DISTRIBUTION OF THE WESTERN PARAGALAXIAS (*PARAGALAXIAS JULIANUS*) (PISCES: GALAXIIDAE) ON THE WESTERN CENTRAL PLATEAU, TASMANIA

by Mark Nelson

(with one text-figure and one appendix)

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The known distribution of the rare Tasmanian endemic fish species Western paragalaxias (*Paragalaxias julianus* McDowell & Fulton, 1978) is extended from 17 to 63 sites restricted to the Tasmanian Central Plateau in a region known as the Western Lakes in the World Heritage Area. The species was found in catchments, some lakes where it had not previously been recorded and from a wider range of habitat types than previously described.

Key Words: *Paragalaxias julianus*, Western Lakes, fish surveys, electrofishing.

INTRODUCTION

The Western Paragalaxias, *Paragalaxias julianus* McDowall & Fulton, 1978, is the largest of four endemic Tasmanian *Paragalaxias* species, the others being *P. eleotroides* McDowall & Fulton, 1978, *P. dissimilis* (Regan, 1906) and *P. mesotes* McDowall & Fulton, 1978. It may reach 100 mm in length (Fulton 1990) and varies in colour from dark brown to black on the back and sides with irregular patches on the sides. Background colour is yellowish-olive with a belly of silvery-olive (McDowall 1996). A comprehensive description is given by McDowall (1996, 1998).

Paragalaxias julianus is restricted to the Western Lakes region of the Central Plateau and is known from a number of lakes in the upper Little Pine and Ouse rivers catchments and from waters in an area known as the "Nineteen Lagoons". *P. eleotroides* and *P. dissimilis* are found in the Great Lakes and *P. mesotes* occurs in Arthurs and Woods lakes.

The origins of these species are uncertain. Fulton (1988) suggests all four species evolved in the Great Lakes area, but the genus predates the glacial periods because of its degree of dissimilarity to any of the other galaxiids. McDowall (1998) proposes that *P. julianus* occupied its present range only since the last glacial retreat, 15,000–25,000 years ago. McDowall (1998) further proposes the possibility that a species of *Paragalaxias*, not dissimilar to *P. julianus*, was widespread in central Tasmania and dispersed through the area following the last glacial retreat. Speciation would have occurred in the interim.

P. julianus is listed as rare under the *Tasmanian Threatened Species Protection Act 1995* because of its limited distribution, relatively small number of possibly fragmented localities, and the potential risk of decline due to introduced species and changes in habitat quality.

The Western Lakes Fishery Management Plan (Inland Fisheries Service 2002) indicated a need for surveys to clarify the species' distribution and conservation status. This paper reports on such surveys in the James River system, Ouse and Little Pine rivers and the "Nineteen Lagoons" region.

METHODS

Sites in the Western Lakes region of the Central Plateau were accessed by walking, limiting sampling capability.

Fish sampling was conducted using portable, battery-powered (24V, 7Ah) backpack electrofisher units (Smith-Root Model 12-B). Due to the low water conductivity in this region (Mean = 32.7 µS/cm, SD = 14.6) high power outputs were required. At each site sampling was conducted over a 10–15 minute period (electrofisher 'on' time when electrical current was passed through the water). Sites were sampled once only. Physical parameters recorded at each site were water temperature and electrical conductivity (WTW Model LF330), percent substrate type (Bedrock, Boulder >256 mm; Cobble 64–256 mm; Pebble 16–64 mm; Gravel 4–16 mm; Sand 1–4 mm; Silt/Clay <1 mm) and sampling period. Species identity and fork length were recorded for each fish collected.

Ninety-two sites were sampled in a five-week period. Site selection was based on information from prior surveys indicating known locations and expected distribution of *P. julianus*. Catchments where previous surveys failed to locate the species were also targeted (e.g., James R, lower Little Pine R systems).

RESULTS

Fish Species

Sites sampled and fish species recorded are detailed in appendix 1. Forty-six sites (50%) sampled contained *P. julianus* (appendix 1, fig. 1). A further 17 locations are known from the literature (Fulton 1988, Sloane & French 1991, Hydro Tasmania unpubl. data). Four fish species were recorded: the introduced brown trout (*Salmo trutta* Linnaeus, 1758), the climbing and spotted galaxias (*Galaxias brevipinnis* Günther, 1866 and *Galaxias truttaceus* Valenciennes, 1846 and the Western paragalaxias (*P. julianus*). The three native species were frequently recorded in the same water bodies (43.5% of sites) while *P. julianus* was occasionally found with only *G. brevipinnis* (21.7% of sites) and infrequently with only *G. truttaceus* (6.5% of sites). *P. julianus* was also recorded as the only fish species at a number of sites (28.3% of sites).

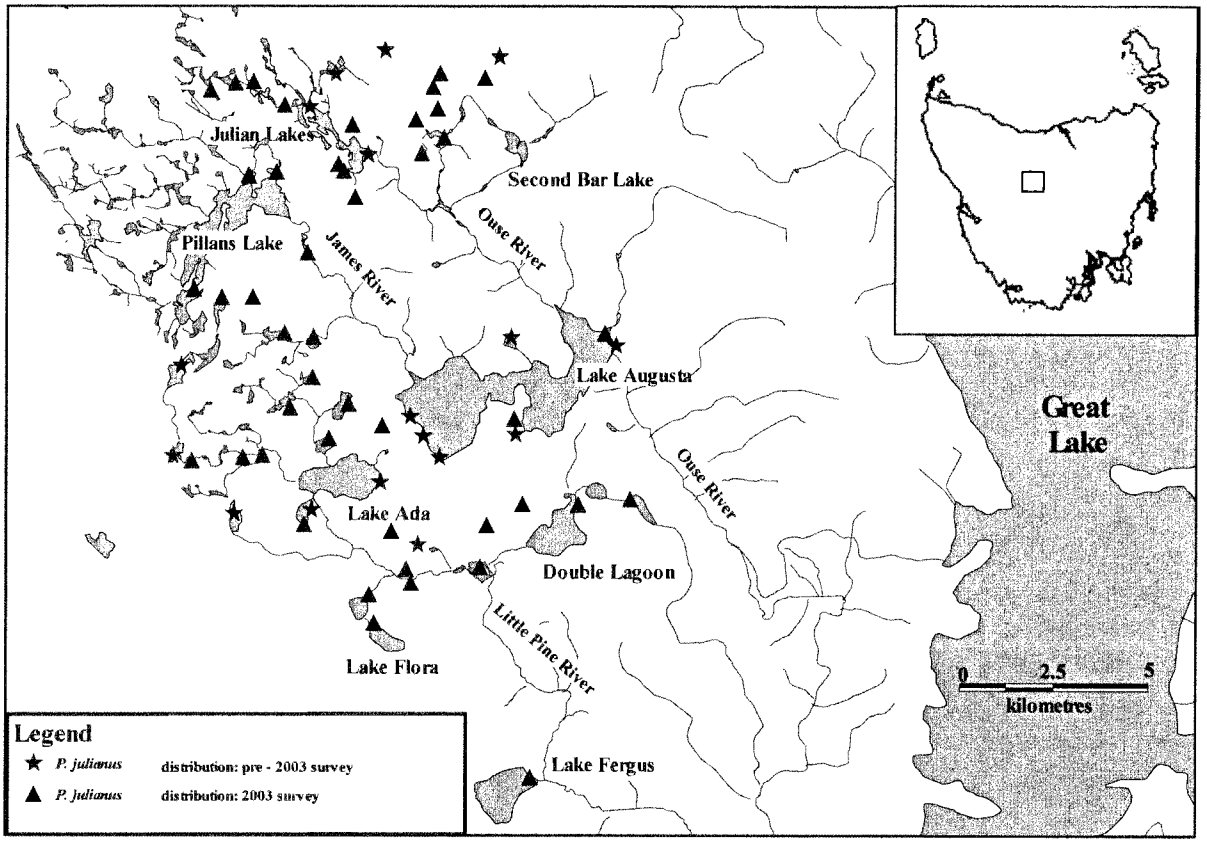

FIG. 1 — Collection sites in the Western Lakes for Paragalaxias julianus.

A total of 562 individuals of *P. julianus* were collected, ranging from 16 to 91 mm (mean=52.6 ± 14 SD) in length.

Habitat

Most water bodies contained shorelines of rock that graded into a uniform silt/sand bottom. *P. julianus* were most commonly found among uniform boulder (>256 mm diameter, 80% of sites) or cobble (64–256 mm diameter, 11% of sites) substrates, and frequently in a mix of both but with boulder dominant (74% of mixed substrate sites with boulder dominant). Of the remainder, two sites were individual boulders in a sand and silt substrate, one site a pebble (16–24 mm diameter) substrate and one site a silt substrate. Occasionally individuals were located in small piles of cobbles surrounded by silt substrate. Some individuals were located hiding under individual rocks of cobble or boulder size.

Field observations indicated that *P. julianus* preferred uniform cobble substrate in mixed habitat.

Distribution

The known distribution of *P. julianus* has now been significantly expanded. New areas include the James River system and Pillans Lake, and the middle and lower reaches of the Little Pine River as far down as Lake Fergus. The species range also includes the upper Lake Ada catchment incorporating Sandy and Tin Hut lakes, and the unnamed river system draining into the northwest corner of Julian Lakes, as well as the Stumps and Wadleys lakes system which is a sub-catchment of the James River system above Lake Augusta. All sites where the species occurred are above 1000 m elevation (appendix 1). The range area (extent of occurrence) is approximately 200 km^2.

The species was not located in one of the two northwest Julian Lakes catchments that drain into the main Julian Lake (fig. 1), nor were any specimens found in any of the lakes draining into Pillans Lake, although in many drainages no barriers to upstream movement were apparent.

DISCUSSION

Paragalaxias julianus is widespread within a restricted area delimited by the upper catchments of the Ouse and Little Pine rivers. Prior surveys indicated the species was common within a more limited range which included lakes in the Little Pine-Christys Creek system, between Lake Baillie and Lunka Lake, the Ouse River system above Lake Augusta, as well as the Carter Lakes and Lake Dudley (Sloane & French 1991). Clearly, the known distribution has not expanded beyond the expected range; rather, the species is widespread within this range. Sloane & French (1991) considered the species to be locally quite common and findings from the present study support this. *P. julianus* was frequently found in numbers exceeding those of the other galaxias species. However, at several sites only one or two specimens were located after intensive sampling, indicating that the current recorded distribution pattern is also partly a reflection of sampling effort. Due to the rapid survey technique used, small populations may have been missed during sampling. There is, therefore, the

potential for *P. julianus* to be present in some areas where it was not found during these surveys.

Although the surveys focused on lakes and relatively few riverine environments, *P. julianus* was not found in running water habitats. Several specimens were located in river lagoons and marginal river environments suggesting that it has a strong preference for standing water. It is possible that individuals were being forced into less favourable habitats by the dry conditions during the study period.

The absence of this species in catchments flowing into Pillans Lake indicates that the species may have moved up through the system to this current limit. Since data indicate a preference for lentic environments, dispersal upstream through riverine channels would be limited and slow. Fulton (1988) suggested the possibility that the species moved across catchments from the Ouse River system to the Little Pine River system in the area of Lake Augusta. This seems a likely scenario as the Little Pine River system was independent of the Great Lake system before construction of hydro-electric infrastructure and flows into the middle Derwent River, and the species has now been located in all adjacent catchments across the top of its known range.

It is unlikely that the species exists outside its known range which encompasses all the catchments in the upper Ouse and Little Pine rivers. The presence of trout also may have restricted distribution and abundance within this range but no pre-trout data are available. Trout predation or competition may reduce habitat availability by restricting the species to shallow backwaters and edgewaters and deterring them from moving into and spawning in or adjacent to open water (P. Davies pers. comm.). A common observation during this survey was for adult native fish to be seen swimming freely in open waters away from protective habitat in what were assumed to be trout-free waters. In contrast, where trout were known to be present, adult native fish were only collected from rocky substrates and were rarely visible.

Trout were not recorded in many lakes sampled but the backpack electrofishing technique used is not efficient for sampling trout in shallow lake margins. A fright effect can occur in open water through the fish sensing the electric field before stunning can occur, and through fish seeing operators before they come into capture range. Some trout-free lakes containing *P. julianus* may occur, but this is as yet unconfirmed.

In this study *P. julianus* were most abundant in uniform boulder or cobble substrates and frequently in a mix of both. Whilst McDowall & Fulton (1978) describe the species as being found beneath rocks on lake beds particularly where rocks are lying spaced apart on a gravelly substrate, they considered it less common among piles of rocks.

Much of the basic biology of *P. julianus* remains unknown. The species spends its entire life-cycle in freshwater, spawning in spring with eggs laid in masses on the sheltered, inland-facing side of rocks in shallow water, and the larvae are pelagic (P. Davies, pers. comm.). Information required for management to conserve the species includes life history; habitat requirements for spawning and all life stages; impacts of trout; and impacts of water management for hydro-electricity. A better understanding of trout-free areas would also assist in the future management of the species. It is unclear if the species distribution is stable, declining or expanding; future monitoring programs are necessary to determine this.

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APPENDIX 1
Fish species caught during the survey for *Paragalaxias julianus*

#	Site	Date (2003)	Easting AGD 66	Northing AGD 66	Altitude m a.s.l.	*Paragalaxias julianus*	*Galaxias brevipinnis*	*Galaxias truttaceus*	*Salmo trutta*
1	Carters Lake	3 Feb	461300	5365300	1150	*	*	*	
2	Emma Tarns	4 Feb	457614	5361922	1145		*		
3	Emma Tarns	4 Feb	457535	5361880	1145	*	*		
4	Hood Lagoon	4 Feb	457991	5360717	1148	*			
5	unnamed lagoon	4 Feb	458135	5360294	1161	*			
6	Little Pine River	4 Feb	458356	5360339	1161				*
7	Little Pine River	4 Feb	458832	5360523	1142				*
8	Lake Kay	4 Feb	460261	5360783	1145	*			
9	Lake Agnes	4 Feb	459022	5361294	1152				
10	Rocky Lagoon	5 Feb	458306	5363301	1158				
11	unnamed lake	5 Feb	452392	5362957	1166				
12	Ada Lagoon	5 Feb	454869	5362085	1159	*	*	*	*
13	Double Lagoon	5 Feb	463269	5362690	1161	*	*		
14	unnamed lagoon	5 Feb	464224	5365033	1157				
15	Lake Augusta	5 Feb	463972	5367717	1151				
16	Thomsons Rvt	5 Feb	464083	5367894	1156	*	*		*
17	Thomsons Rvt lagoon	5 Feb	464520	5368229	1164		*		*
18	Little Pine River	6 Feb	462195	5354325	1041				*
19	Lake Fergus	6 Feb	461803	5354378	1047	*	*		*
20	Bull Lagoons	6 Feb	460089	5355964	1156		*	*	
21	unnamed lake	7 Feb	455092	5372137	1170		*	*	
22	unnamed lake	7 Feb	456417	5372025	1217	*	*	*	
23	unnamed lagoon	11 Feb	458904	5370060	1224				
24	Pillans Lake	11 Feb	453135	5372675	1203	*	*	*	
25	Pillans Lake	11 Feb	453119	5372698	1203	*	*	*	*
26	Pillans Lake	12 Feb	451437	5369239	1201	*	*	*	
27	Hunters Lake	12 Feb	451813	5368460	1218			*	
28	unnamed lake	12 Feb	452298	5368986	1220	*	*	*	
29	Wadleys Lake	12 Feb	453261	5369002	1190	*	*	*	*
30	unnamed lake	13 Feb	451286	5371762	1212		*		
31	unnamed lake	13 Feb	450585	5371708	1216		*	*	
32	unnamed lake	13 Feb	449350	5371899	1228		*		
33	unnamed lake	13 Feb	449748	5371044	1245		*	*	
34	unnamed lake	13 Feb	450361	5371160	1228		*	*	
35	unnamed lake	13 Feb	451091	5371084	1236		*	*	
36	unnamed lake	14 Feb	452328	5373188	1216		*	*	*
37	unnamed lake	14 Feb	456056	5372823	1214	*	*		*
38	Lake Botsford	17 Feb	459104	5363402	1161				*
39	Ouse River	17 Feb	465395	5364999	1134		*		*
40	Little Blue Lagoon	18 Feb	457253	5365090	1158	*	*	*	
41	Sandy Lake	18 Feb	455631	5364702	1168	*			
42	unnamed lake	18 Feb	454431	5365638	1171	*	*	*	*
43	unnamed lake	18 Feb	453162	5365032	1179		*	*	
44	unnamed lake	18 Feb	453345	5365946	1180		*		
45	unnamed lake	18 Feb	455120	5366554	1181	*	*	*	*
46	James River	20 Feb	457892	5366857	1171		*	*	*
47	James River	20 Feb	455692	5369606	1177		*	*	*
48	James River lagoon	20 Feb	454953	5370333	1189	*			*
49	Lake Howe	20 Feb	453814	5370062	1223		*		
50	unnamed lake	20 Feb	454246	5367901	1199	*		*	
51	Stumps Lake	20 Feb	455141	5367788	1162	*	*	*	*
52	Lake Flora	21 Feb	457020	5359068	1145	*	*	*	
53	O'Dells Lake	21 Feb	456865	5359942	1145	*	*	*	
54	First Lagoon	23 Feb	464863	5362849	1155	*			
55	Ouse River	24 Feb	459503	5371432	1226				*
56	Second Bar Lake	24 Feb	461536	5373133	1230				*
57	unnamed lagoon	24 Feb	460342	5372210	1221		*		*

APPENDIX 1, cont.

#	Site	Date (2003)	Easting AGD 66	Northing AGD 66	Altitude m a.s.l.	*Paragalaxias julianus*	*Galaxias brevipinnis*	*Galaxias truttaceus*	*Salmo trutta*
58	unnamed lake	24 Feb	455889	5373037	1218	*	*	*	*
59	unnamed lake	24 Feb	456316	5374227	1224	*	*	*	
60	Lake Ila	25 Feb	458420	5373364	1221	*	*		*
61	Thomsons Lake	25 Feb	459111	5373839	1228	*			
62	Grubb Lake	25 Feb	460364	5375655	1225	*	*		
63	First Bar Lake	25 Feb	458980	5375776	1220	*			*
64	unnamed lake	25 Feb	458763	5375361	1216	*			*
65	unnamed lake	25 Feb	458906	5374716	1216	*			
66	unnamed river	25 Feb	458233	5374383	1217	*	*		*
67	unnamed lake	26 Feb	454231	5374820	1224	*			
68	unnamed lake	26 Feb	454158	5375521	1226		*		
69	unnamed lake	26 Feb	453264	5375530	1227	*	*	*	*
70	unnamed lake	26 Feb	452707	5375490	1230	*	*	*	
71	unnamed lake	26 Feb	451933	5375277	1227	*	*	*	
72	unnamed lake	26 Feb	451050	5376096	1245			*	
73	unnamed lake	26 Feb	451333	5376432	1243		*		
74	unnamed lake	26 Feb	453781	5375816	1242		*	*	
75	Pillans Lake	27 Feb	453993	5372796	1204	*	*		
76	unnamed lake	27 Feb	454158	5373070	1207		*	*	
77	unnamed lake	27 Feb	453778	5373621	1216		*		*
78	Tin Hut Lake	4 Mar	456232	5365752	1172	*		*	
79	East Rocky lagoon	4 Mar	460454	5362051	1152	*			
80	Lake Chipman	4 Mar	461553	5362690	1147	*	*	*	*
81	Little Pine Lagoon	5 Mar	465895	5348953	1020		*	*	*
82	unnamed lake	11 Mar	451618	5372864	1218		*	*	
83	unnamed lake	12 Mar	450103	5374919	1255		*	*	
84	Lake Gwendy	12 Mar	449664	5374783	1255		*	*	
85	Lake Lexie	12 Mar	448829	5374816	1264		*	*	
86	Pencil Pine Tarn	12 Mar	448447	5374083	1256		*		
87	unnamed lake	12 Mar	448921	5373395	1256		*	*	
88	unnamed lake	14 Mar	451727	5363709	1178		*	*	
89	unnamed lake	14 Mar	451384	5364019	1193	*	*		*
90	Terry Tarn	14 Mar	450656	5363586	1196		*	*	*
91	unnamed lake	14 Mar	452970	5364122	1170	*		*	*
92	unnamed lake	14 Mar	453580	5364195	1169	*			*

* indicates presence of species.
Sampling effort – 15 min. electrofisher 'on' time per site.