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The Sorong Rainbowfish *Melanotaenia fredericki*.

D.G.



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## Kosciuszko *Galaxias*: a story of confusion and imminent peril.

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Confusion surrounds the discovery and identity of the galaxiids that live at the highest altitude inhabited by any Australian native fish, and it seems a shame that we may resolve this issue just when we are about to lose them through trout predation.

Small fish were first noticed by Baron von Mueller during his exploration of the Snowy Mountains in 1853–4, as he travelled the pathless alpine regions, and for a number of years after, but he was unable to preserve zoological specimens. He saw these fishes again in 1874 in little glacier ponds at Mount Kosciusko (now spelt Kosciuszko) but was again unable to catch any (Macleay 1882). However, in 1882 he received two specimens caught on Mount Kosciuszko by S. Findlay Esq., J.P., which he passed on to Sir William Macleay who worked on Australian fishes at the time (1881–1884). Macleay prepared a description and read his paper, prior to publication, at a meeting of the Linnean Society of NSW in March the same year, naming the species *Galaxias findlayi*, dedicating it to the collector of the specimens on the request of Baron von Mueller (Macleay 1882). These fish were subsequently lost.

Mr. Richard Helms brought a few more specimens from the Mount Kosciuszko area ('Tom's Flat', possibly Diggers or Pipers Creek) to J. Douglas Ogilby, an ichthyologist at the Australian Museum in Sydney, in 1889. An interesting observation was that Helms found them '...almost everywhere...' (Helms 1890, p. 13) on the Snowy River side but could not find any on the other side which drained to the Murray River (Wilkinson's Valley), later incorrectly surmised to be the Murrumbidgee River side (Ogilby 1896, p. 62). When Helms later requested a report on the specimens from Ogilby in 1895, it was realised that they had gone missing after Ogilby was dismissed earlier from the museum. Soon after Ogilby tried to obtain more specimens through Rev. Mr. Curran and Mr. Hedley who visited Mount Kosciuszko in January 1896, but the two or three specimens brought back by Hedley were given to the Australian Museum, and unavailable to Ogilby. Ogilby persisted and eventually managed to get '...a fine series...', consisting of 16 individuals, from Rev. Curran, who re-visited the area. These fish were collected from the headwaters of the Snowy River and the Crackenback, now known as the Thredbo River (Ogilby 1896, p. 68.).

Ogilby re-described *Galaxias findlayi* on the basis of this new material (Ogilby 1896) and it appears that he later deposited five specimens at the Australian Museum (museum specimen number AMS I.3477). Ogilby commented on Macleay reading his paper at the meeting in 1882, and provided additional information not contained in the earlier paper, which seems to indicate that he attended this meeting himself. Macleay did not document the exact locality of capture of the specimens in his original published description (he may not have known), and Ogilby speculated on this. He stated that Macleay's specimens were found by Findlay in '...the streams which drain the southern slopes of Mount Kosciusko...' (p.62), and one can assume that he got this information verbally during the meeting.

*Galaxias findlayi* is now not recognised as a valid species, and is considered a form of mountain galaxias *Galaxias olidus* (McDowall and Frankenberg 1981), though the taxonomy of *G. olidus* is currently under review (Raadik 2001).

The second author visited Mount Kosciuszko in late spring last year, contemplating diving in Blue Lake on the summit, but, having no idea how cold and difficult this was to be, this idea was soon forgotten when checking out some small orchids along the road well short of the summit. Instead, checking out some streams at a much lower altitude was much more appealing,





*Galaxias* sp 1. Juvenile colouration, c. 45 mm TL. Blue Lake, summit Mt Kosciuszko.

R.K.



*Galaxias* sp 1. Adult colouration, c. 65 mm TL. Blue Lake, summit Mt Kosciuszko.

R.K.



*Galaxias findlayi*-form. Adult, c. 90 mm TL. Carruther's Creek, near summit, Mt Kosciuszko

R.K.



*Galaxias* sp 2. Adult, c. 75 mm TL. Sawpit Creek, low altitude slope, Mt Kosciuszko

R.K.



Blue Lake, summit, Mt Kosciuszko. Habitat of *Galaxias* sp 1-form.

T.R.

and a few small *Galaxias* were found and photographed from Sawpit Creek, Wilson's Valley. These were thought to be the '*findlayi*' form of Macleay and Ogilby. A few months later the first author collected galaxiids more extensively from the Mount Kosciuszko area for his study on mountain galaxias *Galaxias olidus* (Raadik 2001), and brought back some specimens from Carruthers Creek and Blue Lake. The galaxiids from these areas looked totally different from each other, and in turn were also different from those at lower elevation at Wilson's Valley. Therefore at least three different forms of *Galaxias* appeared to be present on the Snowy River side of Mount Kosciuszko.

A close examination of the descriptions by Macleay and Ogilby was undertaken. Whilst Ogilby's description is more detailed, it differs significantly from Macleay's with regard to some important characters, and it is therefore difficult to accept that the two descriptions are for the same form of *Galaxias*. It apparently did not occur to Ogilby that more than one form of *Galaxias* might be present on Mount Kosciuszko, and that fish collected from a different location to those in the original description may be different. It therefore appears that the fish obtained by Hedley, and used by Ogilby, were from a different stream to those obtained by Findlay, and originally described by Macleay.

Our fish collected from Carruthers Creek was intriguing, as it was very long and skinny and appeared to have been starved for a long time, though all other fish in this particular stream were similar. Once established in an aquarium to photograph, it was given plenty of food but remained long and skinny. This fish has a body depth that goes 10 times into the total length, and many other features also match the original description of *Galaxias findlayi* by Macleay. The fish we collected from Wilson's Valley closely matches Ogilby's re-description of *Galaxias findlayi*, with the body being shorter and thicker than the true '*findlayi*' form (5.5 to 8 times in total length). This fish also has other differences.

To add further confusion, the fish in Blue Lake have unusual eyes with proportionally larger pupils than the other *Galaxias* forms, and in the aquarium they would at first only take food





Carruther's Creek, near summit, Mt Kosciuszko. Habitat of *Galaxias findlayi*-form.

T.R.

from the bottom. They seem not to recognise mosquito larvae that were offered, usually readily taken by other newly introduced galaxiids to the aquarium, but took amphipods that crawled on the bottom or on rocks instead. It may be that their vision has adapted to orientate to the substrate. When photographed with a flash, the eye produced a glare in the lower half, not seen in other galaxiid species. The Blue Lake fish represents another distinctive form on Mount Kosciuszko.

Specimens from each form have been collected (preserved in formalin or frozen in liquid nitrogen) for more detailed analysis later in the year. Careful examination of the external and internal morphology of each form may detect additional differences, and analysis of frozen tissue will determine how different they are genetically. Finally, after 150 years since they were first noticed we may have a clear answer as to what species of *Galaxias* are present on Mount Kosciuszko, though additional collecting will also be conducted in the very upper tributary of the Snowy River, and in Club Lake, where galaxiids are known to be present.

What is apparent is that several forms of what are currently known as *Galaxias olidus* appear to inhabit this mountainous area, and they may be endemic and highly restricted in their geographical range. A similar scenario was noticed on the Bogong High Plains near Falls Creek where there are at least two (possibly three) distinct forms of *Galaxias olidus*, one in upper tributaries of the Mitta Mitta River system, and the other in tributaries of the upper Kiewa River system. (Raadik 2001, p. 788). These forms also appear to have differences to the Mount Kosciuszko forms.

It is critically important to determine the taxonomic status of all forms of *Galaxias olidus*, and identify significant forms or populations, so that we can determine how much diversity we actually have in this group of fishes. Trout are a major threat to many native Australian fish species, particularly galaxiids, and riverine frogs, especially in alpine regions. As introduced species, such as brown and rainbow trout, work their way upstream, they completely replace galaxiid populations, leading to local extinctions.





Hedley Tarn, near summit, Mt Kosciuszko.

T.R.

Brown and rainbow trout (*Salmo trutta* and *Oncorhynchus mykiss*) are present throughout the upper Snowy River system (and elsewhere in south-eastern Australia), having been introduced during the mid to late 1800's. They have slowly continued to spread upstream in the Snowy River catchment, colonising small tributary streams where they are not prevented access by natural instream barriers. Currently, *Galaxias* only persist above barriers, or where trout have not been able to colonise yet. Given the persistent rate of trout colonisation, the galaxiids on Mount Kosciuszko are now restricted to small remnant areas of their previous range, and we may lose them forever if action is not taken soon. Brown trout have been reported in the very upper Snowy River near the summit (Green, 2002), and have restricted the galaxiids in Sawpit Creek, Wilson's Valley, to the last upper 3 km of stream. Galaxiids also appear to have disappeared from the area that Hedley collected them in 1896 (Diggers or Pipers Creek) along the Kosciuszko Road.

The recognition of the degree and uniqueness of biodiversity values in aquatic flora and fauna has received little attention until recently, and efforts to protect values even more so. Control measures have been undertaken to prevent trout causing the extinction of another unique galaxiid, the barred galaxias *Galaxias fuscus* (Raadik et. al. 1996). This involved creating predator-free zones in small upland streams by removing trout, and constructing barriers to prevent them moving back upstream.

With respect to the galaxiids of Mount Kosciuszko, there is a high diversity of unique *Galaxias* forms, unknown until now, present in a small and unique habitat, some of which may be undescribed species. These fish are in danger of soon becoming extinct if action to control predators is not undertaken. They are the original 'fish from the Snowy River', and it would be a great shame to now recognise their true uniqueness and to name them, just before they become extinct.





Orchids (*Stegostyla alpina*) and frogs (*Pseudophryne corroboree*) are highly habitat sensitive and often used as indicator-species. Both species occur on Mt Kosciuszko. R.K. (left) & N.A. (right)

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