Observations on Fishes of the Family Galaxiidae

Part I

By

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In addition to their general importance as members of a remarkable family, the Tasmanian Galaxiidae are of special interest for several reasons. First, there are, as shown below, good grounds for believing that the island provides the type-locality of the genotype of the foundation-genus; secondly, the early observations of Johnston in Tasmania rank in historic interest with those of Hutton and Clarke in New Zealand; thirdly, the diversity of the Tasmanian Galaxiid fauna, it is now becoming apparent, rivals that of New Zealand, traditionally regarded as the headquarters of the family.

The primary object of the present paper is the description of four new species, one of which is referred to a new genus, *Saxilaga*, an interesting annectant form linking *Galaxias* Cuvier and *Neochanna* Günther.

Previously described Tasmanian species are listed, and in several cases commented upon: a detailed consideration of them is reserved, however, for a subsequent communication.

Since the revision by Regan, some thirty years ago, the family has considerably increased in number and diversity of forms, and it is apparent the time has arrived when some redistribution of its members is called for. In a recent paper Whitley (1935) has expressed the opinion that *Galaxias indicus* Day,[1] from littoral districts of Bengal and Madras, is 'only superficially like a *Galaxias*, and belongs to some other genus not yet determined', and has suggested the new generic names *Nesogalaxias*, *Lyragalaxias*, and *Querigalaxias*, for *Galaxias neocaledonicus* Weber and De Beaufort (New Caledonia), *Galaxias o'connori* Ogilby (Queensland), and *Galaxias dissimilis* Regan (? New South Wales), respectively. As these proposed names are not yet validated by the provision, in

[1] This species, which is not noted by Regan (1906) in his revision, is described (1888, p. 806) as having 'fine conical' teeth 'in the lower jaw, vomer and palatines, and some larger ones on the tongue'; the pelvics are eight-rayed.

accordance with the Code, of a summary of characters, it seems advisable, in order both not to anticipate Mr. Whitley's conclusions and to avoid any possibility of nomenclatural confusion, to leave the species concerned for the present in the position in which they now stand. *Galaxias bullocki* Regan, for which the genus *Brachygalaxias* has been proposed, I would at present be inclined to refer to a subgenus of *Galaxias*, occupying the position tentatively shown in brackets in the accompanying key, rather than to a separate genus: it is possible, however, that the two main characters noted by Regan (1908) as distinguishing it from all other species, namely, the presence of only five rays in the pelvic, and the insertion of the anal partly in advance of the dorsal, may prove, upon further consideration, to be worthy, when regarded in combination, of generic recognition. The resuscitation by Whitley of Ogilby's genus *Austrocobitis* for *Galaxias attenuatus* (Jenyns) has not been followed here, again in view of the absence of the diagnosis needed for the satisfactory delimitation of the genus.

The suggestions in regard to classification put forward in the present communication are governed by the desire, first, to supply such elements of the scaffolding of the taxonomic frame of reference as seem at once well-founded and expedient for the convenient handling of the material here dealt with, and, secondly, to avoid taking, at the present stage of the inquiry, any steps likely in any way to prejudice the complete revision of the systematics of the family that is undoubtedly desirable, but for which adequate data are perhaps not yet available.

The present taxonomic proposals comprise the institution of two new subfamilies, a new genus, with two subgenera, and two new subgenera of *Galaxias*. The primary feature on which the subfamilies are based is the general location of the dorsal, whether above the anal or the pelvic; to which may be added in part the uniserial or biserial arrangement of the premaxillary and mandibulary teeth, and the number of vertebrae. Characters regarded as of generic importance are the presence or absence of teeth on the palate, and the presence or absence of pelvic fins; while the number of rays in the pelvic is accorded subgeneric recognition. In the forms with a posteriorly placed dorsal the exact point of origin of the fin in relation to the anal, while affording a superficially attractive, if confessedly somewhat artificial, subgeneric criterion, is not made use of here for, among others, the following reasons: first, it exhibits some individual variation; secondly, its employment would involve, on the one hand, the association of species (*e.g.*, *G. (G.) attenuatus* and *G. (G.) scopus*) that, judged by other standards, are obviously far from being closely allied, and, on the other hand, the separation of species (*e.g.*, *G. (G.) auratus* and *G. (G.) scopus*) clearly belonging to the same group.

In retaining *Paragalaxias shannonensis* (and possibly also *G. dissimilis* Regan) in the Galaxiidae a conservative course has been followed. It may be observed that Regan (1913, p. 289) has pointed out, and has since (1914, p. 405) emphasized the importance of, the fact that of the salmonoid fishes, *sensu lato*, the Salmonidae alone have the vertebrae upturned at the base of the caudal fin. A comparison of *P. shannonensis* (all examples of which hitherto secured are small, the largest, the holotype, having a total length of 40·7 mm.), *G. attenuatus*, and *Salmo irideus* Gibbons seems to show that, morphologically, no sharp line of demarcation can be drawn between them. The practical value of the criterion, which lies principally in the circumstance that the upturned centra in the representative of the Salmonidæ are more or less of normal form, would appear to be considerably diminished by the rather distinctly marked segmentation of the upwardly deflected section, accompanied by no great attenuation of the centra, met with in *P. shannonensis*, and by the existence, though to a less marked degree, of an essentially similar state of affairs in young individuals of *G. attenuatus*. It is of interest to observe, incidentally, that in immediately post-larval examples of the lastnamed species the upward flexure of the distal end of the vertebral axis is clearly indicated during life by the course of a line of dark pigment deposited along the superior border of the notochordal sheath.

Key to Subfamilies, Genera, and Subgenera of Galaxiidae Here Considered

A. Dorsal fin inserted well back (about over anal fin); teeth in the jaws uniserial, vertebrae > 50 .... Subfamily *GALAXIINAE*

B. Teeth present on entopterygoids; dorsal and anal fins relatively high .... Genus *Galaxias*

C. Pelvic fin with seven rays .... Subgenus *Galaxias*

CC. Pelvic fin with six rays .... Subgenus *Agalaxis*

[CCC. Pelvic fin with five rays .... *Galaxias bullocki* Regan]

BB. No teeth on entopterygoids; dorsal and anal fins relatively low:

D. Pelvic fins present .... Genus *Saxilaga*

E. Pelvic fin with six rays; lingual teeth biserial .... Subgenus *Saxilaga*

EE. Pelvic fin with five rays; lingual teeth in more than two series .... Subgenus *Lixagasa*

[DD. Pelvic fins absent

F. Anal and dorsal fins subcontinuous with caudal fin .... Genus *Neochanna*]

AA. Dorsal fin inserted well forward (about over pelvic fin); teeth in the jaws biserial or uniserial; [vertebrae < 50 in *P. shannonensis*] .... Subfamily *PARAGALAXIINAE*

G. Teeth in the jaws biserial .... Genus *Paragalaxias*

[GG. Teeth in the jaws uniserial .... *Galaxias dissimilis* Regan]

Family GALAXIIDAE

Subfamily *GALAXIINAE*, nov.

Diagnosis. Dorsal fin inserted well back, about over anal fin, the length to origin of dorsal being about two-thirds of total length. Pelvic fins present or absent. Premaxillary and mandibulary teeth uniserial. Entopterygoids toothed or toothless. Lingual teeth in two or more series. Vertebrae more than 50.

Type-genus. Galaxias Cuvier, 1817.

The subfamily includes *Galaxias* Cuvier, *Neochanna* Günther, and *Saxilaga*, nov.

Genus **Galaxias** Cuvier, 1817

Galaxias Cuvier, *Règn. Anim.* ed. 1. II. 1817. p. 183.[1]
Mesites Jenyns, *Zool. Voy. Beagle.* III. *Fish.* 1842. p. 118. Preoccupied by *Mesites* Geoffroy, 1838 (Aves), and *Mesites* Schoenherr, 1838 (Coleoptera).
Austrocobitis Ogilby, *Proc. Linn. Soc. N.S.W.* XXIV. 1899. p. 158. Substitute for *Mesites* Jenyns, preoccupied.

Diagnosis. Body more or less elongate. Dorsal fin inserted well back; free of caudal; relatively high; with 9-15 rays, which are mixed (simple and branched). Anal fin partly below dorsal; free of caudal; relatively high; with 10-19 mixed rays. Pelvic fins present; with 7, 6, or 5 rays. Premaxillary and mandibulary teeth uniserial, conical, pointed. Entopterygoids each with a single series of teeth. Lingual teeth biserial. Eye fairly large to small; with free circular lid. Vertebrae 53-64, *fide* Regan (1906, p. 365).

Haplotype. Esox truttaceus Cuvier.

Subgenus **Galaxias,** nov.

Diagnosis. Pelvic fin with 7 rays.

Orthotype. Esox truttaceus Cuvier = *Galaxias (Galaxias) truttaceus* (Cuvier).

This, the typical and dominant section of the family, includes 24 of the 27 species of *Galaxias* regarded by Regan in his revision as well established, a total since considerably extended. McCulloch (1929) admitted 18 Australian species, including the 5 species accredited by authors generally to Tasmania, to which 3 species are here added. Phillipps (1926 (a)) listed 8, and later (1927) 7 New Zealand species, and Regan (1913) noted 6 species from South American localities, referable to this subgenus.

[1] McCulloch (1929, p. 47), citing this reference, gives the date as '" 1817 " = Dec. 1816', and adopts 1816 as the date of publication of the genus. Sherborn, however, in his bibliography (*Index. Anim.* 1801-1850. I. 1922. p. xli) seems clearly to indicate that only vol. 1 of the first, or " 1817 ", edition was published in Dec., 1816, and in his systematic text (XI. 1926. p. 2621) formally gives 1817 as the date for *Galaxias* Cuvier. Sherborn has questioned the validity of this edition, noting ' it abounds in vernaculars '; and has observed that ' Cuvier's vernac. are latinized and available for first time by Schinz ', *i.e., Das Thierreich.* 4 vols. Stuttgart. 1821-1825 (vol. 2, with *Galaxias*, 1822).

Distribution. Australia, and neighbouring islands; Tasmania, and neighbouring islands; New Zealand and neighbouring, and sub-antarctic, islands; Falkland Islands; Tierra del Fuego; Patagonia, and neighbouring islands; Argentina; Chile; &c.: not South Africa. [*G. neocaledonicus* Weber and De Beaufort, which, if retained in *Galaxias*, would be, to judge from the original account in the *Zoologischer Anzeiger*, XLII, 1913, p. 173, referable to this subgenus, is from Southern New Caledonia.]

Galaxias (Galaxias) truttaceus (Cuvier)

Esox truttaceus Cuvier, *Règn. Anim.* ed. 1. II. 1817. p. 184.
Galaxias ocellatus McCoy, *Intercol. Exhib. Essays.* 7. 1866. p. 14.

Distribution. Tasmania, and neighbouring islands; Victoria: not New Zealand. Type-locality (by present designation): Agnes River, South-Eastern Tasmania.

In the Check-List McCulloch (1929, p. 48) gives the original reference to this species as—'1816. *Esox truttaceus* Cuvier, *Règn. Anim.*, ed. 1, II, "1817" = Dec. 1816, p. 184; ed. 2, II, 1829, p. 283. *Ex Esox alepidotus* Forster MS. No locality [= New Zealand].'

Realizing that an error had somehow crept in, apparently arising from some confusion regarding *Esox alepidotus* Forster MS., and believing that the type-locality should certainly be Tasmania, I have communicated with Mr. G. P. Whitley, Ichthyologist, Australian Museum, Sydney, who agrees with me that the designation of New Zealand is incorrect, and has very kindly supplied the greater part of the bibliographical data discussed below.

Disregarding the interesting side-issues that arise in connexion with the status of *E. argenteus* Gmelin, *E. argenteus* Forster MS., *E. alepidotus* Forster, and *G. forsteri* Cuvier and Valenciennes, the position in regard to *G. truttaceus* may be summarized as follows. (*a*) In the first edition of Cuvier (1817, pp. 183-184) we find the first publication of the names *Galaxias* and *Esox truttaceus*—*i.e.*, the generic and specific names of the present form, the former in the heading (p. 183) to the description, 'Les Galaxies. (Galaxias. Cuv.)', the latter in a footnote (p. 184), '*Esox truttaceus* Cuv. espèce nouvelle, ou peut-être l' *es. argenteus* Forster?' (*b*) Here, it is to be noted, no locality is given, nor is there any mention of *Esox alepidotus* Forster as such. (*c*) Mr. Whitley remarks that at that date the French had little knowledge and very few specimens of New Zealand fauna, and surmises that Forster's MS. description of *alepidotus* was probably in Berlin. (*d*) In the second edition of Cuvier (1829, p. 283) the description of the genus is the same as that in the first, but the footnote reads, '*Esox truttaceus* Cuv.;—*Esox alepidotus* Forst.', indicating that Cuvier considered these two (separate) species belonged to *Galaxias:* no localities are given. This account is translated as it stands by Voigt (1829). (*e*) In the German edition of Cuvier by Schinz (1822, p. 309), a translation and enlarge-

ment of the first edition, in which Cuvier's names are latinized, the combination *Galax (ias) truttaceus* appears for the first time. (*f*) In the second (the only accessible) edition of Cuvier and Valenciennes (1846, p. 253) appears the following passage. 'Le genre Galaxie est une création de M. Cuvier; il l'a établi sur un petit poisson, rapporté de la Nouvelle-Holland par MM. Péron et Lesueur, et qui a été ensuite retrouvé par MM. Quoy et Gaimard. Ces deux chirurgiens de la marine royale nous apprirent que le poisson de Péron vivait dans les eaux douces de la terre de Van-Diemen'. (*g*) These facts, particularly (*f*), seem clearly to show that the type-locality of New Zealand, given by McCulloch, is erroneous, and further, that it should be 'fresh water, Tasmania'. There seems to me little doubt that the type-material of the species was collected in the D'Entrecasteaux Channel district during the visit of Baudin's expedition, January 13th - February 17th, 1802. This would presumably be now in the Paris Museum. Dealing with an excursion made by a party in the neighbourhood of the 'Rivière Fleurieu' inland from 'le port des Cygnes', Péron (1807, p. 234) remarks, '. . . . ils y avaient aussi vu de nombreuses truites; et M. Lesueur m'en rapportoit quelques-unes qu'il avoit tuées d'un coup de fusil'. It seems very probable that these 'truites' were *Galaxias truttaceus*, and, on the evidence available, I venture to redesignate the type-locality of this species as Agnes River (Rivière Fleurieu of Péron), South-Eastern Tasmania. It should be noted that elsewhere Péron (1824, p. 73) mentions *Esox* among marine fishes and sharks, the reference, which may be presumed not to be a Galaxiid, possibly relating to *Dinolestes*, or *Sphyraena*.

Galaxias (Galaxias) attenuatus (Jenyns)

Mesites attenuatus Jenyns, *Zool. Voy. Beagle*, III. *Fish.* 1842. p. 121. pl. XXII. fig. 5.
Austrocobitis attenuatus Ogilby, *Proc. Linn. Soc. N.S.W.* XXIV. 1899. p. 158.
Galaxias attenuatus Regan, *Proc. Zool. Soc.* 1905. II. (1906). p. 368. pl. XII. fig. 1 and pl. XIII. fig. 2. (references and synonymy).

Distribution. Queensland (Marshall, 1928); New South Wales; Victoria; South Australia; Tasmania, and neighbouring islands; New Zealand, and neighbouring islands; Falkland Islands; Tierra del Fuego; Patagonia; Chile; &c. Type-locality: Bay of Islands, New Zealand.

Galaxias (Galaxias) rostratus Klunzinger

Galaxias rostratus Klunzinger, *Arch. Naturges.* XXVIII. 1. 1872. p. 41.

Distribution. South Australia. Type-locality: Murray River, South Australia.

Remarks. Regan (1906, p. 378), in error, cites the type-locality as 'Mersey River', thus suggesting a Tasmanian habitat: fortunately, this slip has not crept into any of our faunal lists. The species, incidentally, does not seem to have been recognized since its description more than sixty years ago.

Galaxias (Galaxias) auratus Johnston

Galaxias auratus Johnston, *Pap. Roy. Soc. Tasm.* 1882 (1883). pp. 62 and 131.

Distribution. Tasmania. Type-locality: Great Lake, Tasmania.

Remarks. In Johnston's MS., made available by Whitley (1929, p. 48), there appears under the record of *G. atkinsoni* ('Pieman River, Tasmania, 28th Nov., '79. T. R. Atkinson') a subsequently added note: 'Mr. Irving, in early May, 1894, sent me from Great Lake one of several specimens almost identical with the above, as regards dusky bar markings, but close to the characters of *G. attenuatus* in other respects'. Unless the resemblance to *G. attenuatus* was of a most superficial character, I am at a loss to make a conjecture as to the identity of this specimen. If, however, the observation was the result of quite a casual inspection, signifying, for instance, little more than the body was slender, and the mouth small, there seems a possibility that the specimen might have been a young example of *G. (G.) parkeri*: but the available evidence is of too uncertain a character to be invested with any taxonomic significance.

Galaxias (Galaxias) weedoni Johnston

Galaxias weedoni Johnston, *Pap. Roy. Soc. Tasm.* 1882 (1883). p. 131.
? *Galaxias atkinsoni* Johnston, *Pap. Roy. Soc. Tasm.* 1882 (1883). p. 131.

Distribution. Tasmania. Type-locality: Mersey River, Tasmania.

Remarks. The relegation by Regan of *G. (G.) atkinsoni* to the synonymy of *G. (G.) weedoni* has been generally followed by Australian authors, *e.g.*, McCulloch (1929), Lord and Scott (1924, p. 33). Further evidence, particularly data derived from adult specimens, appears to be required, however, before the status of the species can be satisfactorily determined. The type-locality of *G. (G.) atkinsoni*—spelt *atkinsonii* by Regan (pp. 377 and 378)—is Pieman River, Tasmania: the specimens discussed by Regan came from Lake Laura.

In Johnston's memoranda, redacted by Whitley (1929, p. 47), there is included under the heading of *G. auratus* a note on a 'Mountain Trout. Lake Sorell'. Though it might naturally be presumed Johnston would be quite clear on the limits of one of his own species, I have, nevertheless, a suspicion that the specimen in question may possibly be referable to *G. (G.) affinis* Regan. The whole matter, however, appears too vague to warrant even a queried inclusion of the reference in the synonymy.

Galaxias (Galaxias) affinis Regan

Galaxias affinis Regan, *Proc. Zool. Soc.* 1905. II. (1906). p. 380, pl. X. fig. 1.

Distribution. Tasmania. Type-locality: Lake St. Clair, Tasmania.

Remarks. I have previously (1934, p. 39) called attention to the omission of this species from the Tasmanian lists of Lord (1923) and Lord and Scott (1924).

Galaxias (Galaxias) johnstoni, sp. nov.

(Text-fig. 1)

B. 8 [8-9]. D. III, 7 [III, 6-7]. A. III, 7 [III, 6-7]. P. 12 (IV, 8). V. 7. C. 14, II + $\frac{\text{IX} +}{\text{IX} +}\left[\text{14, II} + \frac{c.\ \text{VIII} - \text{X}}{c.\ \text{IX} - \text{XI}}\right]$. Gill-rakers on lower limb of anterior arch 8 [7-8], moderately stout, fairly short.

Depth of body, 6·9 [7·2-7·6] in total length, 5·9 [6·1-6·6] in standard length. Head 5·9 [5·4-5·5] in total length, 5·0 [4·6-4·8] in standard length. Snout 3·4 [3·8-4·3] in head. Eye 1·4 [1·0-1·3] in snout, 2·3 [1·9-2·1] in interorbital width, 4·8 [4·3-4·6] in head. Depth of caudal peduncle 1·4 [1·4-1·7] in its length, 2·1 [2·3-2·4] in head. Length of caudal peduncle 1·4 [1·4-1·5] in its superior length (*i.e.*, interval between termination of dorsal and hypural joint), 1·3 [1·2-1·3] times base of dorsal.

Body rather slender; greatest width 1·1 [1·1-1·2] in greatest depth. Head moderate; greatest depth 1·1 [1·1-1·2] in greatest width; depth at eyes 1·1 [1·1-1·3] in width there, the latter dimension being 1·1 [1·0-1·1] times length of postorbital portion of head. Eye rather small. Interorbital region almost flat. Snout obtuse, little depressed; jaws equal [equal-subequal] anteriorly. Maxillary extending almost to level of middle [anterior ⅓—almost middle] of eye. Tubular anterior nostril nearly as wide as high; equidistant from anterior margin of upper lip and eye. Simple posterior nostril slightly in advance of, barely above, eye; nearly thrice as far from anterior nostril as from orbit.

Pores along midlateral line about 29 + 23, one to each myomere, decreasing in size caudad.

Lingual teeth rather large. Pterygoidal teeth moderate. Premaxillary teeth rather small, subequal. Mandibulary teeth moderate, somewhat enlarged laterally.

Dorsal fin moderate, fairly high; base 2·0 [1·8-1·9] in head, subequal to postorbital portion of head; longest (2nd [2nd-1st] branched) ray 1·3 [1·6-1·7] in head, more than twice snout; distance from its origin to base of caudal 4·1 [3·4-3·8] in total length, 3·5 [2·9-3·1] in standard length; laid back, extends less than half-way along superior profile of peduncle, barely reaching origin of caudal ridge.

Anal fin subequal to dorsal; base 1·8 [1·8] in head, less than caudal peduncle; longest (2nd [2nd-1st] branched) ray 1·3 [1·4-1·6] in head, less than depth of body; originating behind origin of dorsal by 0·5 [0·5-0·6] of base of latter; terminating behind base of dorsal by 0·6 [0·6] of latter; laid back, extends scarcely half-way along peduncle, reaching well past origin of caudal ridge.

Pectoral fin moderate, obtusely pointed; longest (5th [5th]) ray 1·3 [1·5-1·6] in head; extending 0·6 [0·5-0·6] of distance from its origin to origin of pelvic.

Pelvic fin moderate; longest (4th [4th]) ray 1·6 [1·7-2·0] in head; originating midway between base of caudal and anterior margin of eye; length to its origin 2·2 [2·1-2·2] in total length, 1·9 [1·8-1·9] in standard length; extending 0·6 [0·6-0·7] of distance from its origin to origin of anal.

Caudal fin moderate; emargination 10 per cent. [9-12 per cent.]; length 1·1 [1·2-1·4] in head. Caudal ridges well developed; extension cephalad from level of hypural subequal to median caudal rays.

Total length 71 mm. [49-50·5 mm.]; standard length 60·5 mm. [42·5-43 mm.].

Ground colour in life translucent greenish, becoming greyish white, shot with silvery gold, below. Back and sides irregularly blotched, obscurely barred, and reticulated with brownish. In the holotype (Text-fig. 1) and in one paratype, viewed laterally, the much-reticulated dark colour-pattern, the area of which equals, or slightly exceeds, that of the interspaced ground colour, descends, behind vent, to ventral profile, but, in advance of vent, ceases at about one-third

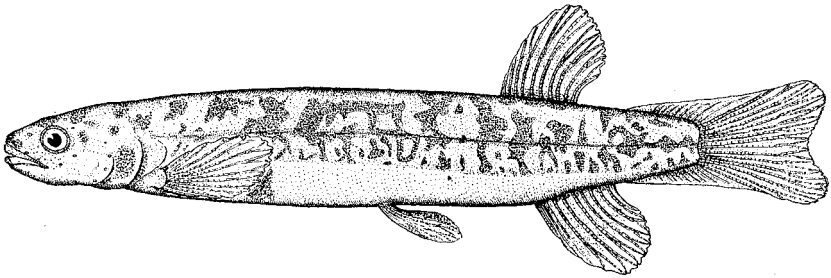

Fig. 1.—*Galaxias (Galaxias) johnstoni*, sp. nov. Holotype. Near Nive River, Tasmania. (× 1½.) [Parasites not shown.]

of the body-height above ventral profile, the line of demarcation being moderately sharp. In two paratypes the broad bars of the dark colour-pattern, the area of which greatly exceeds that of the interspaced ground colour, cease above the ventral profile throughout the entire length, the line of demarcation being decidedly sharp. Dorsal markings similar to lateral, meeting a well-defined narrow median stripe of gold, extending from nape to dorsal origin: in preserved specimens this stripe, along which the body becomes sunken to form a groove, appears as a continuous, or subcontinuous, dark streak. Whole body lavishly and brilliantly punctuated with metallic gold. Head in general concolorous with body, with darker patches between and behind eyes, where there is much scattered gold, at bases of anterior nostrils, and on tip of snout; ventral surface concolorous mesially with that of body, darker laterally; lower lip scarcely lighter than upper, the latter concolorous with general dorsal surface of snout. Operculum with conspicuous metallic gold blotch. A narrow gold annulus surrounding pupil; iris otherwise blackish

with purplish cast. No suborbital dark streak. Enteric canal metallic greenish gold. All fins immaculate, golden, in some lights presenting a metallic appearance.

Specific name in honour of Robert Mackenzie Johnston, the father of Tasmanian ichthyology, who paid considerable attention to the local Galaxiidae.

Types. Described from the holotype (Text-fig. 1) in the Queen Victoria Museum, Launceston (Reg. No. HT 948), and from three paratypes, the variations exhibited by which are recorded throughout in square brackets. Paratypes will be offered to the British Museum (Natural History), London; Australian Institute of Anatomy, Canberra; Australian Museum, Sydney.

Locality. Creek crossing the Hobart-Queenstown road, about three and three-quarter miles westward from the Nive Bridge; 31st March, 1934.

Affinities. It is convenient here to observe that the Tasmanian representatives of the subgenus fall naturally into three sections: the *truttaceus* group, comprising that species, *auratus*, and *scopus*; the *weedoni* group, comprising that species (and *atkinsoni*, if distinct), *johnstoni*, *parkeri*, and, rather towards the fringe of the assemblage, *affinis*; and the *attenuatus* group, represented locally by that species only. While the familiarity acquired from handling of actual specimens renders the relegation of any species to its appropriate group a simple matter, a formal and precise delimitation of the groups naturally presents some little difficulty. Broadly speaking, however, and allowing for occasional exceptions to individual diagnostic points, the members of the *truttaceus* group exhibit the following characters:—rather small mouth; pelvic fins inserted well back; anal fin set well forward, relative to dorsal; anal and dorsal not pointed, without macroscopic spots, often blackish distally; colour-pattern not extensive, usually in the form of spots, which are often ocellated; suborbital dark streak; relatively little metallic gold in life: members of the *weedoni* group exhibit.—rather large mouth; pelvic fins inserted moderately to well forward; anal fin set below about middle of dorsal; anal and dorsal more or less pointed, often with macroscopic spots, not blackish distally; colour-pattern extensive, usually in the form of bars, chevrons, blotches, or reticulations, seldom in spots, which, in any case, are never ocellated; no suborbital dark streak; a considerable amount of metallic gold in life: members of the *attenuatus* group (including extralimital species, *e.g.*, *G. gracillimus*, *G. maculatus*) differ from the two preceding groups by, among other characters, the small mouth, elongated body, origin of anal vertically below that of dorsal (*cf.*, however, *G. scopus*), large number of anal rays, and nature of colour-pattern.

G. (G.) johnstoni is distinguishable from all other members of the *weedoni* group by its colour-pattern. It further differs from *G. (G.) weedoni* (and *G. (G.) atkinsoni)* in the radial formulae of anal, dorsal, and pectoral; from *G. (G.) parkeri* in having fewer anal rays, jaws equal anteriorly; from *G. (G.) affinis* in having fewer anal rays, &c.

Parasites. The holotype is parasitized to a slight extent by an Opisthorchiid trematode (not shown in figure), probably congeneric with the *Clonorchis* noted by Whitley (1935, p. 51) as occurring in Galaxiids and in *Retropinna.* The distomes are encysted in the immediately subdermal tissue and the fin-membranes, where they induce local melanosis. A few scattered cysts are observable, particularly on the caudal fin, in each of the paratypes.

As Regan (1906, p. 364) has pointed out, 'in some species' of *Galaxias* these 'numerous small blackish spots on the body and fins are almost always present, and have been mistaken for colour-markings characteristic of the species (*e.g.*, *G. lynx* and *G. olidus*)'.

Galaxias (Galaxias) scopus, sp. nov.

(Text-fig. 2)

B. 8 [9]. D. IV, 8 [IV, 8]. A. IV, 10 [IV, 12]. P. 16 [15]. V. 7. C. 14, II $+\frac{\text{VIII}+}{\text{VII}+}\left[\right.$ 14, II $+\frac{\text{IX}+}{\text{IX}+}\left.\right]$. Gill-rakers on lower limb of anterior arch 10 [11], long, slender.

Depth of body 6·6 [6·3] in total length, 5·5 [5·3] in standard length. Head 5·5 [5·7] in total length, 4·6 [4·8] in standard length. Snout, 3·6 [3·6] in head. Eye 1·2 [1·2] in snout, 1·9 [2·1] in interorbital width, 4·3 [4·4] in head. Depth of caudal peduncle 1·1 [1·2] in its length, 2·1 [2·1] in head. Length of caudal peduncle 1·5 [1·4] in its superior length, 1·3 [1·1] times base of dorsal.

Body stout; greatest width 1·2 [1·2] in greatest depth. Head moderate; greatest depth 1·0 [1·0] in greatest width; depth at eyes 1·0 [1·0] in width there, the latter dimension being 1·2 [1·3] times length of postorbital portion of head. Eye moderate. Interorbital region convex. Snout obtuse, little depressed; jaws equal anteriorly. Maxillary extending to level of anterior ¼ [⅕] of eye. Tubular anterior nostril higher than wide; about twice as far from eye as from anterior margin of upper lip. Simple posterior nostril above, and well in advance of, eye; nearer to orbit than to anterior nostril.

Pores along midlateral line about 40 + 22, one to each myomere.

Lingual teeth moderate. Pterygoidal teeth moderate. Premaxillary teeth fairly large, increasing somewhat in size laterally. Mandibulary teeth moderate; several more or less distinctly enlarged lateral canines; an enlarged tooth on either side near the symphysis.

Dorsal fin rather small, fairly high, base 2·4 [2·0] in head, less than, or equal to, postorbital portion of head; longest (3rd [3rd] branched) ray 1·5 [1·3] in head, two and a half times snout; distance from its origin to base of caudal 4·6 [4·6] in total length, 3·9 [3·8] in standard length; laid back, reaches half-way along superior profile of peduncle, extending beyond origin of caudal ridge.

Anal fin much longer, slightly higher, than dorsal; base 1·4 [1·4] in head, noticeably more than caudal peduncle; longest (2nd [3rd] branched) ray 1·3 [1·2] in head, more than half anal-pelvic interspace; originating behind origin of dorsal by 0·05 [0·0] of base of latter; terminating behind base of dorsal by 0·6 [0·6] of latter; laid back, extends three-fourths of the way along peduncle, reaching beyond anterior procurrent ray.

Pectoral fin moderate, rounded; longest (5th [6th]) ray 1·5 [1·4] in head; extending 0·5 [0·5] of distance from its origin to origin of pelvic.

Pelvic fin moderate; longest (3rd [3rd]) ray 1·8 [1·7] in head; originating midway between base of caudal and a point between orbit and anterior nostril [equidistant from base of caudal and eye]; length to its origin 2·3 [2·2] in total length, 1·9 [1·8] in standard length; extending 0·6 [0·6] of distance from its origin to origin of anal.

Caudal fin moderate; emargination [about 20 per cent.]; length 1·1 [1·1] in head. Caudal ridges well developed; total depth at level of hypural greater than [equal to] length of caudal peduncle.

Total length 129 mm. [114 mm.]; standard length 108·5 mm. [96 mm.].

Ground colour in formalin faintly bluish grey. Ventral surface in holotype ivory with minute dark punctulations, scarcely apparent to the naked eye; in paratype obscurely brownish from the presence of numerous stellate black pigment-spots. Holotype with lower half, or more, of sides behind level of dorsal origin with distinct yellowish suffusion. A dark, sharply defined postpectoral bar or blotch, preceded (right side of holotype), or followed (left side of holotype), or encircled (both sides of paratype) by a narrow region of pale sulphur yellow. Back and sides with numerous circular or elliptical dark purple spots of several sizes, the great majority conspicuously annulated with sulphur yellow. On the sides in advance of the anal base these cease below at about the horizontal level of middle pectoral base, but cover the whole caudal peduncle, on which the large spots are of greater dimensions than elsewhere, while small spots are few, or absent. The whole interspace between the spots, including the light-coloured annuli, thickly covered with blackish punctulations, somewhat more sparsely set in the holotype on the lower part of the caudal peduncle. Occipital region, cheek, and

opercle concolorous with dorsal and lateral aspects of body; ventral surface of head concolorous with ventral surface of body; interorbital region and dorsal surface of snout darker than rest of head, markedly so in paratype, in which they are black. Upper lip very dark, almost black; posterior half of lower lip lighter than, anterior half almost concolorous with, upper lip. Broad oblique suborbital dark streak. Dorsal and anal fins with about the proximal third abundantly punctulated greyish; remainder, except tips, which are blackish, immaculate and with some indication of having been yellowish in life. Pectoral fins with membrane sparsely pigmented at base, immaculate elsewhere; rays with lateral and some medial pigmentation, rendering them somewhat dusky. Pelvic fins mainly hyaline, with small faintly ashen basal region; tips blackish. Caudal fin in holotype slightly, in paratype moderately, dusky; a dark basal region; in paratype distal region narrowly blackish. Caudal ridges minutely and abundantly punctulated: in holotype upper ridge with four or five dark spots; in paratype upper and lower ridges each with one or two spots.

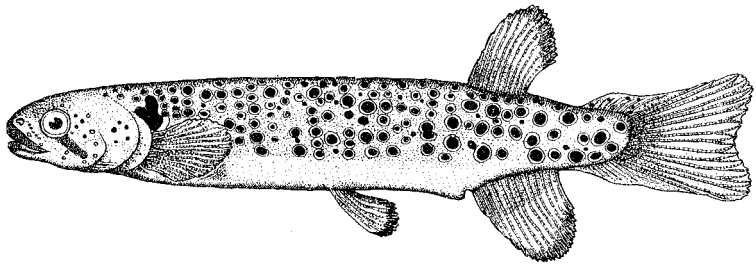

Fig. 2.—*Galaxias (Galaxias) scopus*, sp. nov. Holotype. Clarke Island, Bass Strait. (× ¾.)

Scopus, a target—in allusion to the general suggestion of resemblance, arising from the irregular, crowded distribution of the spots, to a target riddled with bullets.

Types. Described from the holotype (Text-fig. 2), in the Queen Victoria Museum, Launceston (Reg. No. HT 949), and from one paratype, which will be offered to the British Museum (Natural History), London.

Locality. Clarke Island, Bass Strait. Holotype from a 'small brackish-water stream, running very slowly indeed in hot summers, and forming a six feet deep by 400 yards long lagoon at the mouth', the specimen being caught on the 18th January, 1935, 'about 100 yards above this creek-lagoon in a rocky pool, making the distance from the sea just over a quarter of a mile'; (Mr. A. Maclaine). Paratype from another creek, flowing eastward, 'about 200-300 yards from sea; water definitely brackish', February, 1935; (Mr. G. Maclaine).

Distribution. Among some Galaxiid material recently received on loan for examination from the Australian Museum, Sydney, through the courtesy of the Director, Dr. C. Anderson, were two undetermined specimens from Flinders Island, collected many years ago by Mr. A. S. Le Souef. One of these (Aus. Mus. Reg. No. 1.A.3913), about 140 mm. in total length, is clearly *G. (G.) attenuatus*; the other (Aus. Mus. Reg. No. 1.A.3912), the total length of which is of the order of 120 mm., is possibly referable to the present species, but is in too poor a state of preservation to admit of definite determination.

Affinities. *G. (G.) scopus* is clearly a member of the *G. (G.) truttaceus* group, from all other members of which, however, it is at once distinguished by the origin of the anal being below, or very slightly behind, the level of the dorsal origin.

It is nearest to *G. (G.) truttaceus*, from which it differs mainly in the relative positions of the anal and dorsal, as noted above, and in the more lavish spotting. Apart from these characters, it closely resembles that species, and, on the evidence afforded by the holotype alone, might naturally be suspected to be possibly merely a regional, subspecific variant of it. The subsequent capture, in the same creek as that from which the paratype was obtained, of a quite characteristic specimen of *G. (G.) truttaceus* would seem to indicate, however, that *G. (G.) scopus* is a distinct species.

Remarks. The important diagnostic character of the point of origin of the anal relative to that of the dorsal may probably be with advantage the subject of more precise investigation than it has customarily received hitherto: it is not unlikely that the adoption of a convenient quantitative notation, followed by its application to extensive series of specimens, may prove of value, not only in indicating specific, but also in revealing and assessing subspecific, differences, the latter, incidentally, being a taxonomic aspect that is as yet scarcely touched upon in the case of members of the present order.

In the formulae discussed below, D and d denote, respectively, length to origin, and to termination, of base of dorsal; A and a, respectively, length to origin, and to termination, of base of anal; T, total length; S, standard length (*i.e.*, from tip of snout to hypural joint). Employing a slight modification of the expression $\frac{a - d}{t} \times 100$ (a = length to vent; d = length to dorsal; t = total length) used with striking success by Schmidt (1928) in the investigation of our Australian eels, we find $\frac{A - D}{T} \times 100$ gives the following values: *G. (G.) scopus* 0-0·4; *G. (G.) truttaceus* (one specimen, total length 134 mm.; Clarke Island) 2·6; *G. (G.) truttaceus* (ten specimens, total length 82-141 mm.; various Tasmanian localities) 2·1-3·1, av. 2·4.

Substituting S for T, the values, noted in the same sequence, are: 0-0·5; 3·1; 2·4-3·6, av. 2·8. After making trial of various formulae, involving such factors as head-length, eye-diameter, length and depth of caudal peduncle, pelvic-anal interspace, and so on, I find perhaps the most useful to be $\frac{A - D}{(d - D) + (a - A)} \times 100$: this yields satisfactorily consistent results, with the values of a convenient magnitude, and, further, introduces the appropriate factors of the lengths of the bases of the fins under consideration. The values derived from this formula, in sequence as before, are: 0-2·0; 14·3; 10·6-14·5, av. 11·9.

Galaxias (Galaxias) parkeri, sp. nov.

(Text-fig. 3)

B. 8 [8-9]. D. IV, 7 [IV-V, 6-9]. A. IV, 9 [IV-V, 7-9]. P. 14 [14-15]. C. 14, II $+\frac{c.\ X}{c.\ IX}\left[14,\ II + \frac{V + - IX}{V + - X}\right]$. Gill-rakers on lower limb of anterior arch 9 [8-9], fairly long.

Depth of body 7·2 [5·9-12·0] in total length, 6·2 [5·0-10·3] in standard length. Head 5·3 [5·2-6·9] in total length, 4·5 [4·5-5·9] in standard length. Snout 3·3 [3·1-3·8] in head. Eye 1·3 [1·2-1·9] in snout, 1·9 [1·6-2·6] in interorbital width, 4·3 [3·9-6·2] in head. Depth of caudal peduncle 1·5 [1·3-1·7] in its length, 2·2 [2·0-3·1] in head. Length of caudal peduncle 1·5 [1·2-1·4] in its superior length, 1·8 [1·4-1·8] times base of dorsal.

Body rather slender; greatest width [1·0-1·2] in greatest depth. Head moderate; greatest depth 1·1 [1·1-1·3] in greatest width; depth at eyes [1·1-1·4] in width there, the latter dimension being [1·0-1·3] times postorbital portion of head. Eye moderate. Interorbital region almost flat, or even slightly concave. Snout obtuse, much depressed; upper jaw protecting beyond lower. Maxillary extending to level of middle [anterior margin or barely beyond, in small paratype — anterior ⅓ or middle in larger paratypes] of eye. Tubular anterior nostril a little higher than wide; rather nearer anterior margin of upper lip than eye. Simple posterior nostril level with, or slightly in advance of, eye, barely above eye; about thrice as far from anterior nostril as from orbit.

Pores along midlateral line about 41 + 20, one to each myomere.

Lingual teeth rather small. Pterygoidal teeth rather small to moderate. Premaxillary teeth moderate, subequal. Mandibulary teeth moderate, scarcely enlarged laterally.

Dorsal fin rather short, of moderate height; base 2·7 [1·6-2·7] in head, rather more than, or subequal to, postorbital portion of head; longest (1st [1st-2nd] branched) ray 1·6 [1·6-2·1] in head, slightly

more than [subequal to] twice snout; distance from its origin to base of caudal 4·0 [3·8-4·3] in total length, 3·4 [3·2-3·6] in standard length; laid back, extends less than half-way along superior profile of peduncle, barely, or not, reaching origin of caudal ridge.

Anal fin rather longer than, subequal in height to, dorsal; base 2·1 [1·4-2·5] in head, less than caudal peduncle; longest (2nd [2nd-3rd] branched) ray 1·6 [1·5-2·0] in head, less than depth of body; originating behind origin of dorsal by 0·5 [0·5-0·6] of base of latter; terminating behind base of dorsal by 0·7 [0·5-0·7] of latter; laid back, extends half-way, or less, along caudal peduncle, reaching beyond, or barely to, origin of caudal ridge.

Pectoral fin moderate, obtusely pointed; longest (6th [6th-8th]) ray 1·6 [1·4-1·9] in head; extending 0·5 [0·4-0·6] of distance from its origin to origin of pelvic.

Pelvic fin moderate; longest (4th [4th]) ray 1·5 [1·3-1·9] in head; extending 0·6 [0·4-0·6] of distance from its origin to origin of anal. The point of insertion exhibits considerable variation, correlated, in the main, with size: in the holotype it is about equidistant from base of caudal and anterior margin of eye; in the larger and moderate-sized paratypes it lies midway between base of caudal and vicinity of anterior nostril; while in small paratypes (and in other small individuals, including one of the 12 specimens, 42-50 mm. in length, forwarded to the British Museum by Mr. Critchley Parker, which I have been able to examine through the courtesy of Mr. J. R. Norman) it lies at, or even decidedly in advance of, the middle of the standard length. Length to origin is hence rather variable, being 2·2 [2·1-2·4] in total length, 1·9 [1·9-2·1] in standard length.

Caudal fin moderate; emargination 14 per cent. [14-19 per cent.]; length 1·4 [1·0-1·6] in head. Caudal ridges well developed; extension cephalad from level of hypural subequal to median caudal rays.

Total length 79 mm. [45-113 mm.]; standard length 68 mm. [38·5-99 mm.].

Colour of holotype (in alcohol) pale brownish, heavily barred with dark slate grey, the number (round about ten) and size of the bars differing on the two sides; the widest bar, near the dorsal fin, involves about ten myomeres, its width being about equal to the length of the pectoral. At level of midlateral line, the bars of ground colour vary in breadth from about one-quarter, anteriorly, to one-third or one-half, posteriorly, of the width of the dark bars. The dark areas, which, except on and near the caudal peduncle, fail to reach the ventral profile, are continued up from the sides in irregular broad saddles over the back. A narrow bluish postpectoral bar. Lower lateral and ventral aspects of body yellowish white, punctulated with bluish grey, except for an immaculate median area, less than one-third as wide as the body, that extends from level of pectorals nearly to level of pelvics. Sides of head in general concolorous with sides of body; an ill-defined dark spot on operculum, the postero-inferior

portion of which latter is lighter than most of head; dorsal surface in general concolorous with sides, but with darker interocular and occipital patches; lower lip rather lighter than upper. No suborbital dark streak. Dorsal and anal fins immaculate macroscopically; yellowish grey, darker and with tinges of green basally, where there is abundant dark punctulation; well-developed ridges, probably originally yellowish, extending up between the rays for about three-quarters of their length. Pectoral and pelvic fins immaculate macroscopically; yellowish grey, somewhat dusky distally; scattered punctulations near base. Caudal fin pale yellowish grey, somewhat dusky distally; a few punctulations on proximal third.

Colour in life of a large paratype, 77·5 mm. in total length (*i.e.*, about same size as holotype), brown, more or less olivaceous; barred and blotched with darker brown, becoming somewhat greenish anteriorly. Along mid-dorsal line, from nape to origin of dorsal, a linear series of about eight narrow dark brown stripes, narrowly margined on either side with gold specks. A dark brown midlateral ridge clearly traceable backwards to origin of dorsal. Sides below midlateral line moderately punctulated with gold. Narrow dark post-pectoral bar. Ventral surface pale green. Head in general concolorous with body; dorsal surface of snout a characteristic pale jade green, with golden spot near base of each anterior nostril; upper lip dark greenish, faintly brown; lower lip pale greenish. Operculum with golden green blotch, not very sharply delimited. Iris silvery green, much punctulated, especially above, with brown. No suborbital dark streak. Dorsal and anal fins green proximally, brown-orange mesially, ashen distally. Pectoral fin brownish, with a narrow almost white region at tip, and extending somewhat inwards along postaxial border. Pelvic fin similar to pectoral, but with two or three of the anterior rays darker distally. Caudal fin rich brown, with a suffusion of orange; ashen distally; rays rich brown up to the bifurcation, thereafter either ashen or dusky.

The ground colour in life of moderate-sized specimens (50-60 mm. in total length) is commonly green, varying in depth in different individuals; body-markings dark green. Fins mainly greenish or hyaline. Other details much as in large paratype described above.

Specimens of about the size of the smallest paratype (45 mm. in total length), and smaller, are in general pale greenish, translucent—appearing, however, much darker, almost dark greenish brown, when viewed swimming at some distance below the surface. The colour-pattern varies greatly, and may be well-developed, inconspicuous, or almost entirely absent. Small black spots on dorsal surface, irregularly scattered, except for two well-marked rows embracing base of dorsal fin. Narrow dark midlateral line. Snout translucent, often faintly greenish; olfactory sacs metallic green-gold punctulated with blackish. Occipital patch green-gold, submetallic. Superior aspect of ocular capsules orange-gold, scintillant—a very conspicuous feature

in life, the spots being clearly visible even under a depth of a couple of feet of water, and giving a curious illusion of self-luminosity. Upper lip pale green, but darker than lower. Metallic green-gold spot on operculum. Iris greenish silver, speckled with blackish. Fins colourless, or sometimes (especially vertical fins) faintly green; caudal fin occasionally slightly dusky distally. Enteric canal golden green. Vertebrae forming a series of greenish or blackish subrectangular blocks.

Specific name in honour of Mr. Critchley Parker, who collected, and presented to the British Museum, the holotype and about a dozen smaller individuals.

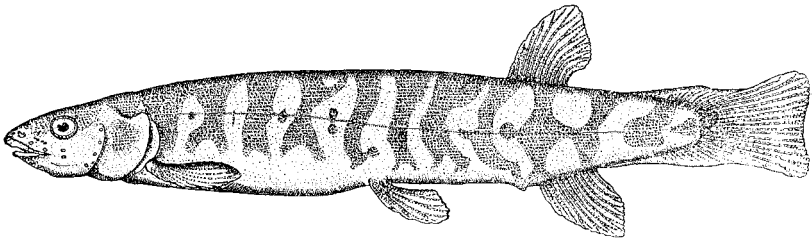

Fig. 3.—*Galaxias (Galaxias) parkeri*, sp. nov. Paratype. Great Lake, Tasmania. (× 1½.)

Types. Described from the holotype, in the British Museum (Natural History), London, and from nine paratypes, the variations exhibited by which are recorded throughout in square brackets. A paratype figured (Text-fig. 3). Two paratypes in the Queen Victoria Museum, Launceston (Reg. Nos. PT 950, a-b). Paratypes will be offered to the British Museum (Natural History), London; Australian Institute of Anatomy, Canberra; Australian Museum, Sydney; National Museum, Melbourne; Tasmanian Museum, Hobart; Museum of the Department of Biology, University of Tasmania, Hobart; Museo Argentino de Ciencias Naturales, Buenos Aires.

Locality. Holotype from Great Lake (about off Howell's Neck), Tasmania; caught, on artificial fly, by Mr. Critchley Parker, April, 1934. Paratypes from streams running into the Great Lake at northern end (Little Lake), near Duck Point, and at Reynold's Neck; January, March, April, 1934, February, 1935.

Distribution. In May, 1935, I obtained specimens of this species, collected in ice-covered pools, at Tangled Tarns, in an unmapped region of the Central Plateau, lying on Ritter's track, westward from the Chudleigh Lakes.

Habits. G. (G.) parkeri is common in the Great Lake, and in creeks running into it, its frequency in that locality being at the present time equal to, if not greater than, that of *G. (G.) truttaceus:* these two species appear to be the only forms found in the lake in recent years.

In the streams the smaller individuals occur chiefly near the lake, the larger individuals being met with as a rule from three or four hundred yards to a mile, which is as far as I have as yet had opportunity to trace them, inland. Observations made in February, 1935, showed that, at that time, the younger individuals in the creeks and ditches migrated in large numbers into the lake near sunset, returning in shoals shortly after daybreak, belated examples entering the streams, however, throughout most of the morning.

Specimens at present in captivity exhibit the general habits of the genus, but are characterized by the peculiar attitude of repose noted below. Unless the aquarium has a considerable height above the water-line, it must be kept covered, *e.g.*, with flywire, since, like other species of the genus, the present form is capable of leaping clean out of a tank the walls of which rise five or six inches above the level of the water.

Moderate-sized individuals, fed twice a week, consume a couple of worms at each meal, the hungry fish often struggling vigorously for the food. During the months of May, June, and July, their appetite is not so keen, and they are satisfied with one small meal per week.

When at rest, *G. (G.) parkeri* lies upon the bottom in a peculiar attitude, curiously suggestive of a tetrapod in repose. The whole body is held approximately horizontal, the head being little, if at all, raised; the tail, and frequently the posterior part of the trunk as well, is strongly curved to the right or left; the pectoral and pelvic fins are held motionless, splayed out, their tips resting on the bottom, the preaxial border of the former and the postaxial border of the latter elevated. This attitude, which is generally similar to, though perhaps not identical in detail with, that assumed by some other members of the *weedoni* group, is very different from the resting posture of *G. (G.) truttaceus*, in which species the general level of the body is much higher in front than behind, the head being held well above the bottom; the tail is not, or scarcely, curved; and the pectoral fins are kept in constant motion.

As in other members of the genus, the pectoral fins are commonly furled close to the sides during short bursts of swimming.

Affinities. *G. (G.) parkeri* belongs to the *weedoni* group, from the other members of which it is rather clearly distinguished by its colour-markings. On the whole, it is nearest to *G. (G.) weedoni*. Mr. J. R. Norman, who has compared the holotype with the specimen, 110 mm. in length, forwarded to the British Museum by Johnston in 1880, which Regan (1906) determined and figured (Pl. XI, fig. 1) as *G. weedoni*, observes that the latter differs from the type of *G. parkeri* 'chiefly in the more slender body, rather larger eye, stronger teeth in the lower jaw and on the tongue, and in the coloration'. On comparing the paratypes of *G. (G.) parkeri* with a specimen of *G. (G.) weedoni*, total length 133 mm., standard length 115

mm., in the Australian Museum, Sydney (Aus. Mus. Reg. No. 1. 7431), recorded, in a memorandum by Waite, as being one of the actual examples used by Regan in his revision, I find that these features appear to be constant. The type of *G. (G.) weedoni* has been lost, but Whitley (1929) has made available Johnston's notes on, and sketch of, a specimen, which, judging from the general context and from the dimensions given, appears clearly to be the type—indeed, the figure is so designated by Whitley. This specimen has the head 22 mm. long, and the 'body' (comparison with the figure, which is about 0·93 natural size, shows standard length is meant) 97 mm. The 'more slender body' and 'rather larger eye' of *G. (G.) parkeri*, noted by Mr. Norman as characterizing his material, hold good here. Johnston's sketch seems to depict an individual with rather less marbling of the sides than the example figured by Regan. To these differences may be added the rather more posterior insertion, in moderate-sized or large individuals, of the pelvics in *G. (G.) parkeri* (*G. (G.) weedoni*, it may be recalled, is placed in Regan's *Synopsis of the Species* within the section, 'Origin of ventrals equidistant from tip of snout and base of caudal'), and perhaps the rather longer head, and longer caudal peduncle, relative to the total length, in the present species. Apart from its colour-pattern, *G. (G.) parkeri* differs from *G. (G.) johnstoni* notably in its more numerous anal rays, and its projecting upper jaw; and from *G. (G.) affinis* chiefly in its longer pectoral, longer caudal peduncle, relative to total length and to head, more pointed dorsal and anal, and more depressed snout.

A reference by Johnston to a specimen that may possibly be referable to this species has already been noted in the section of the present paper dealing with *G. (G.) weedoni*.

Parasites. Seven specimens, obtained from streams running into the northern end of the Great Lake, in January, 1934 (from which series one paratype has been selected), are very heavily parasitized by the Opisthorchiid trematode already mentioned as attacking *G. (G.) johnstoni*. The cysts, of which there may be more than a hundred in a square centimetre, commonly give the fish a distinctly verrucose appearance, and may entirely obscure the colour-pattern. It is of interest to observe that of twenty-two individuals of *G. (G.) truttaceus*, collected at the same time, not one exhibits any signs at all of infection.

In another series, comprising five *G. (G.) parkeri* and seven *G. (G.) truttaceus*, collected in streams running into the Great Lake, near Duck Point, in April, 1934, all specimens of the former species are parasitized, though to a decidedly lesser extent than those of the series noted above, while all those of the latter are without apparent signs of infection.

Examples of *G. (G.) parkeri* secured on other occasions are in general wholly free of this parasite.

Under unfavourable conditions in captivity, and presumably also in a state of nature, this species, like most others, is liable to be attacked by a *Saprolegnia*.

History. The holotype and 12 smaller specimens, 42-50 mm. in length, were collected by Mr. Critchley Parker, and forwarded by him to the British Museum, where Mr. J. R. Norman at once recognized the novelty of the form, and drew up a manuscript description of it. Learning, however, that I was working on the Tasmanian Galaxiidae, Mr. Norman very generously handed over his notes to me and forwarded one of the small individuals, with the request that I should describe the species. As I already possessed examples of this form, which I proposed to describe, and as, moreover, I had an opportunity of making full notes on, and a rough colour-sketch of, the holotype prior to its despatch to England, I have accepted with pleasure Mr. Norman's courteous proposal. For the accuracy of the present account, which has been drawn up independently of Mr. Norman's description, I must, of course, assume full responsibility.

Subgenus **Agalaxis,** nov.

Diagnosis. Pelvic fin with 6 rays.

Orthotype. Cobitis zebratus Castelnau = *Galaxias (Agalaxis) zebratus* (Castelnau).

Cobitis zebratus Castelnau, *Mem. Poiss. Afrique Austr.* 1861. p. 56.
Galaxias capensis Steindachner, *Sitzb. Akad. Wien.* CIII. 1894. p. 460. pl. III. fig. 2.

Scope. The subgenus comprises the orthotype and *Galaxias (Agalaxis) punctifer* (Castelnau), 1861.

Distribution. South Africa.

Remarks. The presence of only six rays in the pelvic fin in South African species of *Galaxias* appears to be worthy, particularly in view of the correlation of this character with distribution, of subgeneric recognition.

Agalaxis, an anagram of *Galaxias.*

Genus **Saxilaga,** nov.

Diagnosis. Body elongate. Dorsal fin inserted well back; free of, or obscurely continuous with, caudal ridge; relatively low; with 11-12 simple or mixed rays, all, or some, of which are compressed, clumsy. Anal fin about opposite dorsal; obscurely continuous with caudal ridge; relatively low; with 10-13 rays, similar to those of dorsal. Pelvic fins present; reduced in size; with 6 or 5 rays. Premaxillary and mandibulary teeth uniserial, conical, moderately acute. Entopterygoids toothless. Lingual teeth in two or more series. Eye rather small to small; with free circular lid.

Agrees with *Galaxias*, and differs from *Neochanna*, in possessing pelvic fins: differs from *Galaxias*, and agrees with *Neochanna*, in lacking teeth on the entopterygoid. Apparently an annectant form between these two genera.

Orthotype. *Galaxias cleaveri* Scott.

Saxilaga, an anagram of *Galaxias*.

Subgenus **Saxilaga**, nov.

Diagnosis. Pelvic fin with 6 rays. Lingual teeth biserial.

Orthotype. *Galaxias cleaveri* Scott = *Saxilaga (Saxilaga) cleaveri* (Scott).

Scope. The subgenus comprises the orthotype and *Saxilaga (Saxilaga) anguilliformis*, sp. nov.

Distribution. Tasmania.

Saxilaga (Saxilaga) cleaveri (Scott)

Galaxias cleaveri Scott, *Pap. Roy. Soc. Tasm.* 1933 (1934). p. 41. pl. VI.

Remarks. This Galaxiid, with the pelvics reduced, and with only six rays, with the rounded caudal—the last two characters being strangely reminiscent of the South African *Galaxias (Agalaxias) zebratus*—and with other unusual features, has hitherto proved something of an anomaly; and in describing the species, which is based on a unique holotype, met with in exceptional circumstances, I observed (1934, p. 46): 'While it is with some diffidence that I venture to create, on the strength of a single specimen, a new species in a family so variable as the Galaxiidae, this seems to be, on the available evidence, the only honest course, and is accordingly followed'.

The recent discovery of *S. (S.) anguilliformis* not only justifies the recognition of the present as a genuine and distinct form, but also provides the necessary clue to its affinities, since a re-examination, accompanied by a slight dissection, of the holotype discloses the palate to be edentulous.

In possessing both simple and branched rays in the dorsal and anal fins this species presents a greater resemblance to *Galaxias*, and departs further from *Neochanna*, than do the other species of *Saxilaga*. The branched rays, however, still exhibit something of the peculiar appearance that seems to characterize some at least of the fin-rays in this genus. Of the '22 major rays' noted in the description of the species, 16 only are compressed primary rays, the remainder being merely the enlarged posterior procurrent rays.

Saxilaga (Saxilaga) anguilliformis, sp. nov.

(Text-fig. 4)

B. 9 [9]. D. 12 [12]. A. 13 [12]. P. 14 [12]. V. 6. C. 16 + $\frac{4}{4}$. Gill-rakers on lower limb of anterior arch 8, snout, conical.

Depth of body 7·9 [7·8] in total length, 7·2 [7·2] in standard length. Head 6·3 [6·3] in total length, 5·7 [5·8] in standard length. Snout 4·8 [4·7] in head. Eye 1·2 [1·4] in snout, 2·4 [2·9] in interorbital width, 5·8 [6·5] in head. Depth of caudal peduncle 1·3 [1·3] in its length, 1·2 [1·2] in head. Length of caudal peduncle 1·2 [1·3] in its superior length, 1·1 [1·1] times base of dorsal.

Body slender, anguilliform; greatest width 1·05 [1·05] in greatest depth. Head rather small, scarcely marked off from body; greatest depth 1·2 [1·1] in greatest width; depth at eyes 1·2 [1·2] in width there, the latter dimension being 1·1 [1·1] times length of postorbital portion of head. Eye small. Interorbital region convex. Snout obtuse, little depressed; lower jaw projecting slightly beyond upper. Maxillary extending to slightly behind level of anterior margin of eye. Tubular anterior nostril conspicuous, rather higher than wide; rather nearer anterior margin of upper lip than eye. Simple posterior nostril above, and slightly in advance of, eye; about twice as far from anterior nostril as from orbit.

Head with pores of three sizes.[1] Pores along midlateral line about 48 to level of vent, in general one to each myomere: behind the level of the vent, where there are about 25 myomeres, the pores are not countable with certainty.

Lingual teeth biserial, rather large, fairly acute. No pterygoidal teeth. Premaxillary teeth moderate, conical, moderately acute, subequal. Mandibulary teeth moderate, conical, moderately acute; several more or less distinctly enlarged lateral canines.

Dorsal fin long, low; all rays simple; base 1·4 [1·3] in head, less than caudal peduncle, subequal to depth of body; vertical height 3·2 [3·3] in head, less than combined eye and snout; longest (6th [6th]) ray 2·4 [2·3] in head, equal to interorbital width; distance from its origin to base of caudal 4·0 [4·0] in total length, 3·7 [3·7] in standard length; laid back, reaches caudal ridge; a thick fleshy sheath, rising anteriorly, where it is highest, to tip of second ray, envelops basal half of fin.

Anal fin slightly longer than, subequal in height to, dorsal; all rays simple; base 1·3 [1·2] in head; subequal to caudal peduncle; vertical height 3·2 [3·3] in head; longest (6th [6th]) ray 2·1 [2·6] in head; originating behind origin of dorsal by 0·1 [0·1] of base of latter; terminating behind base of dorsal by 0·2 [0·2] of latter; laid back, fails to attain base of caudal by a distance subequal to depth of caudal peduncle; with fleshy basal pad, similar to that of dorsal; obscurely joined by thick membrane to caudal ridge.

Pectoral fin small, rounded; three or four of the median rays feebly cleft for about 1/10 of their length, the rest simple; longest

[1] It is highly probable that, examined by the methods used with such striking success by Sanzo (1911), de Buen (1923), and others in the investigation of the topography of the openings of the mucus-canals and goniopores in the Gobiidae, these cephalic pores would prove of diagnostic value.

(9th [6th]) ray 1·8 [2·2] in head; extending 0·3 [0·2] of distance from its origin to origin of pelvic.

Pelvic fin small; longest (3rd [3rd]) ray 2·8 [2·9] in head, 16·5 [18·3] in total length; originating midway between caudal base and eye; length to its origin 2·2 [2·1] in total length, 1·9 [1·9] in standard length; extending 0·3 [0·2] of distance from its origin to origin of anal.

Caudal fin truncate rounded [feebly emarginate]; small, length 1·7 [2·0] in head, subequal to depth of caudal peduncle. Procurrent rays, except the posterior three or four, deeply buried in fleshy caudal ridge.

Total length 91 mm. [82 mm.]; standard length 82·5 mm. [75·5 mm.].

Ground colour (in formalin) greenish grey, paler beneath. Sides of body heavily barred and blotched with dark greenish brown; about eight or ten fairly regular forwardly convex bars, once to twice as wide as their interspaces, in advance of pelvics, behind which the markings, though in some cases still traceable as bars, tend in general to break up into blotches and reticulations of irregular form and varying size. No special shoulder-bar. Dorsal surface with numerous dark blotches, and vermiculate markings. Ventral surface macroscopically immaculate, minutely and sparsely punctulated with dark green. Head in general concolorous with body, heavily spotted dorsally, and, except for portion of cheek, laterally, with dark greenish brown; a triangular region, whose base embraces the eyes and whose apex about reaches the occiput, decidedly darker than rest of head; lips concolorous with lower part of operculum, which is greenish slate; ventral surface abundantly punctulated with greenish and greenish brown. Iris dark blue, with a lighter semilunar streak overarching pupil; no suborbital dark streak. Dorsal and anal fins with membrane hyaline, with microscopic brownish spots; lateral borders of rays dark; fleshy basal sheath greenish, with a few dark spots and numerous punctulations. Pectoral and pelvic fins virtually colourless, with scattered punctulations, most numerous basally; tips of rays of former dusky. Caudal fin greenish hyaline, the membrane marked with microscopic greenish brown spots; at base an irregular arc of conspicuous dark spots, with indications of the existence of two further, more external, concentric arcs of brownish. Caudal ridges each with eight or ten well-marked dark spots.

Specific name in allusion to the general eel-like facies.

Types. Described and figured from the holotype (Text-fig. 4) in the Queen Victoria Museum, Launceston (Reg. No. HT 951), with variations exhibited by a paratype, which will be offered to the British Museum (Natural History), London, recorded throughout in square brackets. The paratype lacks the left ventral fin, the loss having apparently occurred during life.

Locality. Creek, known locally as Cox's Creek, running into the Inglis River at Wynyard, North-Western Tasmania. Caught, on hook and line, by Master N. Blackwell, where the creek runs through Dead Horse Gully; forwarded by Mr. James Harrison, 11th December, 1934. During the course of a short visit to the locality by the writer, on 27th December, on which occasion no further specimens of the present form were secured, it was observed that the stream was inhabited abundantly by *Galaxias (Galaxias) attenuatus*, and less abundantly by *G. (G.) truttaceus.*

Habits. The general structure strongly suggests the fish is adapted to live in muddy situations.

Major R. E. Smith, Launceston, informs me that a Galaxiid that he identifies with the present form occurs in swamps near the mouths of the Forth River and the Clayton Rivulet, being known locally as 'mud-trout'. While it is not unlikely that this mud-trout may be *S. (S.) cleaveri* instead of, or in company with, *S. (S.) anguilliformis*, there is good reason to believe it to be, at any rate, some member

Fig. 4.—*Saxilaga (Saxilaga) anguilliformis*, sp. nov. Holotype. Cox's Creek, Tasmania. Natural size.

of the present genus. Major Smith states: 'In habits it differs very much [*i.e.*, from *G. (G.) attenuatus* and *G. (G.) truttaceus*]. It is generally found when drains are being cleaned out, and seems to be actually dug out of the mud. In swamps and drains that have completely lost all trace of water they can be found in damp mud. I have often got them by turning over logs and stones where they are to be found in mud. Like an eel they will live a long time out of water'.

Affinities. S. (S.) anguilliformis presents, on the whole, a more neochannoid facies than *S. (S.) cleaveri.* It differs from the latter species chiefly in having the dorsal and anal rays more numerous, and all simple, instead of mixed; markedly more forwardly placed anal, the $\frac{A - D}{(d - D) + (a - A)} \times 100$ value being 4·5-4·9, as against 22·2 for *S. (S.) cleaveri;* larger eye; shorter snout; and perhaps also in the rather stouter body, and rather shorter head.

Remarks. A burrowing Galaxiid has been noted from Tasmania by Hall (1901, p. 65). This, however, was stated to be 'clearly a *Galaxias*'. Hall's specimen, which has never been properly determined, may possibly be referable, if it is indeed a *Galaxias*, to *G. (G.) atkinsoni* Johnston, generally regarded as a synonym of *G. (G.)*

weedoni Johnston. Verbal reports of a burrowing Galaxiid in Tasmania have previously been noted by the present writer (1934, p. 43).

Hall also observes: 'Fish are reported as being occasionally dug up in the "button-grass country" on the west coast of the island, and are stated by a miner to have no eyes, though otherwise similar'. For some time past I have been endeavouring, so far without success, to obtain specimens of a blind, or almost blind, Galaxiid said to occur near Marrawah. It seems not unlikely that these reports relate to *Saxilaga;* though the possibility of *Neochanna,* or of some quite unknown form, occurring in Tasmania is not altogether to be discounted.

Subgenus **Lixagasa,** nov.

Diagnosis. Pelvic fin with 5 rays. Lingual teeth in more than two series.

Orthotype. Galaxias burrowsius Phillipps = *Saxilaga (Lixagasa) burrowsius* (Phillipps).

Galaxias burrowsius Phillips, *Trans. N.Z. Inst.* 56. 1926. p. 531. pl. 88 (issued separately 26th April, 1926).

Scope. The subgenus comprises only the orthotype.

Distribution. New Zealand.

Lixagasa, an anagram of *Galaxias.*

Remarks. Phillipps (1926 (b), p. 532) observes of the subgenotype that it is 'undoubtedly a degenerate form of *Galaxias,* and to some extent a connecting link between *Galaxias* and *Neochanna*'. He notes that the two type-specimens, from West Oxford, in the South Island, packed in damp earth, survived a journey by post of over thirty hours; and gives an interesting account of the aestivation of this species in coconut-shaped holes in the ground.

Subfamily *PARAGALAXIINAE,* nov.

Diagnosis. Dorsal fin inserted well back, about over pelvic fins, the length to origin of dorsal being less than one-half total length. Pelvic fins present. Premaxillary and mandibulary teeth biserial or uniserial. Entopterygoid toothed. Lingual teeth in two series. [Vertebrae less than 50 in *P. shannonensis.*]

Type-Genus. Paragalaxias Scott, 1935.

Scope. The subfamily comprises the genus *Paragalaxias* and *Galaxias dissimilis* Regan.

Distribution. Tasmania. New South Wales(?).

Remarks. Judged solely on its external features, *Galaxias dissimilis* Regan, a figure of which has been made available by Whitley (1933), would appear to be congeneric with *Paragalaxias shannonensis*; and I have already pointed out (1935, p. 45) that its status could be satisfactorily determined only as the result of a re-examina-

tion of the dentition. At my request, Mr. J. R. Norman, of the British Museum, has very kindly made an examination of the unique holotype of the species, and now informs me (*in lit.*) that the teeth in the jaws are in a single series. Mr. Whitley's proposed generic name, *Querigalaxias*, mentioned earlier, will be available for the species when formally completed.

Genus **Paragalaxias** Scott, 1935.

Diagnosis. Body moderately elongate. Dorsal fin inserted well forward; free of caudal; relatively high; with 12-15 rays, which are mixed, or simple. Anal fin inserted well back, originating far behind dorsal, in normal Galaxiid position: free of caudal; moderately high; with about 9 rays, which are mixed, or simple. Pelvic fins present; with 6 rays. Premaxillary and mandibulary teeth biserial or uniserial, subconical, pointed. Entopterygoids each with a single series of teeth. Lingual teeth biserial. Eye small; with free circular lid. Vertebrae 44 (in *P. shannonensis*).

Orthotype. *Paragalaxias shannonensis* Scott.

Paragalaxias shannonensis Scott, *Pap. Roy. Soc. Tasm.* 1934 (1935). p. 41. pl. III. and text-figs. 1-2.

Scope. The genus includes only the orthotype.

Distribution. Tasmania.

Type-locality. Shannon River, Tasmania.

SUMMARY

1. The scope and interest of the Tasmanian Galaxiid fauna are noted, and some general remarks on taxonomy are made.

2. Two new subfamilies of Galaxiidae, namely, Galaxiinae and Paragalaxiinae, are instituted.

3. Two new subgenera of *Galaxias* Cuvier, namely, *Galaxias* and *Agalaxis*, are proposed.

4. A new genus, *Saxilaga*, with two subgenera, *Saxilaga* and *Lixagasa*, is diagnosed.

5. A key to the subfamilies, genera, and subgenera dealt with is provided.

6. Previously described Tasmanian species are listed, and, where necessary, commented upon: *Galaxias rostratus* Klunzinger is shown not to be Tasmanian; *G. cleaveri* Scott is referred to *Saxilaga*, nov.; the type-locality of *G. trattaceus* (Cuvier) is fixed.

7. New species described, and figured, are: *Galaxias (Galaxias) johnstoni*, *Galaxias (Galaxias) scopus*, *Galaxias (Galaxias) parkeri*, and *Saxilaga (Saxilaga) anguilliformis*.

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