

Range-wide decline of Chinese giant salamanders *Andrias* spp. from suitable habitat

BENJAMIN TAPLEY , SAMUEL T. TURVEY, SHU CHEN, GANG WEI, FENG XIE, JIAN YANG, ZHIQIANG LIANG, HAIFENG TIAN, MINYAO WU, SUMIO OKADA, JIE WANG, JINGCAI LÜ, FENG ZHOU, JINGCHENG XU, ZHAO HAIPENG, JAY REDBOND, THOMAS BROWN and ANDREW A. CUNNINGHAM

SUPPLEMENTARY TABLE 1 Environmental and water parameters collected for 98 giant salamander survey sites in China. * Denotes site not selected from the habitat suitability model or identified by the review of historic records.

Province	County	Elevation (m asl)	Water temp °C	DO mg/L	Salinity ppt	pH	NH ₃ ppm	NO ₂ ⁻ ppm	NO ₃ ⁻ ppm	Alkalinity mg/L	Flow rate dKH	Number of giant salamanders found during ecological survey.	
Anhui	Huangshan	399	24.0	7.75	0.00	7.10	0.10	0.00	2.00	0.22	0.60	0.81	0
Anhui	Huangshan	348	23.3	7.78	0.00	7.08	0.10	0.00	0.00	0.10	0.30	0.98	0
Anhui	Xucheng	300	20.1	7.85	0.00	7.78	0.00	0.05	0.00	0.22	0.60	0.65	0
Anhui	Xuancheng	750	17.8	7.68	0.01	7.27	0.00	0.00	0.00	0.22	0.60	0.88	0
Anhui	Huangshan	141	27.0	7.73	0.01	7.19	0.00	0.00	0.00	0.22	0.60	0.73	0
Anhui	Liu'an	587	19.8	7.50	0.00	7.35	0.00	0.05	0.00	0.22	0.60	0.72	0
Chongqing	Wushan	316	18.5	8.40	0.12	8.01	0.10	0.00	2.00	1.93	5.40	0.52	0
Chongqing	chengkou	800	16.6	8.30	0.11	7.95	0.10	0.00	0.00	1.70	4.80	0.31	0
Chongqing	Pengshui	309	20.5	7.20	0.17	7.46	0.10	0.10	50.00	2.28	6.40	0.00	0
Fujian	Pingnan	632	21.7	7.88	0.00	7.58	0.10	0.00	10.00	0.10	0.30	2.28	0
Gansu	Hui	1546	18.6	7.62	0.07	7.32	0.10	0.00	5.00	1.13	3.20	0.62	0
Gansu	Gao Lan	1481	12.9	8.05	0.24	8.81	0.10	0.05	5.00	3.53	9.90	0.62	0
Gansu	Lin Tao	1894	14.6	8.04	0.15	7.90	0.10	0.00	2.00	3.65	10.20	0.64	0
Gansu	Liang Dang	1555	18.5	8.52	0.10	7.94	0.10	0.00	0.00	2.39	5.70	0.84	0
Guangdong	liannan	911	20.9	7.52	0.00	7.45	0.10	0.00	2.00	0.10	0.30	0.14	17
Guangxi	Jinxiu	880	22.4	7.35	0.00	7.37	0.10	0.00	2.00	0.10	0.30	0.11	0
Guangxi	guiping	270	25.0	7.34	0.00	8.10	0.10	0.00	0.00	0.00	0.00	0.24	0
Guangxi	ziyuan	662	20.2	7.88	0.00	7.73	0.10	0.00	2.00	0.10	0.30	0.21	0
Guangxi	longsheng	308	22.0	7.86	0.00	7.91	0.10	0.00	0.00	0.22	0.60	0.75	0
Guangxi	rongshui	393	21.5	7.81	0.00	8.34	0.10	0.00	5.00	0.10	0.30	1.13	0
Guangxi	tianlin	584	21.2	7.84	0.00	7.04	0.10	0.00	5.00	1.59	4.50	0.71	0
Guangxi	xilin	1284	20.1	7.23	0.03	6.71	0.10	0.05	2.00	1.13	3.20	0.86	0
Guangxi	Napo	626	24.0	7.39	0.08	6.33	0.10	0.00	2.00	2.05	5.70	1.15	0
Guangxi	Mengshan	455	25.1	7.03	0.00	8.27	0.10	0.00	2.00	0.22	0.60	0.29	0
Guangxi	beiliu	306	24.6	6.72	0.00	8.58	0.10	0.00	0.00	0.10	0.30	0.25	0
Guizhou	Fenggang	759	15.8	8.17	0.17	7.58	0.10	2.00	0.00	1.82	5.10	0.02	0

Guizhou	Guiding	983	17.5	8.58	0.00	7.62	0.10	0.00	0.00	2.85	8.00	0.06	0
Guizhou	Meitan	702	22.3	8.46	0.62	9.77	0.10	2.00	0.00	0.00	0.00	0.02	0
Guizhou	Huaxi	1027	17.7	6.15	0.26	8.15	0.10	2.00	0.00	1.82	5.10	0.08	0
Guizhou	Kaiyang	598	20.8	6.28	0.27	8.52	0.10	1.00	0.00	2.28	6.40	0.05	0
Guizhou	Xifeng	808	16.7	8.85	0.08	9.80	0.10	1.00	0.00	2.05	5.70	0.29	0
Guizhou	Xiuwen	1272	14.5	4.78	0.37	7.80	0.10	2.00	0.00	0.45	1.20	0.19	0
Guizhou	Jiangkou	545	15.1	8.87	0.00	6.36	0.10	0.00	0.00	0.10	0.30	0.55	0
Guizhou	Taijiang	878	18.2	7.58	0.00	6.50	0.10	0.00	0.00	0.22	0.60	0.46	0
Guizhou	Leishan	880	21.5	6.96	0.00	6.85	0.10	0.50	0.00	0.10	0.30	1.69	0
Guizhou	Jianhe	606	18.0	8.02	0.00	6.98	0.10	0.00	0.00	0.22	0.60	0.42	0
Guizhou	Sansui	633	19.0	7.85	0.00	6.59	0.10	0.00	0.00	0.22	0.60	0.38	0
Guizhou	Tianzhu	750	25.1	6.72	0.01	6.64	0.10	0.00	0.00	0.10	0.30	0.39	0
Guizhou	Cengong	606	20.9	7.00	0.16	7.88	0.10	0.50	0.00	2.16	6.10	0.86	0
Guizhou	Majiang	939	17.5	7.58	0.12	7.58	0.10	2.00	0.00	2.62	7.30	0.79	0
Guizhou	Danzhai	520	23.2	7.45	0.00	7.10	0.10	2.00	0.00	0.33	0.90	1.25	0
Guizhou	Huangping	710	22.1	9.34	0.23	8.61	0.10	0.00	0.00	1.59	4.50	0.73	0
Guizhou	Shibing	613	17.5	8.87	0.21	8.69	0.10	0.00	0.00	1.02	2.80	0.86	0
Guizhou	Jinping	520	29.5	5.34	0.08	9.33	0.10	2.00	2.00	2.05	5.70	0.38	0
Guizhou	Liping	503	29.8	10.1	0.00	9.05	0.10	0.00	0.00	0.33	0.90	0.25	0
Guizhou	Duyun	883	18.4	6.64	0.18	7.46	0.10	1.00	0.00	1.93	5.40	0.36	0
Guizhou	Wengan	1098	17.6	7.27	0.13	7.51	0.10	0.00	0.00	2.05	5.70	0.26	0
Guizhou	Dushan	1098	16.8	7.58	0.00	4.69	0.10	0.00	0.00	0.00	0.00	0.38	0
Guizhou	Yuqing	698	20.3	7.77	0.23	9.04	0.10	0.00	0.00	0.22	0.60	0.24	0
Guizhou	Changshun	1149	16.1	7.56	0.19	7.65	0.10	0.00	0.00	1.93	5.40	1.23	0
Guizhou	Zhenyuan	493	17.5	8.87	0.21	8.69	0.10	0.00	0.00	1.02	2.80	0.68	0
Guizhou	Longli	1110	15.3	8.61	0.17	8.33	0.10	0.10	0.00	2.62	7.30	0.24	0
Guizhou	Songtao	716	14.2	8.68	0.00	6.46	0.10	2.00	0.00	0.67	1.90	0.09	1
Guizhou	Kaili	749	21.1	7.47	0.01	7.24	0.10	2.00	0.00	0.56	1.60	0.45	0
Guizhou	Fuquan	761	24.1	7.11	0.26	7.80	0.10	1.00	0.00	0.10	0.30	0.58	0
Guizhou	Zunyi	844	20.9	7.50	0.31	8.19	0.10	0.10	0.00	1.02	2.80	0.12	0
Guizhou	Pingtang	919	19.6	6.50	0.15	7.84	0.10	0.00	0.00	2.16	6.10	0.39	0
Guizhou	Wanshante	340	17.5	7.75	0.28	8.18	0.10	0.00	0.00	0.00	0.00	0.54	0
Henan	Xinxian	228	21.8	7.33	0.06	7.26	0.10	0.00	2.00	5.30	14.80	1.92	0
Henan	Jiaozuo	213	19.4	11.70	0.42	6.40	0.10	0.05	100.00	0.65	11.66	0.00	0
Henan	Jiyuan	438	21.2	6.60	0.27	6.62	0.10	0.00	50.00	0.33	6.60	0.00	0
Hubei	Badong	320	17.8	9.37	0.07	8.36	0.10	0.00	2.00	2.05	5.70	0.48	0

Hubei	Macheng	370	24.4	8.89	0.02	7.25	0.10	0.05	2.00	0.10	0.30	0.00	0
Hubei	Baokang	740	17.5	9.07	0.04	7.96	0.10	0.00	2.00	0.79	2.20	0.08	0
Hubei	Danjiangkou	613	21.5	8.66	0.02	7.62	0.10	0.00	2.00	0.45	1.20	0.08	0
Hunan	LongShan	602	21.5	8.10	0.12	7.97	0.30	0.00	0.00	2.62	7.30	0.42	0
Hunan	Yongshun	282	22.8	6.89	0.12	7.82	0.30	0.00	0.00	2.16	6.10	0.01	0
Hunan	Chaling	111	20.4	6.68	0.11	7.88	0.10	0.00	0.00	2.62	7.30	0.19	0
Hunan	Guidong	808	22.5	7.20	0.12	8.02	0.10	0.00	0.00	2.50	7.00	0.13	0
Hunan	Zhijiang	287	21.4	7.83	0.13	7.98	0.30	0.00	0.00	2.85	8.00	0.22	0
Hunan	Xinhuang	352	23.7	7.55	0.09	8.21	0.10	0.00	0.00	2.62	7.30	0.09	0
Hunan	Guzhang	239	26.4	6.97	0.12	7.82	0.10	0.00	0.00	2.73	7.70	0.09	0
Hunan	Chengbu	446	21.5	7.81	0.13	8.02	0.10	0.00	0.00	1.82	5.10	0.01	0
Hunan	Suining	384	25.5	6.02	0.06	7.26	0.30	0.00	0.00	2.39	6.70	0.03	0
Hunan	Hengshan	480	19.2	8.06	0.11	7.75	0.10	0.00	0.00	2.62	7.30	0.02	0
Hunan	Jiangyong	326	23.0	7.07	0.03	7.09	0.10	0.00	0.00	2.28	6.40	0.26	0
Hunan	Yongding	262	21.3	8.29	0.13	8.23	0.10	0.00	0.00	2.73	7.70	1.09	0
Hunan	SangZhi	362	23.8	7.05	0.14	8.21	0.10	0.00	0.00	2.28	6.40	0.05	0
Jiangxi	Tonggu	430	19.1	7.82	0.00	7.10	0.10	0.00	2.00	0.00	0.00	0.26	0
Jiangxi	Jingan	310	20.0	8.88	0.00	6.95	0.10	0.05	0.00	0.33	0.90	1.58	0
Shaanxi	Feng Xian	1579	13.0	8.65	0.00	7.53	0.10	0.00	0.00	0.22	0.60	0.46	0
Shaanxi	Lveyang	1076	18.7	8.52	0.09	7.92	0.10	0.00	5.00	1.36	3.80	0.70	5
Shaanxi	Zhou Zhi	961	19.8	7.98	0.00	7.94	0.10	0.00	0.00	0.90	2.50	0.83	1
Shanxi	Yuanqu	963	11.1	9.68	0.05	7.18	0.10	0.00	2.00	0.33	0.90	0.70	0
Sichuan	Emeishan	485	11.4	8.2	0.07	7.88	0.10	0.00	5.00	1.82	5.10	0.24	0
Sichuan	Mabian	585	23.3	7.6	0.05	8.38	0.10	0.00	2.00	0.90	2.50	0.48	0
Sichuan	Pingshan	606	21.5	7.54	0.12	8.16	0.10	0.00	25.00	2.05	5.70	0.58	0
Sichuan	Hejiang	869	21.6	7.1	0.04	7.40	0.10	0.00	5.00	0.45	1.20	0.35	0
Sichuan	Baoxing	1038	14.3	8.1	0.09	7.96	0.10	0.00	0.00	2.05	5.70	0.00	0
Sichuan	Jiu zhaigou	2205	17.7	7.1	0.20	8.39	0.10	0.00	0.00	1.02	2.80	0.12	0
Sichuan	Nanjiang*	954	19.7	7.5	0.06	7.89	0.10	0.00	2.00	1.36	3.80	0.93	1
Sichuan	Hongya	575	16.5	8.35	0.13	8.22	0.10	0.00	2.00	1.82	5.10	0.27	0
Sichuan	Xingwen	464	17.3	8.16	0.16	7.91	0.10	0.13	50.00	2.28	6.40	1.08	0
Yunnan	Zhaotong	720	16.9	8.23	0.10	6.53	0.10	0.05	5.00	2.05	5.70	0.90	0
Zhejiang	Pan'an	429	17.8	8.31	0.00	7.10	0.10	0.10	2.00	0.45	1.20	0.17	0
Zhejiang	Longquan	392	23.7	7.57	0.00	7.46	0.10	0.25	2.00	0.30	0.10	0.24	0
Zhejiang	Jingning	591	18.2	8.09	0.00	7.64	0.10	0.25	2.00	0.10	0.30	0.84	0
Zhejiang	Suichang	516	21.4	7.87	0.00	7.52	0.10	0.25	2.00	0.10	0.30	0.79	0

SUPPLEMENTARY TABLE 2 Summarized data from the standardized questionnaire-based interviews.

Province	County	Most recent sighting (yr ago)	Mean last sighting (yr ago)	Percentage of people seen
Anhui	Jingde	Na	Na	0
Anhui	Jixi	Na	Na	0
Anhui	Liuan	1	21.2	41.4
Anhui	Qimen	4	20.5	6.7
Anhui	Xiuning	0	22.4	93.2
Anhui	Yixian	Na	Na	6.7
Chongqing	Chengkou	0	14.1	66.7
Chongqing	Pengshui	0	13.1	80
Chongqing	Wushan	6	26.4	90
Fujian	Fu'an	0	2.5	6.7
Fujian	Pingnan	3	3	90
Gansu	Cheng	0	11.8	68.8
Gansu	Gaolan	Na	Na	0
Gansu	Liangdang	2	15.1	81
Gansu	Lintao	Na	Na	0
Guangdong	Liannan	0	24.5	63.3
Guangxi	Beiliu	10	10	3.3

Guangxi	Guiping	0	21.8	29
Guangxi	Jinxiu	1	27.4	56.7
Guangxi	Longsheng	2	21.6	22.6
Guangxi	Mengshan	3	22.7	63.3
Guangxi	Napo	0	35.5	6.1
Guangxi	Rongshui	0	24.4	70
Guangxi	Tianlin	7	21.8	20
Guangxi	Xilin	4	4	3.3
Guangxi	Ziyuan	20	30	16.1
Guizhou	Cengong	2	23.5	66.7
Guizhou	Changshun	Na	Na	0
Guizhou	Danzhai	0	23.7	63.3
Guizhou	Dushan	5	9.7	70
Guizhou	Duyun	12	26.9	70
Guizhou	Fenggang	1	13.2	63.3
Guizhou	Fuquan	4	13.4	80
Guizhou	Guiding	3	14.5	66.7
Guizhou	Guiyanghuaxi	20	34.8	23.3
Guizhou	Huangping	8	12.4	63.3
Guizhou	Jiangkou	0	13	100
Guizhou	Jianhe	1	28.5	66.7
Guizhou	Jinping	2	17	70
Guizhou	Kaili	1	9.4	83.3

Guizhou	Kaiyang	20	35.5	43.3
Guizhou	Leishan	1	1	20
Guizhou	Liping	Na	Na	0
Guizhou	Longli	4	18.8	73.3
Guizhou	Majiang	2	14.6	63.3
Guizhou	Meitan	54	54	16.7
Guizhou	Pingtang	0	3.6	100
Guizhou	Sansui	0	7.5	53.3
Guizhou	Shibing	2	14.1	66.7
Guizhou	Songtao	34	35.4	93.3
Guizhou	Taijiang	2	16.4	60
Guizhou	Tianzhu	5	23.5	53.3
Guizhou	Wanshantequ	1	15.3	100
Guizhou	Wengan	16	277	40
Guizhou	Xifeng	Na	Na	0
Guizhou	Xiuwen	29	37.3	50
Guizhou	Yuqing	0	0	73.3
Guizhou	Zhenyuan	10	18.6	46.7
Guizhou	Zunyi	2	12.6	76.7
Henan	Jiaozuo	28	28	5.6
Henan	Jiyuan	5	17.1	61.3
Henan	Xinxian	4	12.6	26.7
Hubei	Badong	4	28.6	70

Hubei	Baokang	1	23.1	84.4
Hubei	Danjiangkou	4	26.1	90
Hubei	Macheng	3	19.8	90
Hunan	Chaling	Na	Na	0
Hunan	Chengbu	4	33	54.5
Hunan	Guidong	11	17.3	23.3
Hunan	Guzhang	18	27.6	50
Hunan	Hengshan	Na	Na	0
Hunan	Jiangyong	20	35.3	10
Hunan	Longshan	5	22	37.9
Hunan	Sangzhi	0	12.3	93.3
Hunan	Suining	Na	Na	0
Hunan	Xinhuangdong	22	29.3	15.4
Hunan	Yongding	0	23.7	93.3
Hunan	Yongshun	3	33.6	73.3
Hunan	Zhijiang	30	40.3	18.5
Jiangxi	Jing'an	0	10.1	100
Jiangxi	Tonggu	5	26.3	10
Shaanxi	Fengxian	5	17.9	83.3
Shaanxi	Lueyang	1	19	70
Shaanxi	Zhouzhi	2	10.9	63.3
Shanxi	Yuanqu	Na	Na	0
Sichuan	Baoxing	13	33.5	66.7

Sichuan	E'mei	0	16.89	56.7
Sichuan	Hejiang	Na	Na	0
Sichuan	Hongya	5	31.1	80
Sichuan	Jiuzhaigou	0	5.3	10
Sichuan	Mabian	12	23.6	66.7
Sichuan	Ningnan	6	13	6.7
Sichuan	Pingshan	14	31.7	23.3
Sichuan	Xingwen	0	14.7	80
Yunnan	Yiliang	0	13	60
Zhejiang	Jingning	16	22	40
Zhejiang	Longquan	10	22	62.1
Zhejiang	Panan	0	0	3.6
Zhejiang	Suichang	0	33	41.4
