleotris swinhonis* (Gunther), *Cyprinus* (C.) *caupio* Linnaeus, *Ctenopharyngodon idellus* (Cuvier et Valenciennes), *Carassius auratus gibelio* (Bloch), *Silurus asotus* Linnaeus, and 2 species indeterminate, and 14 fish species (*Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *Schizopygopsis younghusbandi younghusbandi* Regan, *Triplophysa stewartii* (Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *Schizopygopsis younghusbandi younghusbandi* Regan, *Triplophysa stewartii* (Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), 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(Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *Schizopygopsis younghusbandi younghusbandi* Regan, *Triplophysa stewartii* (Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *Schizopygopsis younghusbandi younghusbandi* Regan, *Triplophysa stewartii* (Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *Schizopygopsis younghusbandi younghusbandi* Regan, *Triplophysa stewartii* (Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *Schizopygopsis younghusbandi younghusbandi* Regan, *Triplophysa stewartii* (Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *Schizopygopsis younghusbandi younghusbandi* Regan, *Triplophysa stewartii* (Lloyd), *Schizothorax waltoni* (Regan), *S. o'connori* (Lloyd), *S. macropogon* (Regan), *Ptychobarbus dipogon* (Regan), *Oxygymnocypris stewartii* (Lloyd), *S*

tii (Hora), *T. stenura* (Herzenstein), *T. tibetana* (Regan), *T. orientalis* (Herzenstein), *T. stoliczkae* (Steindachner), *T. brevicauda* (Herzenstein), *Glyptosternum maculatum* (Regan), and a natural bastard of *S. waltoni* and *S. o'connori*). These 14 fish species were also found by previous researchers. As to the species indeterminate, species indeterminate A looked like *O. stewartii* and also looked like *S. y. younghusbandi*, so it might be omitted by the former investigator; species indeterminate B was very rare and it had many medial morphological characters of species indeterminate A and *O. stewartii*, so it might be omitted by the former investigator or a new natural bastard. We analyzed the distribution of economic fishes of Lhasa River. *S. y. younghusbandi* and *P. dipogon* were dominant species in Lhasa River, especially in the upstream; *O. stewartii* mainly distributed in the downstream; *S. o'connori* was rare in winter; *S. waltoni* and *S. macropogon* were rare in Lhasa River. We inferred that *S. o'connori*, *S. waltoni* and *S. macropogon* mainly inhabited in Yarlung Zangpo River and migrated to Lhasa River to spawn during spawning season. As to the exotic fishes, *C. auratus*, *P. parva* and *M. anguillicaudatus* were majority and distributed widely; *C. (Cyp.) caupio* and *H. swinhonis* increased quickly in amount; *C. idellus*, *C. auratus gibelio* and *S. asotus* were rare. We also pointed out that the two main threats to the fish resources of Lhasa River were decrease and miniaturization caused by overexploitation and invasion by alien fishes. In this paper, we analyzed and discussed the phenomenon and presented a series of strategies on how to protect and reasonably use of fish resources of Lhasa River: reasonable fishing, constituting fishing ban period, controlling alien fishes, protecting habitant of fishes and so on.

Key words: Lhasa River; Fish resources; Alien fish; Protect