Notes on Galaxiids and Eleotrids with Descriptions of New Species

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In a revision of the New Zealand Galaxiidae (Stokell, 1945 and 1949) it was noted that species of *Galaxias* in which the head is contained five or more times in the standard length usually possesses certain additional features suggestive of a natural group. The most important of these are the short paired fins, the anterior position of the ventrals, the long tail, the absence of canine teeth and the poor development of the pyloric caeca. Disagreement with this association occurs in a species obtained recently from Central Otago. This fish has a head in standard length ratio of more than five, a moderately long tail and short paired fins but differs from the generality of long-bodied species in having the average point of ventral fin insertion posterior to midway in the standard length, moderate canine teeth and long pyloric caeca.

Another species dealt with in the present paper also fails to conform to the arrangement usual in long-bodied species, but is more particularly distinguished by the reduced number of rays in the ventral fins, which is usually six. Of twenty specimens examined by removing the fins and compressing them between slides one has 7 rays in each fin, the inner ray of both being poorly developed, one has 6 in one and 7 in the other, one has 5–6, fourteen have 6–6 and three have 6–6 + 1 very rudimentary ray or shred. The latter feature occurs with much the same frequency in many of the seven-rayed forms. Scott (1935) proposed the subgenus *Agalaxis* for species of *Galaxias* having six rays in the ventral fins, but he typed it on a South African form which proved (Stokell, 1950) to be a species of his own genus *Paragalaxias* (1935). Whether the subgenus would be available for a true *Galaxias* having six-rayed ventrals need not be considered here, as the number is inconstant in most species and cannot be regarded as a satisfactory subgeneric distinction. The present fish breaks down one of the original distinctions of *Paragalaxias* which, though subject to occasional variation in the number of ventral rays is dominantly six-rayed, but it does not infringe the other distinctions between the two genera and must be retained in *Galaxias*. It fills the gap between typical *Galaxias* and *Galaxias burrowsius* Phillipps (1926) which normally has five-rayed ventrals and was referred by Scott (1935) to his proposed genus *Saxilaga*. Even before the discovery of the present fish *burrowsius* could not be regarded as distinct in this character as both it and many dominantly seven-rayed forms are subject to occasional variation, but the existence of a dominantly six-rayed form ranging to five and seven now renders the intergradation complete. The species *burrowsius* possesses certain additional features such as the form of the dorsal and anal fins and the permanently rounded caudal which tend to distinguish it from typical *Galaxias*, but the question of its generic or subgeneric separation involves similar considerations in respect of the Tasmanian forms *Galaxias cleaveri* and *Galaxias anguilliformis* Scott (1934 and 1935), and possibly *Galaxias globiceps* Eigenmann (1928) of South America, material for which is not available.

Galaxias anomalus n.sp.

B. 6–8 D iii–iv 6–7. A. iii–iv 7–9. V. 7. Vertebrae 52–54. Jaws about equal, mouth from ventral aspect well curved. Lower jaw with moderate enlargement of lateral teeth, entopterygoidal teeth strong, 7–8 on each side, gill rakers very short, pyloric caeca well

developed. Head 5.1–5.3 in standard length, maxillary extending slightly past perpendicular from anterior of eye, arrangement of large open pores on dorsal surface of head about normal, there being one on the inner side of each anterior nostril, one on the inner side of each posterior nostril, four in the interorbital space, and one behind the upper part of each eye almost level with the posterior interorbital pair. Dorsal fin originating at .70–.72 of the standard length, ventrals at .50–.53 (average 51) of same. Pectoral fins extending .41–.48 of the distance from their origin to the origin of ventrals, ventrals extending .40–.42 of the distance from their origin to origin of anal, anal origin below 7th–9th dorsal ray, branched rays of anal subdivided into 3–4. Least depth of tail .36–.43 of the distance from rear of dorsal to hypural joint, caudal fin moderately concave with rounded lobes. Colour varying from an indistinct brown mottling on a lighter ground to almost uniform brownish grey.

Maximum total length observed, 98 mm.

Differs from *G. paucispondylus* Stokell in having the average point of ventral insertion posterior to midway in standard length, the strongly developed pyloric caeca, the enlargement of lateral teeth and the form of the mouth; from *G. prognathus* Stokell in the lower number of vertebrae, the equal jaws, the strongly developed caeca, and the enlargement of lateral teeth.

The species is named on account of its failure to conform to the arrangement usual in long-bodied species.

HOLOTYPE. A specimen 88 mm in total length in the Dominion Museum. Registered number 2776.

TYPE LOCALITY. The outlet of a spring which is drained by a ditch crossing the Ophir-Omakau road a few chains north-east of the Ophir Hotel.

LOCALITIES. Mud-bottomed creeks, ditches and waterholes in Central Otago.

Galaxias divergens n.sp.

B. 7–8. D. ii–iv 6–7. A. iv–vi 7–8. V. 5–7 (usually 6) Vert. 50–53.

Lower jaw slightly the shorter with moderate enlargement of lateral teeth, mouth rather straight across. Entopterygoidal teeth 2–5 on each side rather weak. Gill rakers very short or rudimentary, pyloric caeca entirely lacking. Head 5.1–6.0 in standard length, maxillary scarcely reaching to perpendicular from anterior of eye. The dorsal surface of the head has one large open pore on the inner side of each anterior nostril, one inward from each posterior nostril but with the opening confluent with that of the nostril, four in the interorbital space and one behind the upper part of each eye. Dorsal fin originating at .69–.73 of the standard length, ventrals at .47–.51 (average .49) of same. Pectoral fins extending .33–.41 of the distance from their origin to origin of ventrals, ventrals extending .39–.50 of the distance from their origin to the origin of anal, anal origin below the 2nd–4th dorsal ray, branched rays of anal occasionally divided into 3. Least depth of tail .43–.50 of the distance from the rear of dorsal fin to the hypural joint, caudal slightly concave becoming almost straight across in large specimens.

COLOUR. Distinct grey-green spots and blotches on a greenish white ground, belly silvery.

Maximum total length observed, 78 mm.

Differs from *G. paucispondylus* in the poor development of the gill rakers; from *G. prognathus* in the equal jaws, from both species in the possession of moderate canines and the reduced number of ventral rays; from *G. anomalus* in the reduced number of ventral rays and the absence of pyloric caeca.

The species is named on account of its differing from typical *Galaxias* in the number of rays in the ventral fins.

HOLOTYPE. A specimen 64 mm in total length in the Dominion Museum. Registered No. 2777.

TYPE LOCALITY. A rapid shingly creek flowing into the Maruia River about a mile west of the hot springs.

LOCALITIES. Local creeks within the riverbed of the Maruia. Altitude about 2,000ft.

A form from shingly streams in the Wellington province agrees with *G. divergens* in the number of ventral rays and the absence of pyloric caeca but has a head in standard length ratio of less than five and a definitely curved mouth. The specimens available are small, and a decision on the status of the fish must be deferred until adults are collected. The characters concerned are rather more important than come within the author's conception of subspecific distinctions.

FIG. 1.—*Galaxias anomalus*. Total length, 88 mm. Ophir. Clutha Basin. Otago.

FIG. 2.—*Galaxias divergens*. Total length, 67 mm. Maruia. Buller basin. Nelson.

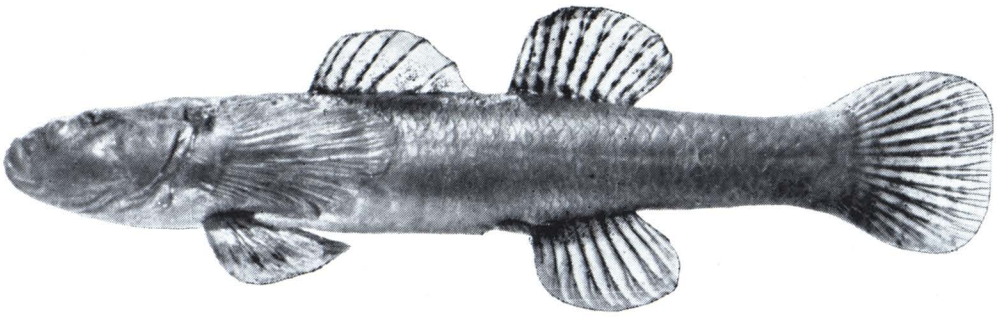

FIG. 1.—*Philypnodon hubbsi.* Total length, 59 mm. Ashley River, Canterbury.

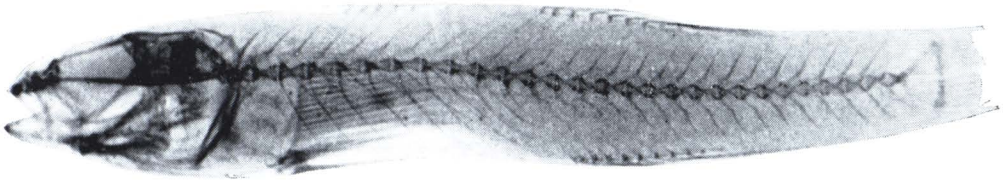

FIG. 2.—X-ray of type of *Eleotris huttoni* = *Gobiomorphus radiata* Cuv. and Val.

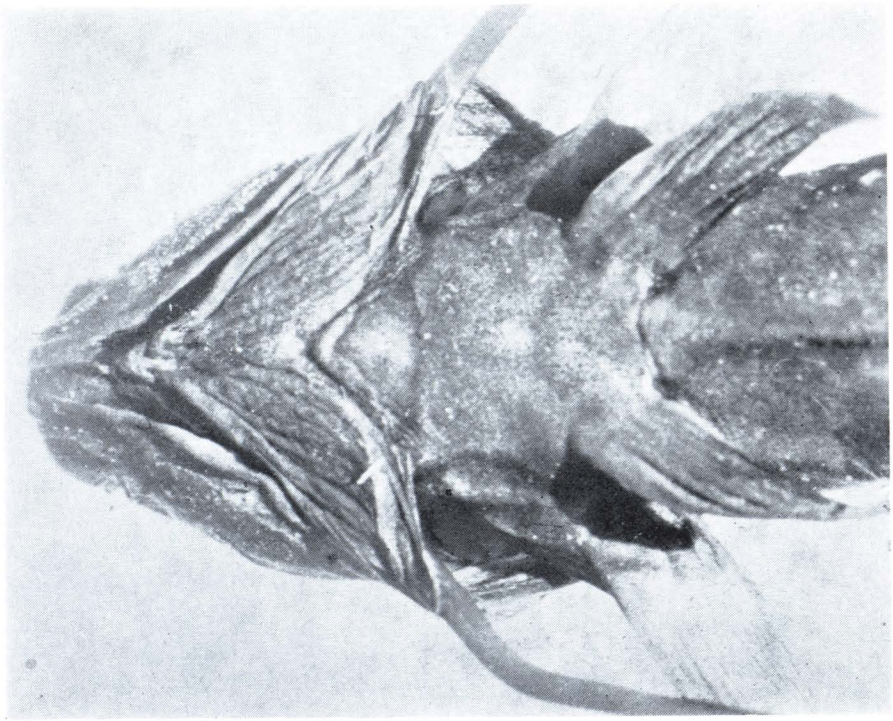

FIG. 3.—Isthmus of *Philypnodon hubbsi.*

The two species described above are of particular importance to a consideration of evolutionary progress in the family Galaxiidae. They indicate the unsoundness of the general conception that a reduced number of ventral rays is a result of degeneration brought about by dis-use in mud-dwelling forms, and that *Galaxias burrowsius* represents a transitional state between typical *Galaxias* and *Neochanna*. The occurrence of *G. divergens* in rapid, shingly, upland streams shows that reduced ventrals may occur independently of the environmental influences regarded as causative, while in *G. anomalus* the influence of a mud habitat is shown to be at least not always operative. This species has been taken only from mud-bottomed streams, ditches and waterholes of the type inhabited by *G. burrowsius* notwithstanding extensive collecting in the shingly streams of Central Otago. It has not been observed in a state of hibernation in solid mud as *burrowsius* has, but it has not been sought in this condition. The restricted area in which *G. anomalus* has been taken is more subject to prolonged droughts than any other locality in New Zealand, and the occurrence of the fish in waterholes and races that sometimes dry up completely suggests that it hibernates at such times after the manner of *G. burrowsius* and *Neochanna*.

ELEOTRIDAE

Genus PHILYPNODON Bleeker

The genus *Philypnodon*, as recognised in New Zealand, differs from the typical Australian form in having a broad isthmus and correspondingly narrow gill openings. In the genotype, *P. grandiceps* Krefft of Australia, the branchiostegal curtain is attached to the isthmus only at the anterior extremity and the gill-openings are fully extended below. The broad isthmus and narrow gill-openings occur also in typical *Gobiomorphus* of New Zealand, but the Australian species referred to this genus has the isthmus reduced to the minimum and fully extended gill-openings as in typical *Philypnodon*. It is possible that this difference is more important than the generic characters recognised at present and that nominal *Gobiomorphus* of Australia has greater affinity with *Philypnodon* of the same country than with typical *Gobiomorphus* of New Zealand. Similarly it is questionable if the New Zealand and Australian forms now referred to *Philypnodon* are truly congeneric.

Philypnodon hubbsi n.sp.

B. 6–7. D. vi. i 9–10. A. i. 9. V. i. 5 P. 18–21. Vertebrae 27–28.

Head naked or with a few scales posteriorly, predorsal surface varying from almost naked to almost completely scaled from the level of the pectoral base. Pectoral base naked, ventral surface naked to anus. Scales imbricated on tail but deeply imbedded and irregularly placed on trunk, about 45 from pectoral to rear of scale covering, 21–22 from level of anus to rear of scale covering, 12–13 around tail. Teeth in jaws in villiform bands about five wide, the outer row moderately enlarged. Mouth steeply inclined, the lower jaw the longer, premaxillary and maxillary not extending to perpendicular from anterior of eye. Rows of papillae on cheeks, opercles and snout, those on the lower edge of cheeks small, closely set, in single row, those below cheek somewhat larger and more widely spaced, in single row, a well-defined furrow above the eye, usually containing subnormal papillae arranged multiserially. Two large open pores in interorbital space to the rear of and inward from the posterior nostrils, usually one medially placed about the rear of the interorbital space, this pore occasionally lacking, occasionally replaced by a pair of smaller ones, a large pore behind each eye. Gill openings narrow, isthmus very broad. Body terete anteriorly, moderately compressed posteriorly, genital papilla large. Head 4.0–4.4 in standard length, depth before first dorsal 5.2–6.5 in same, least depth of caudal peduncle .39–.45 of peduncle length. First dorsal inserted at .35–.36 of the standard length, separated from the second by 2–3 scales, both rounded in outline. Origin of anal about perpendicular from third ray of second dorsal, its height greater than its basal length, outline rounded, caudal rounded.

Colour pale greyish green, usually with numerous lighter specks each about the extent of one scale, sometimes lighter or darker mottlings on ground colour, fins varying from almost uniform to heavily speckled with darker, branchiostegal curtain usually brilliant blue.

Maximum total length observed, 59 mm.

Mature at total length of 55 mm.

VARIATION. Of ten specimens dissected nine have 27 vertebrae and one has 28. One of the same group has 7 branchiostegals on one side and 6 on the other; all the others have 6–6.

Named after Dr. C. L. Hubbs, of California, who drew attention to the distinctness of the species while collecting with the author in 1949.

TYPE. A specimen 51 mm in total length in the Dominion Museum. Registered No. 2778.

TYPE LOCALITY. Ashley River, Canterbury, about ten miles from the sea.

Differs from *P. breviceps* Stokell in the lower number of vertebrae, the presence of large open pores on the head and the much smaller maximum size.

DISTRIBUTION AND HABIT. This fish is abundant in streams along the Canterbury and Westland coasts and probably will be found to be widely distributed. It inhabits rapid, shingly, lowland streams where it is sometimes taken in association with *Gobiomorphus basalis,* and does not appear to extend above an altitude of 600ft.

Genus GOBIOMORPHUS Gill.

When the writer revised the genus *Gobiomorphus* in 1941 three New Zealand species were found to exist and four names were available for possible application to them. Dispositions were made of *Eleotris gobioides* Cuvier and Valenciennes (1837) *Eleotris radiata* Cuvier and Valenciennes (1837) and *Eleotris basalis* Gray (1842) but *Eleotris huttoni* Ogilby (1894) could not be associated with any known form either as a valid name or a synonym. It was found to agree most closely with *Gobiomorphus radiata,* but a determination of its status was not possible in the absence of knowledge of the number of vertebrae. Through the kindness of Dr. Evans, Director of the Australian Museum, two X-ray photographs of the unique holotype have been taken and made available to the writer. They are of excellent quality and show the number of vertebrae to be 27 without the urostyle. This is the dominant number in *G. radiata,* only three of thirty specimens dissected having 28, and there is further agreement in the short mouth in addition to the points of resemblance discussed in 1941. It is now impossible to differentiate the two nominal forms and *huttoni* becomes a synonym of *radiata.* It should be noted here that Whitley (1956) disagreed with the writer's disposition of *Eleotris radiata* and identified with that species a new marine fish for which he proposed the genus *Grahamichthys.* Unfortunately he had only two somewhat shrunken specimens of this fish and overlooked certain features that would have been observable in fresh material. The second ray in the second dorsal fin of *Grahamichthys* is not branched as figured but is a single segmented ray. It is preceded by a slender spine and followed by the branched rays, the arrangement being similar to that occurring in *Micropterus salmoides* of North America except for the different length of the rays and incomplete separation of the first and second dorsal sections in the latter fish. The anal fin of *Grahamichthys* also has a single segmented ray between the spine and the branched rays. Cuvier and Valenciennes record the second dorsal of *E. radiata* as i 9, a specification that has not been matched in *Grahamichthys.* In ten specimens from Picton Harbour examined by the writer the second dorsal consists of a fine spineform ray from half to two-thirds of the height of the fin, a long single segmented ray and 9–10 branched rays. The total number of rays is, therefore, always greater than is recorded in *E. radiata.* The head in standard length ratio of *radiata* is recorded as four, but in *Grahamichthys* it does not attain this value, the range in the ten specimens examined being 3.5–3.7. *Eleotris radiata* is described as being reddish in colour with ten reddish-brown bars across the sides, but there is no trace of red in *Grahamichthys,* the body being yellowish white with indistinct pale brownish bars or mottlings. On the other hand the species of *Gobiomorphus* identified with *radiata* by the writer in 1941 has normally i 9 rays in the second dorsal fin, ranges above and below the specified head in length ratio

and frequently has a series of reddish bars across the sides. In view of this agreement with the principal characters of *radiata* recorded by Cuvier and Valenciennes and the disagreement of *Grahamichthys* with the same characters Whitley's deposition of the present writer's fish and his substitution of the name *Gobiomorphus stokelli* for it cannot be accepted. There is no question of the validity of the specific name *radiatus* for Whitley's fish, but it is doubtful if the genus proposed for it can be maintained. *Grahamichthys* agrees with *Fagasa* Schultz (1943) in the incomplete scale covering of the body, the possession of canine teeth and the truncated caudal fin, and shows affinity in the arrangement of the dorsal and anal fins; *Fagasa* is described as having all rays in the second dorsal and anal single. Schultz and also Harry (1949) retained *Fagasa* in Eleotridae, but Whitley placed *Grahamichthys* in Gobiomoridae, an arrangement which appears to have merit and might be worth adopting for *Fagasa* irrespective of the status of *Grahamichthys*.

The synonymy of the species of *Gobiomorphus* concerned in the above discussion is as follows.

Gobiomorphus radiata Cuvier and Valenciennes

Eleotris radiata Cuvier and Valenciennes. *Hist. Nat. Poiss.* 1837, pp. 247–250.
Eleotris huttoni Ogilby. *Pro. Linn. Soc. N.S.W.* 1894. vol. 9. pp. 367–374.
Gobiomorphus huttoni Whitley and Phillipps. *Trans. Roy. Soc. N.Z.* 1939. pp. 228–236.
Gobiomorphus radiata Stokell. *Trans. Roy. Soc. N.Z.* 1941. pp. 265–276.
Gobiomorphus stokelli Whitley. *Pro. Roy. Zool. Soc. N.S.W.*, 1956. pp. 34–38.

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