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Fifteen from one: a revision of the *Galaxias olidus* Günther, 1866 complex (Teleostei, Galaxiidae) in south-eastern Australia recognises three previously described taxa and describes 12 new species

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Abstract

The systematics of the *Galaxias olidus* hyper-species complex from freshwater habitats in south-eastern, mainland Australia is revised. *Galaxias olidus* Günther 1866 is redescribed, *Galaxias fuscus* Mack 1936 and *Galaxias ornatus* Castelnau 1873, previously synonymised with *G. olidus* (*sensu lato*), are reinstated as valid taxa and redescribed, and 12 taxa are described as new: *Galaxias aequipinnis* **sp. nov.**, *Galaxias arcanus* **sp. nov.**, *Galaxias brevissimus* **sp. nov.**, *Galaxias gunaikurnai* **sp. nov.**, *Galaxias lanceolatus* **sp. nov.**, *Galaxias longifundus* **sp. nov.**, *Galaxias mcdowalli* **sp. nov.**, *Galaxias mungadhan* **sp. nov.**, *Galaxias oliros* **sp. nov.**, *Galaxias supremus* **sp. nov.**, *Galaxias tantangara* **sp. nov.**, and *Galaxias terenasus* **sp. nov.** These species are morphologically similar and, whilst there is extensive overlap in meristic counts and morphometric characters, each can be diagnosed by unique combinations of characters, including allozyme loci and colour pattern; morphological diagnosis is improved greatly if based on freshly formalin-fixed material. *Galaxias schomburgkii*

Peters 1868, *Galaxias bongbong* Macleay 1881, *Galaxias kayi* Ramsay & Ogilby 1886 and *Galaxias oconnori* Ogilby 1912 are retained as junior synonyms of *G. olidus* (*sensu stricto*). The types for *Galaxias findlayi* Macleay 1882 are lost and no specimens matching its description were collected or examined from the Mt. Kosciuszko region; it is also currently retained as a junior synonym of *Galaxias olidus* s.s. The species *G. terenasus* **sp. nov.** and *G. arcanus* **sp. nov.** are the most morphologically specialised in the complex and *G. olidus* s.s remains the most morphologically variable species. It also remains the most widespread taxon, though its previously known distribution is reduced, particularly in the south-west of its range. Nine species are narrow-range endemics, known from one, or only a few, locations, and these restricted distributions most probably reflect the fragmentation and reduction of former ranges caused by the effects of alien salmonids. Eleven species are of conservation concern, most are considered critically endangered.

Key words: Galaxiinae, systematics, sympatric, cryptic species, salmonid impacts, threatened species, endemic fishes, freshwater.

Introduction

The Galaxiidae is arguably the most widespread freshwater fish family of southern-temperate affinity in terms of geographic spread across continents (South America, South Africa, Australia, New Caledonia and New Zealand) and altitudinal range, occurring from sea level to more than 2000 m above sea level (m asl) (McDowall 1990, Raadik & Kuiter 2002, Berra 2007). With 50 valid extant species world-wide in two subfamilies (47 species in Galaxiinae and three in Aplochitoninae), galaxiids have reached a particularly high level of species richness in Australia (McDowall & Frankenberg 1981) and New Zealand (McDowall 1970a, 2000), with 20 endemic species each, and sharing two additional taxa (Allen *et al.* 2003, McDowall 1970b, 2010). *Galaxias fuscus* Mack, 1936, currently a synonym of *Galaxias olidus* Günther (see McDowall & Frankenberg 1981) is considered a valid species by some authors, though it has not been formally re-elevated to species status. It is therefore excluded here. Eight species have so far been described from fossil remains in New Zealand (Stokell 1945, Whitley 1956a, Lee *et al.* 2007, Schwarzhans *et al.* 2012).

A relatively morphologically conservative family (Wishart *et al.* 2006), galaxiids have undergone traditional taxonomic revision a number of times (Stokell 1966, McDowall 1968, Scott 1968, McDowall 1970a, 1971, 1973a,b,c, 1976, 1978a, McDowall & Fulton 1978a, McDowall & Frankenberg 1981), leading to a number of previously valid species being synonymised and a period of relative stability in galaxiid nomenclature. Recent genetic analyses, however, provide considerable additional insight into species-level diversity in the Galaxiidae.

For example, a morphological revision placed a number of similar described taxa in New Zealand into a single, widespread, and rather variable species, the Common River Galaxias, *Galaxias vulgaris* Stokell, 1949 (McDowall 1970a). Subsequent genetic analyses revealed the presence of substantial cryptic diversity in this nonmigratory member of the *Galaxias brevipinnis* species group (Allibone 1991, Allibone & Wallis 1993, Allibone *et al.* 1996), suggesting that *G. vulgaris* was a species complex. A combined molecular and morphological focus on this species complex has reinterpreted its taxonomy to include six species, four of which are new (McDowall & Wallis 1996, McDowall 1997a, McDowall & Chadderton 1999, McDowall 2006b). Four additional genetic lineages are still awaiting taxonomic delineation (McDowall & Wallis 1996, Waters & Wallis 2000, 2001a,b, Waters *et al.* 2001a,b, McDowall 2006b, Burridge *et al.* 2007, Crow *et al.* 2009). A similar case is also being observed in South Africa for the nonmigratory Cape Galaxias, *Galaxias zebratus* (Castelnau, 1861), where ten deeply divergent genetic lineages flag an unresolved species complex (Waters & Cambray 1997, Wishart 2002, Wishart *et al.* 2006, Chackona *et al.* 2011, 2013).

In the Australian Galaxiidae, significant genetic divergence has been identified in two nonmigratory species suggesting the presence of additional morphologically similar taxa (cryptic species, *sensu* Bickford *et al.* 2007; p. 149): Western Galaxias, *Galaxias occidentalis* Ogilby, 1899 (Watts *et al.* 1995, Morgan *et al.* 2010, Murphy 2010), and Dwarf Galaxias, *Galaxiella pusilla* (Mack, 1935) (Coleman *et al.* 2010, Unmack *et al.* 2012). More recently, significant levels of genetic diversity were discovered in the Mountain Galaxias, *Galaxias olidus* Günther, 1866 in which 15 deeply divergent, distinctive, genetically defined candidate species (*sensu* Vences *et al.* 2005) were diagnosed (Raadik 2011, Adams *et al.* 2014).

Substantial genetic subdivision in *G. olidus* sensu lato (s.l.) is not surprising. It is globally the most widespread, nonmigratory, obligate freshwater species of galaxiid, recorded from an estimated area of 890,000 km^2 in south-

Jamie Knight, Wayne Koster, Erika Laws, Mark Lintermans, Lance Lloyd, Andrew Lo, Allan Lugg, James Maclaine, Jonathan Marshall, David Moffat, Anthony Moore, Michael Nicol, Justin O'Connor, Damien O'Mahony, Justin O'Mahony, Woo O'Reilly, Martyn Robinson, Stephen Saddlier, Andrew Sanger, Michael Sharp, Russell Strongman, Klaus Toft, Keith Walker, Ann Walton, Jon Waters, Ian Wooden, Gustavo Ybazeta, and Brenton Zampatti.

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