Contributions to Galaxiid Taxonomy

By G. Stokell

Shand's Track, No. 4 R.D., Christchurch.

[*Read before the Canterbury Branch June 6, 1951; received by the Editor, November 12, 1953.*]

Since the writer reviewed the classification of the Galaxiidae in 1945 a quantity of material has been received which shows the need of extending the number of genera then recognised. One genus (*Paragalaxias*) has been dealt with elsewhere (Stokell, 1950), and another (*Brachygalaxias*) is redefined below. The latter was created by Eigenmann (1928) for a fish from Chile which Regan (1908) described, under the name of *Galaxias bullocki*, as having five rayed ventral fins and the anal fin inserted in advance of the dorsal. Eigenmann based his genus principally on these two characters, but recent examination of the species has disclosed others of at least equal importance. Through the good offices of Professor George S. Myers, of Stanford University, the writer has received three of Eigenmann's specimens which had been stored in the Indiana University. Dissection of these specimens revealed a much lower number of vertebrae than has been found in any species of *Galaxias*, two specimens having 39 each and the other 41. A further distinction exists in the presence of a median ridge or keel between the ventrals and the anus, very similar to that occurring in Retropinnidae but not extending as far forward as it does in the latter family. Another fish, described as having the anal fin originating before the dorsal and five rayed ventrals is *Galaxias pusillus* Mack (1936) of Victoria, Australia. A keel is indicated in the line drawing presented, but no mention of it is made in the description, which is incomplete in other respects also. A re-examination of the fish was facilitated by the courtesy of Mr. R. T. M. Pescott, Director of the National Museum, Melbourne, in which the whole of the material of the species is housed. Three specimens were dissected, and showed an even lower number of vertebrae than *Brachygalaxias bullocki*, the counts being 34–38–40. In the Australian species the keel is much more strongly developed than in the Chilean one, but does not extend forward of the ventrals. The anal origin is well before that of the dorsal and the ventrals are usually five rayed, but one specimen has one fin with four rays and another has one fifth ray extremely rudimentary. Of the four characters noted, only the keel is really exclusive, a low number of vertebrae occurring also in *Paragalaxias*, five rayed ventral fins in *Galaxias burrowsius* and a tendency for the anal fin to precede the dorsal existing in *Neochanna diversus*, but the association is so distinctive in the family that it must be regarded as indicating a natural group. While Eigenmann's genus as defined by him appeared to be of questionable validity, its position is now considerably strengthened, and its retention justified. It may be redefined as follows.

Brachygalaxias Eigenmann, 1928

A single series of conical teeth in jaws and on entopterygoids, tongue with two rows. Vertebrae 34–41. Dorsal fin inserted at ·68–·77 of the standard length, anal originating in advance of the dorsal, ventrals with 4–5 rays. A median ridge or keel between base of ventrals and anus. Adult length 25–45 mm.

Vol. 82, Part 2, pp. 411–418, Plate 22, September, 1954.

GENOTYPE: *Brachygalaxias bullocki*

The two species known are:

Brachygalaxias bullocki (Regan), 1908

Galaxias bullocki Regan. Ann. Mag. Nat. Hist. (8) 1908, p. 372.

Brachygalaxias bullocki Eigenmann. Mem. Nat. Acad. Sci. 22 second Mem. 1928, pp. 48–51.

Vertebrae 39–41. Developed rays in dorsal 7, in anal 13–14. Head 3·7–4·1 in standard length, depth about 4 in same. Dorsal inserted at ·73–·77 of the standard length, above 6th anal ray (all counted). Gill rakers short or rudimentary, two pyloric caeca, extremely short or rudimentary. Keel only slightly developed.

Mature at total length of 41 mm. Number of eggs about 100.

LOCALITY. Chile.

Brachygalaxias pusillus (Mack) 1936

Galaxias pusillus Mack. Mem. Nat. Mus. Vict. IX 1936, p. 101.

Vertebrae 34–40. Developed rays in dorsal 5–6, in anal 7–8. Head 4·2–5·2 in standard length, depth 5·5 in same. Dorsal inserted at ·68–·71 of the standard length, above 4th anal ray (all counted). Gill rakers long. No pyloric caeca, the pylorus enlarged with abrupt shoulders. Keel strongly developed.

Mature at total length of 27 mm.

LOCALITY. Victoria, Australia.

The existence of a fourth galaxiid genus, and its representation in such widely separated countries as South America and Australia, necessitate a reconsideration of the old problem of distribution. While this does not come within the scope of the present work it may be legitimate to review the basic circumstances as they now appear, bearing in mind the possibility of the taxonomic position being still further affected by future work. The four genera now recognised are *Galaxias* Cuvier, *Neochanna* Gunther, *Paragalaxias* Scott, and *Brachygalaxias* Eigenmann, the first and second of which have a posterior dorsal fin insertion associated with a high number of vertebrae, and are separated principally by the absence of ventral fins in *Neochanna*. *Paragalaxias* has a more anterior dorsal insertion than either of these genera and a low number of vertebrae, but the relation between these characters disappears in *Brachygalaxias*, which has the dorsal inserted as far back as in *Galaxias* and as low a number of vertebrae as *Paragalaxias*. Of these four genera only *Galaxias* is extensive. It comprises some fifty species while, so far as is known, the other three contain only two each. *Galaxias* is represented in New Zealand, South America and Australia, but in no country does it occur alone. In New Zealand it is associated with *Neochanna*, in South America with *Brachygalaxias* and in Australia with *Brachygalaxias* and *Paragalaxias*. The only country restricted to a single genus is South Africa, where *Paragalaxias* occurs, and the only genus restricted to a single country is *Neochanna*, of New Zealand.

In the revision of species published in 1949 the writer presented a list of specific names that had been applied to New Zealand *Galaxias*, and gave the identification of all that could be associated with known species. No disposition was made of *G. brocchus* Richardson (1848) and *G. reticulatus* Richardson (*loc. cit.*) which were recorded from the Auckland Islands but have never been recollected in this locality. The descriptions indicate large, short-bodied forms

agreeing fairly well with *G. fasciatus* but, so far as *brocchus* is concerned, manifesting some affinity with *G. alepidotus*. A sharp distinction between these two species is provided by the degree of development of the pyloric caeca, *alepidotus* having maximum development, while in *fasciatus* the caeca are rudimentary or lacking. The types of *brocchus* and *reticulatus* are in the British Museum and have been examined by Dr. E. Trewavas, Ichthyologist of that institution, who informs the writer that they have no pyloric caeca, only a shoulder where the caeca should be. Richardson's two species are therefore satisfactorily established as synonyms of *fasciatus* Gray, but the question of whether his material came from the Auckland Islands or some other locality remains unanswered. The dissection of these types also disposes of the slight possibility that appeared to exist of the name *reticulatus* being applicable to the only species known from the Auckland Islands. In the Auckland Islands fish the caeca are well developed.

Galaxias brevipinnis Gunther, 1866

Earlier attempts to clear up the confusion that has surrounded *G. brevipinnis* since its first description have been handicapped by the specification of a higher number of vertebrae than the species normally possesses. Gunther's (1866) count of 65 and Regan's (1906) of 64 appear to have been obtained from the skeleton in the British Museum, but if this is in sufficiently good condition for the enumeration of vertebrae and either count is correct the specimen must be an unusual one. The remainder of the original material, consisting of three complete adults, gave counts of 60–60–61 (without hypural) when subjected to X-ray examination. Other characters, as near as they can be determined from the X-ray photographs are D. iii–iv 8–9, A. iii–iv 9–10. Head in standard length 4·4–4·9, dorsal inserted at ·74–·76 of the standard length, ventrals at ·51–·53 of same, ventrals extending ·40–·45 of the distance from their origin to origin of anal. These specifications are closely matched by a fish from lowland waters on the west of the South and North Islands, six adults and seven juveniles of which have been collected recently. The number of vertebrae in the juveniles is 60 for one specimen and 61 for the others, while in the adults it ranges from 59 to 62. Considerable variation in proportionate characters is manifest in the adults, but extreme forms intergrade as completely as could be expected in so small a group. The six specimens are listed individually in the following table, together with comparative data obtained from the X-ray photographs of the types. The characters listed and indicated by abbreviations in the table are: dorsal fin rays, anal fin rays, vertebrae, head in standard length, dorsal fin insertion, ventral fin insertion, length of pectoral fin in relation to pectoral-ventral interspace, length of ventral in relation to ventral-anal interspace, least depth of tail in relation to distance from rear of dorsal to hypural joint.

Photographs of No. 1 and No. 3 are shown in Plate 1, Figures 1 and 2 respectively. In addition to the difference in the length of the paired fins these specimens differ noticeably in the form of the head. Other specimens, however, are intermediate in this character, and preclude even a varietal separation of the two forms. The variation in proportionate characters is considerable, but the intergradation with the types of *brevipinnis* is so complete that the present specimens must be referred to this species.

TABLE.
Data on Specifications of Galaxias brevipinnis

	Locality	D.	A.	Vert	Head in S.L.	D. ins.	V. ins.	P. ratio	V. ratio	Tail ratio
1	Westland	iii 8	iii 8	59	4.95	.74	.51	.56	.52	.60
2	„	iii 7	iii 8	61	4.91	.75	.52	.55	.57	.53
3	Nelson	iii 8	iii 8	60	4.34	.74	.51	.52	.50	.60
4	„	iv 8	iii 9	61	4.57	.73	.51	.53	.508	.55
5	Wellington	iv 8	iii 9	62	5.0	.75	.51	.50	.43	.60
6	„	iv 10	v 10	60	4.8	.74	.50	.56	.50	.59
7	X-rays of types	iv 8	iv 10	60	4.4	.76	.53		.45	
8	„	iii 8	iii 10	60	4.9	.74	.52		.40	
9	„	iii 9	iii 9	61	4.7	.74	.51		.43	

As now known *brevipinnis* is scarcely separable specifically from the Auckland Islands form previously referred to *G. campbelli*, but in this instance a varietal difference appears to exist in the length of the paired fins. In the present specimens of *brevipinnis* the ventrals extend from ·43 to ·57 of the distance from their origin to the anal, while in the Auckland Islands fish the ratio is never less than ·5 and averages over ·6. The pectorals also are longer in the Auckland Islands fish, the ratio being ·54–·68 as compared with ·5–·56 in the present specimens. Other differences are slight, and may disappear when adequate material is examined. The vertebral counts in the present small group of *brevipinnis* come well within the ascertained range of *campbelli* and have the same peak. For the present it may be said that *campbelli* appears to be inseparable from *brevipinnis* as a species, but may have to be recognised as a variety or sub-species.

The particulars of *brevipinnis* now available indicate the probability of *G. huttoni* Regan (1906) being referable to this species. The vertebral count of 61 previously recorded as having been obtained by Dr. Trewavas from one of the seven juveniles that constitute the whole of the material of *huttoni* agrees with the dominant number in *brevipinnis*. Although *brevipinnis* has not been collected actually from lakes adults have been taken from tributaries within a short distance of lowland lakes, and juveniles have been taken in tidal water below them. It would thus appear probable that the locality of *huttoni*, misspelt as Lake Rainiera, is one of the low lying lakes along the Westland coast.

It is also necessary to consider the possibility of *G. robinsonii* Clarke (1899) being a synonym of *brevipinnis*. None of Clarke's types or other named specimens has been discovered either in Westland or Wellington, but there is a collection of his unpublished drawings and notes in the Dominion Museum. Among these there is a well executed figure of *G. robinsonii* showing the long tail, short head and anterior ventral insertion, by which Clarke's species as described is differentiated from the present material. While the least depth of the tail of *robinsonii* is represented as less than ·5 of the distance from the rear of the dorsal fin to the hypural joint, it is always more than ·5 in the present specimens and

is similarly recorded in the original description of *brevipinnis*. The head in standard length ratio of *robinsonii* is given as 5⅓ but in the present material 5 is the maximum and the average is 4·75. In *robinsonii* the ventral fins are recorded as being inserted at less than ·5 of the standard length, while in the present species ·5 is the minimum and the average is over ·51. Against this morphological evidence of distinctness there are the circumstances of occurrence and locality. Clarke made no record of *brevipinnis* as such from Westland, but, in addition to *robinsonii*, noted only *G. attenuatus, G. fasciatus,* a very large species recognisable as *G. alepidotus* and a stout bodied form, *G. postvectis*, which could not be confused with the present species. He further stated that *robinsonii* was rare, which the present species certainly is, and that it was the only juvenile *Galaxias,* apart from *attenuatus,* that he had found as a component of whitebait. The juvenile specimens averaging about two inches in total length in the present collection were taken among whitebait in South Westland. Among the recorded localities of *robinsonii* is Frosty Creek, from which the present writer obtained the specimen shown in Figure 1 and the one listed as No. 2 in the table. The only other *Galaxias* observed in this water was *attenuatus*. Despite this circumstantial evidence it would seem unsafe to refer Clarke's fish to *brevipinnis,* in view of the general accuracy of his descriptions where it is possible to check them, and the standing of *robinsonii* must be regarded as still uncertain. The following description of *brevipinnis* is based on the six adult specimens listed and the X-ray photographs of the types.

Galaxias brevipinnis Gunther, 1866

B.8–9. D.iii–iv 7–8. A.iii–iv 8–10. V.7. Vertebrae 59–62. Lower jaw the shorter with maximum development of lateral canines, upper with strong lateral canines, entopterygoidal teeth well developed, 5–6 on each bone. Gill rakers rather short, pyloric caeca of moderate length, somewhat conical in shape. Maxillary extending past middle of eye. Head 4.34–5 in standard length, dorsal inserted at ·73–·76 of the standard length, least depth of tail ·53–·6 of the distance from rear of dorsal to hypural joint. Caudal fin moderately concave with rounded lobes, becoming straight or convex in old specimens. Pectoral extending ·5–·56 of the distance from its axil to the origin of the ventral, ventral inserted at ·50–·53 of the standard length, extending ·43–·57 of the distance from its origin to origin of anal, anal originating below 7th–9th dorsal ray (all counted), branched rays of anal subdivided into 4–5. Maximum total length observed 7½ inches.

Differs from *lynx, koaro* and *vulgaris* in the higher number of vertebrae, the greater enlargement of the lateral canines and the finer subdivision of the anal rays.

TYPES. Three co-types are in the British Museum.

Type locality unknown, presumably coastal regions in Westland or Southland.

LOCALITIES. Streams at altitudes of up to 600 feet on the Westland, west Nelson and west Wellington coasts.

Among the names recorded as having been applied to a New Zealand fish was *G. olidus* Gunther (1866) to which species Hutton (1872) referred a specimen from Lake Wakatipu. Later (1896) when describing his new species *lynx* from Lake Coleridge, Hutton abandoned the identification of the Wakatipu

fish with *olidus* and included it in *G. lynx*. The specimen from Lake Wakatipu was described as 7 inches in length and as being of a pale yellow colour with numerous small black specks, a coloration also recorded by Regan in his 1906 revision but which the present writer had never encountered in *lynx*. No *Galaxias* had been obtained from Lake Wakatipu when the previous paper was published, but since then an extensive collection of typical *lynx* has been made from a tributary of this water, and the position has been clarified further by the discovery in the Dominion Museum of an old specimen without name, date or locality but agreeing in size, colour and other particulars with the one referred to *olidus* by Hutton. This fish was dissected with the permission of the Director of the Museum, and proved to be a very large specimen of *lynx*. It is to be noted that Regan recorded 12–14 gill rakers on the lower limb of the anterior gill arch in specimens available to him, whereas the present writer had observed nothing higher than 11 in the material recorded in the previous paper. Specimens from Lake Wakatipu and other waters examined recently have been found to be similar. The British Museum material has been re-examined by Dr. Trewavas, who found that the number varied from 9 to 13. It would thus appear that lack of agreement in records of the number of gill rakers, is partly owing to the personal influence of the recorders, and that the criterion is not a very definite one. By the present writer's method of counting *lynx* has no more gill rakers than *G. koaro*, *G. vulgaris* and *G. brevipinnis*.

No decision was reached in the previous paper regarding *G. charlottae* Whitley and Phillipps (1939), as the single specimen upon which the species was based could not be found in the Dominion Museum owing to war-time disorganisation. The affinities of the species appeared to be with *fasciatus*, and some confusion was occasioned by certain slightly abnormal specimens of *fasciatus* which agreed in locality and identity of collector with the type of *charlottae*. A specimen labelled 1A.5195, the recorded number of the type, has now been found in the Dominion Museum, and has been made available to the writer for examination. This fish agrees well with the description of *charlottae*, and differs from *fasciatus* in having no canines in the jaws. There is a slight progressive enlargement of teeth toward the rear as in most other small-toothed species, and the whole dentition is rather weak. The mouth is shorter than in *fasciatus* and the lower jaw is recessive. There are three pyloric caeca, all short, but longer than the longest observed in *fasciatus*. The ventral fins are inserted more anteriorly, the origin of the anal fin in relation to that of the dorsal is more posterior, the anal rays are more finely subdivided, and there are 59 vertebrae.

Another specimen of the same species which was brought to light in the Dominion Museum recently was taken at Inglewood in 1940, and has a total length of 261 mm. This fish has a higher head in standard length ratio than the type of *charlottae* (4·8 as compared with 4·1) and has only two caeca, one of which is rudimentary, but the agreement in dentition and the other characters noted is complete. The number of vertebrae in the Inglewood specimen is 60. Notwithstanding agreement with *fasciatus* in vertebral counts and several other characters, the difference in dentition is so definite as to exclude these two specimens from this species. However, the name to be used for them is open to question. In 1899 Clarke described a Westland form under the name of *postvectis*, but the species has not been recognised since its description, and

FIG. 1.—*Galaxias brevipennis*. Frosty Creek, Westland.

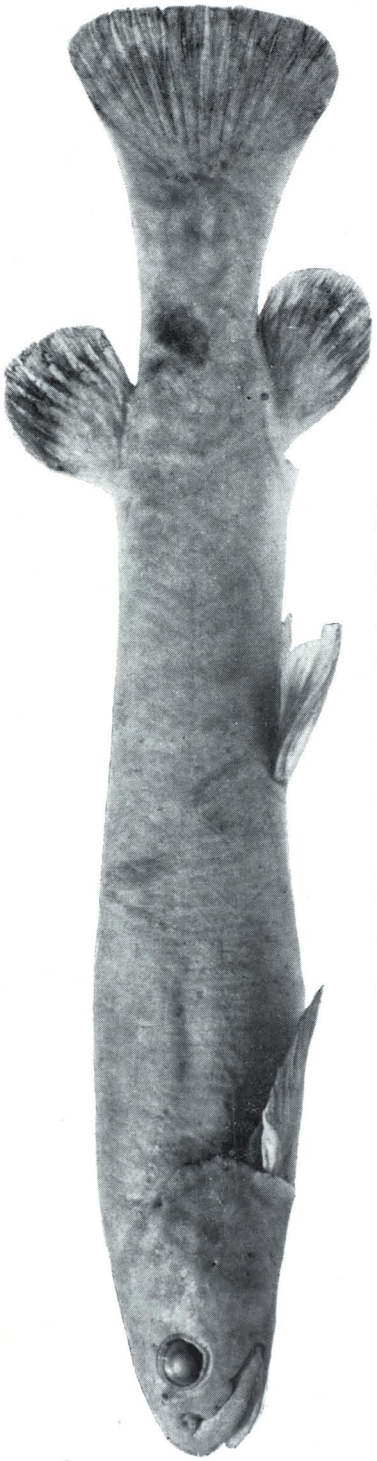

FIG. 2.—*Galaxias brevipinnis*. Twelve Mile, Nelson.

is usually relegated to the synonymy of *fasciatus*. Clarke, who was the only one of the early New Zealand workers to record the number of vertebrae, gave the number in *postvectis* as 60, and stated that his species attained a greater length than *fasciatus* but seldom exceeded 10 inches. The Inglewood specimen is about $10\frac{1}{4}$ inches in total length while the largest known specimen of *fasciatus* is $9\frac{5}{8}$ inches. The maxillary of *postvectis* is recorded as extending about to the centre of the eye and the anal fin is depicted as originating well back from the origin of the dorsal, both of which features agree with the present specimens and differ from *fasciatus*. In colour the type of *charlottae* is uniform brown on the back and sides, becoming lighter below, with a dark blotch above the pectorals base, while the Inglewood specimen is similar except that the colour is grey rather than brown. Clarke recorded the ground colour of *postvectis* as pinkish olive brown, unmarked anteriorly except for a purplish patch above the pectorals, but with the posterior part of the body barred with darker brown. The bars are rather weak in the accompanying figure and cannot be regarded as an important distinction in view of the colour variability of most species. While it seems probable that *charlottae* will have to be ranked as a synonym of *postvectis* it is desirable to postpone a decision in the matter till further material has been collected.

The name *argenteus* (Gmelin) which Whitley and Phillipps (1939) applied to a number of valid and nominal species of *Galaxias* has been associated with confusion since its inception. Gmelin's account of *Esox argenteus* has been made available by the kindness of Dr. Robert R. Harry, of The Academy of Natural Sciences of Philadelphia. It is as follows:

> Caroli a Linne
> Systema
> Naturae
> 13th ed. by Gmelin, 1789
> Tom. I. Pars III
> p. 1393 (Esox)
> argenteus. 12 Es. fuscus litteris flavicantibus pictus. G. Forster *it. circa orb. I. p.* 159 Habitat in novae Seelandiae, aliarumque oceani pacifici insularum aquis dulcibus, exilis, truttae similis.

The description appears to have been taken from the account of *Esox alepidotus* in J. R. Forster's MS. while the name is that of an entirely different fish from the island of Tanna in the New Hebrides. In the second volume of "A Voyage Round the World" (p. 281) G. Forster states: "Our fishermen were extremely successful and took upwards of three hundredweight of mullet and other fish," and adds a footnote "particularly a sort common in the West Indies and there called Ten-pounder (*Esox argenteus* N.S.)". Obviously Gmelin transposed the name of the fish from Tanna Island, but whether it is thereby validated for the New Zealand fish appears to be a question for the International Commission of Zoological Nomenclature. Cuvier and Valenciennes (1846) who drew attention to these circumstances, maintained that Gmelin's name had no standing, and proposed *forsteri* as a substitute for *alepidotus* on the grounds that the latter was descriptive of the whole family and did not constitute a satisfactory specific designation.

While some uncertainty regarding the standing of Gmelin's name must be allowed to remain a good deal of the attendant confusion may be cleared up.

The incongruous association of the name *argenteus* with a dark coloured fish is explained. This name was not given directly to any New Zealand *Galaxias*, but is an extraneous one originally applied to a fish of very different family from Tanna Island and transposed by the compiler of the Systema Naturae. It is clear that if any species of *Galaxias* is entitled to the name *argenteus* it is the one referred to herein and in earlier papers as *alepidotus*. The species *fasciatus* was not known till some twenty years after the publication of *Gmelin's* account and was involved in the confusion only as a result of Whitley and Phillipps' failure to distinguish between it and *alepidotus*. Their synonymy includes *brocchus* and *reticulatus* Richardson, both synonyms of *fasciatus*, and *postvectis* Clarke which, as pointed out above, appears to be a prior name for their own species *charlottae*. Clarke's species *G. kokopu* is referable to *alepidotus* but *G. grandis* Clarke is a misconception. Discussing his species *kokopu* Clarke (1899, p. 82) states that it " grows to such constant large size that it would have been more appropriately called *grandis* if the late Professor von Haast had not already adopted such specific name for the fish Professor Hutton now classifies as a variety of *G. brevipinnis.*" Haast's *grandis* is a synonym of *alepidotus*.

ACKNOWLEDGMENTS

The writer expresses his thanks to Dr. E. Trewavas of the British Museum (Natural History) for the examination of types in that institution, to Professor George S. Myers, of Stanford University, for material from Chile, to Dr. Robert R. Harry, of the Academy of Natural Sciences of Philadelphia for literature, to Mr. R. T. M. Pescott, Director of the National Museum, Victoria, for the loan of specimens of *Brachygalaxias pusillus*, to Dr. R. A. Falla, Director of the Dominion Museum, for access to material in that institution, and to Mr. P. Hughson, of Twelve Mile, for a collection from South Nelson.

REFERENCES

CLARKE, F. E., 1899. Notes on New Zealand Galaxiidae, more especially those of the Western Slopes, with Descriptions of New Species, etc. *Trans. N.Z. Inst.*, Vol. 31.

CUVIER, LE B. and VALENCIENNES, A., 1846. Histoire naturelle des poissons, vol. 18.

EIGENMANN, C. H., 1928. The Freshwater Fishes of Chile. *Mem. Nat. Acad. Sci.* 22 second mem. pp. 48–51.

GUNTHER, A., 1866. *Cat. Fish British Museum.* Vol. 6.

HUTTON, F. W., 1872. Contributions to the Ichthyology of New Zealand. *Trans. N.Z. Institute* vol. 5, p. 270.

——— 1896. Notes on some New Zealand Fishes, with Description of a New Species. *Trans. N.Z. Institute* vol. 28, p. 317.

MACK, G., 1936. Victorian Species of the Genus *Galaxias* with Descriptions of two New Species. *Mem. Nat. Mus. Vict., Melbourne*, No. 9, pp. 98–101.

REGAN, C. T., 1906. A Revision of the Fishes of the Family Galaxiidae. *Pro. Zool. Soc. London.* Vol. 2, pp. 363-384.

——— 1908. Description of a new fish of the Genus *Galaxias* from Chile. *Ann. Mag. Nat. Hist.* (8) 1, p. 372.

RICHARDSON, J., 1848. Zoology of the Voyage of the Erebus and Terror.

STOKELL, G., 1945. The Systematic Arrangement of the New Zealand Galaxiidae, Part 1. *Trans. Roy. Soc. N.Z.*, Vol. 75, pp. 124–137.

——— 1949. The Systematic Arrangement of the New Zealand Galaxiidae, Part 2. *Trans. Roy. Soc. N.Z.*, vol. 77, pp. 472–496.

——— 1950. A Revision of the Genus *Paragalaxias Rec. Queen Victoria Museum, Launceston*, Vol. 3, No. 1, pp. 1–4.

WHITLEY, G. P. and PHILLIPS, W. J., 1939. Descriptive Notes on some New Zealand Fishes. *Trans. Roy. Soc. N.Z.* vol. 69, pp. 229–231.