

TRANSACTIONS
AND
PROCEEDINGS
OF THE
NEW ZEALAND INSTITUTE
1900

VOL. XXXIII.

(SIXTEENTH OF NEW SERIES)

EDITED AND PUBLISHED UNDER THE AUTHORITY OF THE BOARD OF
GOVERNORS OF THE INSTITUTE

BY

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DIRECTOR

ISSUED JULY, 1901



WELLINGTON
JOHN MACKAY, GOVERNMENT PRINTING OFFICE
KEGAN, PAUL, TRENCH, TRÜBNER, & CO., PATERNOSTER HOUSE,
CHARING CROSS ROAD, LONDON

ART. XXIV.—Notes on New Zealand Land Planarians:
Part IV.

By ARTHUR DENDY, D.Sc., F.L.S., Professor of Biology in
the Canterbury College, University of New Zealand.

[Read before the Philosophical Institute of Canterbury, 27th February,
1901.]

THE last part of these notes was read before this Institute more than four years ago, and in the interval a considerable amount of valuable material has accumulated in my hands. I am indebted to the kindness of various correspondents, whose names are mentioned in the sequel, for specimens from many parts of New Zealand, and I have myself been able to make small collections in the neighbourhood of Jackson's, on the West Coast Road (Westland), in the beginning of 1898; in the neighbourhood of Lake Te Anau in the early part of 1900; and on Chatham Island in January, 1901. While only seven new species are proposed in this communication, it has been found necessary to describe no less than eight new varieties of *Geoplana graffii*. The wide distribution of this species and the manner in which it tends to produce slight local varieties, of restricted range, are extremely interesting, though at the same time not a little perplexing to the systematist. In addition to these varieties, I have to record the occurrence of another common Australian species (*Geoplana munda*) in the South Island of New Zealand, and to record new localities for various species previously described.

It might have been expected that the Land Planarian fauna of Chatham Island would show considerable differences from that of the mainland. This expectation, however, was not fulfilled. Only four species were met with in the limited time at my disposal. These include the ubiquitous *Geoplana graffii* and a well-marked local variety of the same (var. *wharekauriensis*), the almost equally ubiquitous *Geoplana subquadrangulata*, a new but not very strikingly characterized species which I have named *G. latero-punctata*, and a hitherto undescribed and very distinct species which I have termed *G. exulans*, believing it to be probably an emigrant from New Zealand, a single specimen having been collected in the North Island by Mr. R. M. Laing. It is well known that a southward current from the North Island of New Zealand carries logs of timber and other *débris*—such as kauri-gum and pumice-stone—to the shores of Chatham Island, and this may well account for the distribution of *Geoplana exulans*. Thus,

out of four species found on Chatham Island only one is not already known from the mainland of New Zealand, a result affording a striking contrast to that obtained by Whitelegge and Spencer in the case of Lord Howe Island, whose Planarian fauna is strikingly peculiar both as compared with that of New Zealand and that of Australia.

Since the appearance of the last part of these notes an event of great interest to zoologists has taken place, in the publication of Professor von Graff's magnificent monograph of the Land Planarians.* This great work deals with the Land Planarians, so far as yet known, of the whole world, and brings our knowledge completely up to date. At some future time it will be necessary to revise the nomenclature of the New Zealand species in the light of Professor von Graff's results—thus, for example, *Geoplana maricæ* will probably fall in von Graff's new genus *Artioposthia*—but for the present the necessary anatomical and microscopical investigations must be postponed. It appears to me that the proper way in which to work up our local Planarian fauna is first to get together as complete a collection as possible from all parts of the country, to classify and describe these as species and varieties in accordance with external characters (laying special stress upon the colours of the living animal), and ultimately to work out the internal anatomy of as many species as possible before attempting the final arrangement in genera. In the meanwhile we must refer all the *Geoplanidæ* found in New Zealand to the old genus *Geoplana*.

There must be a large number of New Zealand species of Land Planarians still unknown, and it is of great importance that these should be described before the destruction of our primeval forests has made the work impossible. I therefore again venture to appeal to local naturalists and collectors for assistance in this matter, and to remind them that instructions for collecting and packing specimens will be found in the first part of these notes.†

For specimens described in the present contribution I have to thank especially Captain Hutton, Professor Benham, Mr. W. T. Locke Travers, Mr. R. M. Laing, Mr. W. W. Smith, Mr. H. Suter, and Mr. George Howes.

***Geoplana sanguinea*, Moseley.**

Peel Forest.—March–April, 1898. One specimen; coll., W. W. Smith, Esq. This specimen agrees exactly with the Australian form, so far as I can tell. In spirit it is about 77 mm. long and 6 mm. in greatest breadth, with the genital

* "Monographie der Turbellarien," ii., Tricladida Terricola (Landplanarien). Leipzig, 1899 (with an atlas of fifty-eight plates).

† "Transactions of the New Zealand Institute," vol. xxvii., p. 177.

aperture 16 mm. and the peripharyngeal aperture 30 mm. from the posterior extremity. The body is flat below, convex above, with slightly crinkled margins, tapering very gradually and evenly in front, not quite so gradually behind. Eyes in single series anteriorly and antero-laterally, and extending far back, perhaps nearly to the posterior end. My notes on the living animal state that it resembled the Australian *G. sanguinea* in colour and shape. In spirit it is almost colourless (yellowish-grey) all over, with no stripes.

Near Jackson's (West Coast Road).—One specimen.

Invercargill (in a garden; coll., G. Howes, Esq.).—One specimen, in spirit. Eyes not observed.

***Geoplana triangulata*, Dendy.**

St. Martin's, Christchurch.—One typical specimen; coll., R. M. Laing, Esq.

***Geoplana triangulata*, var. *australis*, Dendy.**

Peel Forest.—March–April, 1898. A number of large specimens; coll., W. W. Smith, Esq.

"Bush" (presumably near Invercargill).—Two specimens; coll., G. Howes, Esq.

***Geoplana flavimarginata*, Dendy.**

I have now received larger specimens of this species than previously recorded. One received by post (presumably from Mr. Travers) measures, after preservation in spirit, about 87 mm. in length by 6.5 mm. in greatest breadth, with the genital aperture about 19 mm. and the peripharyngeal aperture 34 mm. from the posterior extremity. In life the dorsal surface was rather bright Indian-red, with yellow margins. The ventral surface was yellow. There were no spots.

***Geoplana graffii*, Dendy.**

Whangamarino, Chatham Islands.—Five specimens. January, 1901. I have already recorded this species from the Chatham Islands, where I have now found it myself at Whangamarino. The specimens agree very closely with the types from Christchurch, except that they are considerably larger. The living animal when at rest is flat and leaf-like and very broad. Dorsal surface dark-brown, with much paler rather narrow median and supramarginal bands of brown. Flecked all over with small whitish or greenish-white specks. Margins of the median band sometimes paler than the middle, owing to the presence of numerous small whitish specks. The dark-brown ground-colour becomes intensified along the margins of the pale bands. The ventral surface is finely mottled in light and darker brown, with paler narrow sub-

marginal and median bands. The pale submarginal and supramarginal bands are continuous with one another and form an uninterrupted pale marginal band (as is also the case in the Christchurch types, in which I have omitted to mention the pale submarginal bands, and have not laid sufficient stress upon the minutely dark-speckled appearance of the ventral surface which distinguishes this form from *G. moseleyi*).

The largest of the five spirit specimens which I preserved measures now 34 mm. in length by 8 mm. in breadth, with the genital aperture 9.5 mm. and the peripharyngeal aperture 15.5 mm. from the posterior extremity.

Toitoti, Southland.—Coll., Miss J. G. Rich. A number of fine broad specimens, attaining a large size—up to 42 mm. by 8 mm. in spirit—mostly with a strong tendency to suppression of the pale longitudinal bands on both surfaces.

Peel Forest.—March, 1898. Coll., W. W. Smith, Esq. Two specimens, much like the typical *G. graffii* in shape of body, and one of them having the pale-brown supramarginal bands fairly well defined. My notes on the living animal say, "Dorsal surface dark-brown, with narrow median longitudinal band of paler brown and paler brown lateral margins, with small pale longitudinal dashes of whitish or iridescent blue all over it. Ventral surface with no bands, but finely mottled with pale- and dark-brown. Shape as in *G. graffii*." The colouration of these specimens approaches nearly to that of *G. graffii*, var. *angusta* and var. *somersii*.

***Geoplana graffii*, var. *castanea*, nov. var.**

Shape and size in life as in *G. graffii*; dorsal surface of a warm chestnut-colour, with a narrow median band and not very well-defined supramarginal bands of pale yellowish-brown; speckled, especially in the darker parts, with minute spots of pale iridescent green or bluish, which are also very abundant just on the margin of the body; ventral surface nearly white, abundantly but minutely speckled with pale-brown dots, which are almost absent in the middle line, leaving a median whitish band; anterior tip brown. Eyes very numerous. In spirit the body is rather broad, about 24 mm. in length by 6 mm. in greatest breadth; the genital aperture about 5 mm. and the peripharyngeal aperture about 10 mm. from the posterior extremity; convex above, nearly flat below, tapering fairly gradually in front and behind, but narrower in front. The margins of the body are rather broadly rounded. The brown colour of the dorsal surface assumes in spirit a characteristic purplish tint, with numerous minute white specks, and the median stripe of yellow is very well defined, about one-eleventh of the total width.

Locality.—Near Invercargill. Two specimens, collected by G. Howes, Esq. (one specimen on the 17th April, 1898, five miles from Invercargill).

***Geoplana graffii*, var. *ocellata*, nov. var.**

Body at rest (in life) very broad, flat, and thin; about 22 mm. long by 9.5 mm. broad; tapering gradually to the horse-shoe-shaped anterior extremity and to a sharp point behind; with a slightly developed median dorsal ridge. When crawling about 31 mm. long; strongly convex and rounded above, flattened beneath. Eyes as usual, in two crowded lateral patches, and continued in single series round the horse-shoe-shaped anterior end. Dorsal surface in life dark mahogany-brown, with irregularly scattered paler blotches of rounded shape. The margins of the body are occupied by a very narrow pale band, merging dorsalwards in a row of very irregular small patches of the same tint, some of which are quite isolated. In the mid-dorsal line is a single row of the pale rounded blotches at irregular and wide intervals, each with a conspicuous central "eye" of a pale-green, nearly white, colour. (The spirit specimen shows the pale blotches for some distance on either side of the mid-dorsal line to be less distinctly "eyed.") The entire dorsal surface, except about the middle line, is dusted with minute specks of very pale iridescent green, showing a tendency to arrangement in longitudinal rows. The ventral surface in life was pale-brown, pretty uniformly but rather sparsely speckled with small rounded spots of dark-brown, absent for a narrow space submarginally but present in the middle. The pale ground-colour greatly preponderates, and the dark spots are widely separated from one another. Margins dusted with minute specks of the pale iridescent green.

In spirit the body is strongly convex above, flattened below, with narrow, slightly prominent margins; about 23 mm. long and 5 mm. broad, with the genital aperture (?) mm. and the peripharyngeal aperture 9.5 mm. from the posterior extremity.

This variety apparently comes near to *Geoplana gelatinosa*. The single specimen was sent to Dr. Benham by Mrs. Mason, who said it was luminous.

Locality.—Paradise (Lake Wakatipu).

***Geoplana graffii*, var. *wharekauriensis*, nov. var.**

Body in life much flattened; when at rest may be triangular in section, flat beneath, and with a rather prominent mid-dorsal ridge; shape altogether like *G. graffii*. In life the colour of the dorsal surface is mahogany-brown, with a narrow paler reddish-brown stripe down the middle,

and sometimes a more or less definite pale stripe above each margin, but the latter is commonly wanting. Minute specks of darker brown are abundantly scattered all over the dorsal surface (including the pale stripes). There are also less numerous bluish(?) white spots more or less surrounded by very dark-brown shading. These white spots are largest and most conspicuous along the margins of the pale median band, where there may be some fifteen on each side, but quite irregularly arranged, and with the dark shading round their outer margins only; they are usually entirely absent from the median band itself. The ventral surface is pale-brown, closely and minutely speckled with darker brown, sometimes with an indication of a paler narrow median band. Eyes numerous, but apparently absent from the extreme anterior end.

In spirit the body is flat below, convex above, with narrow lateral margins; commonly rather broader behind than in front. A full-grown specimen measures, in spirit, 24 mm. in length by 6 mm. in greatest breadth, with the genital aperture 7 mm. and the peripharyngeal aperture 11 mm. from the posterior extremity.

The spotted appearance of the dorsal surface in this variety is extremely characteristic.

Locality.—Very common under rotten logs at Wharekauri (Mr. Chudleigh's estate), Chatham Island. January, 1901.

***Geoplana graffii*, var. *nodosa*, nov. var.**

Shape as usual in *G. graffii*. A typical spirit specimen measures about 40 mm. by 5.5 mm., with the genital aperture 12.5 mm. and the peripharyngeal aperture 5.5 mm. from the posterior extremity. In this specimen the dorsal surface in life was dark-brown, with a narrow, interrupted, nodose, greenish-yellow mid-dorsal line. Ground-colour flecked with very minute specks of pale iridescent blue. Margins of body occupied by a very narrow but well-defined band of pale yellowish-brown, and flecked with small dashes of pale greenish-yellow like those of the mid-dorsal line, but smaller. Ventral surface light-brown, closely and finely mottled with a darker tint, with no pale median band.

This variety comes very near to *G. graffii*, var. *somersii*, but differs in the typically well-defined narrow marginal pale bands and the more distinct nodose mid-dorsal line; perhaps also in the greater breadth and altogether larger size of the body. Some specimens show traces of a pale median ventral band. The variety attains a large size, one specimen in spirit measuring 50 mm. by 10 mm., and is subject to slight variation in colour-markings which make it impossible to define it

sharply. It appears to be characteristic of the Invercargill bush.

Locality.—Invercargill. Several specimens; coll., George Howes, Esq.

Geoplana graffii, var. dorso-marmorata, nov. var.

Body at rest (in life) flattened or concave below, strongly convex above, somewhat triangular in section. Eyes numerous. Dorsal surface in life pale yellowish-brown, irregularly marbled with much darker brown, except for narrow median and supramarginal bands of the ground-colour. Ventral surface pale yellowish-brown, thickly peppered with small specks of darker brown, except for narrow marginal bands where the dark specks are absent; with an indication posteriorly of a narrow median band free from specks.

In spirit the body is slightly concave below, convex above, with slightly prominent narrow margins; about 24 mm. long by 4.5 mm. broad, with the genital aperture 8 mm. and the peripharyngeal aperture 12 mm. from the posterior extremity.

Locality.—The Nuggets (between Otago Harbour and the Bluff). One specimen, collected by Dr. Benham.

Geoplana graffii, var. clintonensis, var. nov.

My notes on the living specimens merely state that they are very similar to *G. graffii*. The two spirit specimens are of the usual form, but the peripharyngeal aperture is well behind the middle of the body. Length of specimen in spirit, 23 mm.; breadth, 3.5 mm.; genital aperture about 6 mm. and peripharyngeal aperture about 9 mm. from the posterior extremity.

The variety is characterized especially by the well-defined character of the pale median dorsal and supramarginal bands. The pale median band has no included stripes and little or no mottling. The supramarginal pale stripes are mottled, like the ventral surface, with a darker tint. The dark ground-colour of the dorsal surface forms two broad bands, in which the pigment is intensified at the edges, and which are finely mottled with the paler shade. The colours of the dorsal surface in spirit are dirty-yellow and dark-grey. The ventral surface is dull-yellow in spirit, finely and uniformly mottled all over with light-grey. There is no pale median ventral band. Eyes as usual in the genus.

Locality.—Near Mr. Garvey's house, Clinton Valley, head of Lake Te Anau. January, 1900. Two specimens.

Geoplana graffii, var. angusta, var. nov.

I have received this variety from several localities in the South Island, and were it not for the occurrence of inter-

mediate forms I should regard it as a distinct species. The variety is characterized by the comparatively long and narrow body, the difference in shape as compared with the typical form of *G. graffii* being very noticeable in spirit specimens. The colouration is also characteristic, especially the numerous small white specks in the ground-colour of the dorsal surface and the narrow median longitudinal stripe of a yellowish tint, the ventral surface being very similarly coloured, but paler, and with no median longitudinal stripe. The absence of a distinct supramarginal stripe may also be regarded as characteristic. The variety certainly comes near to var. *somersii*, from Springburn.

Localities.

The Nuggets (on the coast between Otago Harbour and the Bluff).—One living specimen, received from Dr. Benham on the 19th April, 1899. The body when at rest was broad and flat, but markedly triangular in section, with a prominent median dorsal ridge; much broader behind than in front; tapering gradually to the horse-shoe-shaped anterior extremity; bluntly pointed behind. Eyes numerous, arranged as usual. The ground-colour of the dorsal surface in life was dark olive-brown, with a narrow median longitudinal band of dark dull-orange. The ground-colour, except in the middle line, was flecked with numerous irregular dashes and dots of dirty-white, varying greatly in shape and size, but all small. The anterior tip was pale-brown. The ground-colour of the ventral surface was pale olive-brown, flecked uniformly all over with irregular specks of dirty-white of varying shape and size, but all small. After preservation in spirit the animal measures about 37 mm. in length by 5.5 mm. in greatest breadth, with the genital aperture about 9 mm. and the peripharyngeal aperture 16 mm. from the posterior extremity. The dorsal surface is slightly convex, the ventral nearly flat; the margins of the body are narrow, slightly prominent, and marked by a fine pale line.

Toitoti, Southland.—Four specimens; collected by Miss J. G. Rich (from the Canterbury Museum).

Bush, near Invercargill.—Two fairly typical specimens; collected by Mr. George Howes. In one the mid-dorsal yellowish line is fairly broad, and there is a strong development of long (in spirit) white dashes in the dark ground-colour on each side of it. The ventral surface (in spirit) is dark-grey, with numerous small white specks.

Invercargill (five miles from).—A living specimen of this variety was received from Mr. G. Howes, together with the living specimen of the variety *castanea* described above. My notes on the living animal only state that it is similar to the latter (var. *castanea*), but with the brown of a much greyer

tint, and no pale mid-ventral band. The same specimen in spirit has the dorsal surface dark-grey, fading at the margins, and flecked with small white specks all over, but more abundantly towards the margins, where the relative proportions of grey and white become gradually reversed. The ventral surface (in spirit) is dirty-white finely mottled with grey. The body (in spirit) measures about 37 mm. by 4 mm., with the genital aperture 10 mm. and the peripharyngeal aperture 15.5 mm. from the posterior extremity. The margins of the body are sharper than in var. *castanea*, and tend to form narrow ridges, marked by a light line; the body tapers gradually to both ends, but is rather narrower in front than behind.

Geoplana graffii, var. *otiraensis*, Dendy.

Near Jackson's (West Coast Road).—February–March, 1898. A considerable number of large specimens were met with in this locality, under logs on the Teremakau Flat. Fifteen specimens were preserved, and these agree so closely with one another and differ so much from the typical *G. graffii* that it may become necessary to consider them as belonging to a distinct species. The original specimens from Otira were hardly so characteristic as those now under consideration, one of which latter may be described from life as follows: "When at rest very broad and flat; when crawling flat below, strongly convex above, tapering very gradually in front and behind. Dorsal surface in life dark-brown, with a narrow median darker line; finely and abundantly speckled (except in the median line) with iridescent green, more sparingly speckled (all over) with much larger longitudinal dashes of opaque white. Ventral surface very pale-brown, abundantly mottled with dark purplish-brown, the mottling rather less abundant in the middle line."

Spirit specimens average about 60 mm. in length by 7 mm. in breadth, with the genital aperture about 19 mm. and the peripharyngeal aperture about 28 mm. from the posterior extremity. The dorsal surface is dark-brown or grey, intensified to nearly black in a narrow median stripe which may become obsolete, and flecked with various-sized specks and dashes of white which may or may not be especially developed about the middle line. The ventral surface is pale-brown, closely mottled with small purplish specks, with narrow pale marginal and median bands where the purplish specks are more or less wanting.

Geoplana graffii, var. *nigrescens*, nov. var.

This variety differs from var. *otiraensis* in the total suppression of the white specks on the dorsal surface. The following description was taken from a living specimen found

under a log on the Teremakau Flat, near Jackson's: "When at rest broad and flat. When crawling, which it does very rapidly, the ventral surface is flat and the dorsal strongly convex, with the anterior end elongated and narrow and the posterior end broader but gradually sharp-pointed. The dorsal surface was shining-black all over, but in a good light a fine median longitudinal darker line could be distinguished, and where stretched by a contained egg-capsule a brownish-black mottling could also be distinguished. There was a narrow marginal band of pale-brown, and the ventral surface was pale-brown mottled finely with a darker tint. The length of the animal when crawling fully extended was about 85 mm., and the breadth about 6.5 mm. The cocoon was extruded through the back of the animal when placed in dilute alcohol."

Another specimen when at rest measured about 35 mm. by 10 mm., was not quite so black, and had a distinct narrow median whitish band on the ventral surface. Two more specimens also show the pale mid-ventral band.

Locality.—Under logs on the Teremakau Flat, near Jackson's (West Coast Road). February–March, 1898. Four specimens.

***Geoplana graffii*, var. *occidentalis*, Dendy.**

Near Jackson's (West Coast Road).—February–March, 1898. One specimen, resembling those previously obtained from Otira, and, like the latter, differing from the Lake Mahinapua specimens in the possession of comparatively large (in spirit) whitish specks on the dark portions of the dorsal surface. The specimen was found beneath a log on the Teremakau Flat.

***Geoplana iris*, Dendy.**

Peel Forest.—March, 1898. I received from Mr. W. W. Smith eight specimens collected in this locality. They showed in life the typical colouration, except that the outer margins of the dorsal orange stripes were yellow rather than green, but sometimes with a greenish tint in the case of the more median ones. They are mostly considerably larger than the original specimens, the largest specimen in spirit measuring 38 mm. in length by 8 mm. in greatest breadth, with the genital aperture 9 mm. and the peripharyngeal aperture 17 mm. from the posterior extremity. The body in spirit is flat below, convex above, broader behind than in front.

The species makes a very near approach to the Victorian *G. adæ*, as well as to *G. graffii* and its allies in New Zealand.

Geoplana latero-punctata, n. sp.

Dorsal surface in life strongly convex, ventral flattened as usual. In spirit the body is short and thick, strongly convex dorsally, flattened ventrally, with broadly rounded not prominent margins. The anterior extremity, with its prominent horse-shoe-shaped sensory ridge, is rather sharply marked off by sudden narrowing from the rest of the body, while the posterior extremity tapers more evenly but rather rapidly to a blunt point (in spirit).

A spirit specimen measures about 11.5 mm. by 2.5 mm., with the genital aperture 3.75 mm. and the peripharyngeal aperture 6.25 mm. from the posterior extremity. The eyes are numerous and continued in close-set single series round the horse-shoe-shaped anterior extremity as usual.

The dorsal surface in life is dark-brown or almost black, with microscopic pale-bluish specks all over. The ventral surface is pale-brown, shading into the darker dorsal tint. The sides of the body are sprinkled with small bluish-white or very pale-greenish specks visible to the naked eye, and extending (for a short distance only) both dorsally and ventrally. The anterior extremity in one of the two spirit specimens is dark-brown above and nearly white beneath, in the other it has a pinkish tint dorsally.

Locality.—Whangamarino, Chatham Island. January, 1901. Two specimens (rotten wood).

Geoplana agricola, Dendy.

I have much pleasure in again recording this species, hitherto known only from a single specimen. On the 18th November, 1897, I received four typical living specimens collected by Mr. R. M. Laing at St. Martin's, near Christchurch. The animal when crawling was long and narrow, strongly convex above, flat below, narrower in front. The largest specimen in spirit measures about 57 mm. in length by 5 mm. in greatest width, with the genital aperture 15 mm. and the peripharyngeal aperture 26 mm. from the posterior extremity. The body in spirit is convex dorsally and characteristically concave ventrally, with inturned lateral margins; tapering gradually and evenly in front, more suddenly behind.

In life the dorsal surface showed a rather narrow median longitudinal band of pale dull-yellow, followed on each side by a very broad band (twice the width of the median) of dark purplish-brown, almost black; then comes on each side another band of pale dull-yellow about as wide as the median band, bounded externally by a very narrow but well-defined marginal or slightly supramarginal line of dark purplish-brown. Anterior tip in life pink; ventral surface pale greyish-yellow, with two broad bands of finely mottled greyish-brown

leaving narrow median and submarginal bands of the ground-colour free from mottling. In spirit the broad brown bands of the dorsal surface assume a greenish tint.

I also found two specimens of this species in a mixed collection of Land Planarians given to me by Mr. H. Suter, with no further locality than "Native bush, New Zealand."

G. agricola, var. **maori**, var. nov.

This variety differs from the type in the suppression of the mid-dorsal and mid-ventral narrow yellow bands, the broad darker bands meeting in the middle line on both surfaces. I have two specimens of this variety, one from St. Martin's, received together with the typical specimens and showing a narrow remnant of the mid-dorsal yellow band anteriorly, and one in Mr. Suter's collection.

Geoplana fagicola, n. sp.

In life rather broad, flat below, convex above, rather blunt behind. In spirit about 37 mm. long and 4.5 mm. broad; flat below, strongly convex above; tapering rather more gradually in front than behind; with rather prominent and sharp lateral margins. Eyes very minute and inconspicuous, visible chiefly around the horse-shoe-shaped anterior extremity. Genital aperture (in spirit) about 9.5 mm. and peripharyngeal aperture about 14.5 mm. from the posterior extremity.

Dorsal surface in life rather dark-brown, fading gradually towards the margins, and with a well-defined, narrow, pale-brown median stripe. Ventral surface the same but lighter, fading to the margins, and with a narrow, pale median stripe. Anterior tip pink.

Locality.—Near Mr. Garvey's, Clinton Valley, head of Lake Te Anau, in a rotten tree. January, 1900. One specimen.

Geoplana exulans, n. sp.

Long and narrow, especially when crawling, when it may attain a length of 45 mm. An average specimen, killed by immersion in strong spirit, measures about 26 mm. by 2 mm., the body being flat below, strongly convex above, and tapering rather gradually in front and behind. The genital aperture in the same specimen is 9 mm. and the peripharyngeal aperture 13 mm. from the posterior extremity. Eyes as usual, numerous and small.

The ground-colour of the dorsal surface in life is dirty-white. There is a broad, well-defined, median longitudinal band of dark chocolate-brown occupying about one-fifth of the total width of the dorsal surface. On each side of this

median band are a number of irregular, more or less discontinuous and anastomosing, narrow, wavy, longitudinal stripes of the same dark chocolate-brown colour. This fine longitudinal striation extends to the margin of the dorsal surface on either side. In addition to the dark stripes, numerous minute specks of the same colour occur, chiefly in the ground-colour on each side of the mid-dorsal band.

The ground-colour of the ventral surface in life is dirty-white, with two broad longitudinal bands of chocolate (paler than that of the dorsal surface) dividing the ground-colour into three narrow stripes, one median and one submarginal on each side. A few minute specks of chocolate-brown occur sparsely scattered in these bands of ground-colour. Anterior extremity in life pinkish.

This is a very distinct and well-characterized species.

Localities. — Chatham Island; common; widely distributed in and under rotten logs (Whangamarino, Wharekauri; January, 1901). Ara-tea-tea, North Island of New Zealand; one very typical specimen; coll., R. M. Laing, Esq.

***Geoplana garveyi*, n. sp.**

Body even when at rest long and narrow, very gradually tapering behind, convex above and flat beneath. When crawling very long and narrow, the larger of the two specimens attaining a length of about 50 mm. In spirit the larger specimen measures about 42 mm. by 2.5 mm., and the smaller about 32 mm. by 2.5 mm. In the larger specimen (in spirit) the genital aperture is distant 21 mm. and the pharyngeal aperture 29 mm. from the posterior extremity; in the smaller specimen the corresponding distances are 13.5 mm. and 19.5 mm. The shape in spirit is long and narrow, more gradually tapering behind than in front, convex dorsally and flat ventrally, but with gradually rounded margins.

The colour in life was an almost uniform bluish-grey, rather paler in the mid-dorsal line and at the margins. The ventral surface paler grey, except for a pair of ill-defined longitudinal stripes (or, one might say, grey, fading in the middle line and towards the margins). The anterior tip was pinkish-brown.

Eyes numerous, continued laterally almost to the extreme posterior end, but more abundant at the sides of the anterior end.

The species is evidently nearly related to *G. purpurea*, from which it differs in colouration.

Locality.—Near Mr. Garvey's house, Clinton Valley, head of Lake Te Anau; in rotten trees. January, 1900.

Geoplana aucklandica, n. sp.

The single specimen was given to me with the following description, evidently taken from the living animal: "Under-surface of a rusty colour, with whitish median line. Upper surface: ground white, with very fine black meandering longitudinal lines; a rather broad median longitudinal brown band, with darker margins and central line. Extended: length, 25, breadth, 3-4 mm. Cross-section half-round."

In spirit the body is strongly convex dorsally. The ventral surface is nearly flat, but with a pair of slightly prominent longitudinal ridges, one halfway between the middle line and the margin on either side. The dorso-lateral margins are sharp and well defined. The body tapers rather bluntly both in front and behind. Length, about 14 mm.; breadth, about 4 mm.; genital aperture 4.5 mm. and peripharyngeal 9.5 mm. from the posterior end.

The dorsal surface in spirit shows a whitish ground-colour, with a broad median band of dark-brown equal in width to about one-fourth the width of the whole dorsal surface. In this dark band the brown colour is intensified to form a narrow median and broader marginal lines. Between the dark median band and the margin of the dorsal surface the ground-colour is thickly strewn with minute dark-brown specks, more or less running together to form slender meandering lines, but almost absent for a narrow space on either side of the dark median band. The ventral surface is of a finely mottled chestnut-brown colour, with a narrow pale-whitish median band, where the brown mottling is less abundant, and a similar but less definite narrow pale band along each of the longitudinal ridges before mentioned. Outside these ridges the chestnut colour darkens towards the margins of the ventral surface; inside the ridges it darkens towards the margins of the pale median band. Anteriorly the pale median ventral band becomes confluent with the almost colourless anterior extremity, where the absence of pigment is continued backwards for a short distance, so as to make a deep indentation in the front end of the dark mid-dorsal band. I was unable to make out the eyes satisfactorily.

This is a remarkably well-characterized species, so that I feel perfectly justified in describing it from a single specimen. The peculiar shape of the body recalls that of *G. subquadrangulata*, but the dorsal surface is more strongly convex, and the lateral surfaces are less sharply differentiated from the ventral (in which I have included them in the above description).

Locality.—Old Cemetery Gully, Auckland; coll., H. Suter, Esq.

Geoplana cucullata, Dendy.

*Near Jackson's, on the Teremakau (West Coast Road).—*February, 1898. One typical specimen, found under wood. When at rest very broad and flat, with a very slight median dorsal longitudinal ridge. The hollow under the anterior end, conspicuous in spirit, was not noticeable in life. The colour of the dorsal surface in life was pale-orange, finely speckled with darker brownish-orange, and with a faint indication of a narrow median longitudinal band of the paler colour; anterior tip dorsally dark-brown, ventrally colourless for some distance; ventral surface pale-orange, finely speckled with darker brownish-orange. Length in spirit, 21 mm.; breadth, 7 mm.

Near Mr. Garvey's House, Clinton Valley, Head of Lake Te Anau.—In this locality I obtained two specimens in rotten trees, both typical. The larger one is thus described in my notes. "At rest very broad and flat. Dorsal surface in life nearly uniform gamboge-yellow, rather paler in the middle line. Numerous thickly scattered minute brown specks visible under a pocket-lens. Anterior tip coloured like rest of body. Eyes numerous, as usual. Ventral surface rather paler than dorsal. Nearly uniform yellowish-brown. Movements very sluggish." In spirit the hood-like or beak-like form of the anterior extremity is very conspicuous.

Geoplana munda, Fletcher and Hamilton.

The two specimens agree very closely indeed with the well-known and common Australian form. I received them both in spirit, but, as usual in the species, the colours are well preserved. The Invercargill specimen is about 17 mm. long and 3 mm. broad, with the genital aperture about 5.5 mm. and the peripharyngeal aperture about 7.5 mm. from the posterior extremity. Thus the peripharyngeal aperture is a little further back than usual in the species, but this may be, in part at any rate, due to unequal contraction.* The body is strongly convex above, flattened below, tapering rather more gradually in front than behind. The ground-colour of the dorsal surface (in spirit) is yellowish-brown, with four distinct longitudinal stripes of dark chestnut-brown—viz., a pair of very narrow well-defined stripes, one on each side of a very narrow median stripe of ground-colour, and a pair of much broader stripes, one halfway between each narrow dark stripe and the margin of the body. The narrow dark stripes have their outer margins uneven, the broad dark stripes have both margins very uneven. In the pale ground-colour between the

* The Toitoti specimen is slightly damaged, and I have not quite satisfied myself as to the apertures.

narrow and broad stripes, and between the latter and the margins of the body, are scattered numerous small specks of the dark-brown colour, just visible to the naked eye.

The ventral surface appears to the naked eye of a uniform very pale brown colour. Microscopic examination shows numerous very minute superficial specks of brown pigment thickly dusted all over both dorsal and ventral surfaces, but paler on the latter. On the dorsal surface they lie more superficially than the dark markings already described.

Specimens from Victoria show a precisely similar microscopic dusting. Eyes numerous, but exact arrangement difficult to make out.

Locality.—Invercargill; one specimen, collected in the bush by G. Howes, Esq. Toitoto, Southland; one specimen, collected by Miss J. G. Rich.

***Geoplana subquadrangulata*, Dendy.**

Near Jackson's (West Coast Road).—Six good-sized specimens, with the three dark dorsal stripes very well defined, and a fairly well-defined narrow dark submarginal stripe. The ventral surface and ground-colour of the dorsal surface show little or no mottling in the spirit specimens. The paired dorsal stripes are very much broader than the median one. The specimens were found under logs on the Teremakau Flat.

Near Mr. Garvey's House, Clinton Valley, Head of Lake Te Anau.—Two specimens, with the three dark dorsal stripes well defined (the paired stripes being broad). The ventral surface and ground-colour of the dorsal surface show little or no mottling in the spirit specimens, but the larger of the two shows an ill-defined narrow marginal stripe.

Peel Forest.—March, 1898. Coll., W. W. Smith, Esq. Three unusually large specimens, the largest measuring in spirit 26 mm. in length by 3.5 mm. in breadth, with the genital aperture 6 mm. and the peripharyngeal aperture 9 mm. from the posterior extremity. The protruded pharynx is narrow and subcylindrical in shape. The dorsal surface (in spirit) is flat, the ventral and lateral convex and indistinguishable from one another. The three dorsal stripes of dark-brown are present as usual—viz., a narrow median one and a broader one at some distance on each side of it. Between the narrow and broad stripes the yellowish ground-colour is abundantly speckled with dark-brown, and there is an ill-defined band of small dark specks on each side of the body, separated from the outer dark stripe by a fairly broad interval of ground-colour almost free from specks. The ventral surface is devoid of dark specks, or very nearly so.

Toitoto, Southland.—Coll., Miss J. G. Rich. A number

(seven) of good-sized specimens agreeing closely with one another in shape and colour; with the dorsal surface very sharply marked off from the lateral surfaces by acute, slightly prominent margins, and the inwardly sloping lateral surfaces distinguished from the narrow ventral surface by their somewhat darker tint and more or less speckled character. Three dorsal stripes as usual, but now (in spirit) the colours are very pale.

Invercargill.—Nine specimens, mostly very similar to (a) of the original description, found in a garden by G. Howes, Esq.

Chatham Island.—January, 1901. Abundant (rotten logs). Two specimens referable to var. (a) of the original description, but mostly with three well-defined dorsal stripes (one narrow and two broad), and well-defined minute brown specks sparsely scattered on the lateral and ventral surfaces, and sometimes between the dorsal stripes.

***Geoplana howesi*, n. sp.**

When crawling very long and narrow; subcylindrical, but flattened below. In spirit contracts very much, measuring finally 24 mm. long by 3.5 mm. broad, with the genital aperture 4.5 mm. and the peripharyngeal aperture 9 mm. from the posterior extremity. The body in spirit is approximately oval in transverse section; flattened below and sometimes also above; of almost uniform diameter throughout, but tapering rather bluntly at each extremity. Colour in life pale-yellow all over, except for the pink anterior tip and three narrow longitudinal stripes of dark-brown on the dorsal surface. The median stripe is narrower than the other two, which are about equidistant between the median stripe and the margins. All the stripes are well defined, and they divide the ground-colour of the dorsal surface into four broad longitudinal zones of about equal width. There are no dark specks either between the stripes or on the ventral surface. In spirit the ventral surface shows a differentiation into three longitudinal bands of about equal width* and very sharply defined, the median band being of a paler tint than the others. Eyes numerous, in single series round the horse-shoe-shaped anterior extremity (? elsewhere).

This species is certainly nearly related to *G. subquadrangulata*, from which it differs in the more elongated body, which is also more oval in section; in the narrowness and sharp definition of all three dorsal stripes; and in the absence of dark specks from the ground-colour. The paired ventral bands of ground-colour, darkening in spirit, evidently repre-

* The median band may be wider than the other two.

sent the lateral surfaces of *G. subquadrangulata*. I have much pleasure in naming the species after Mr. George Howes.

Locality.—Invercargill bush. Three specimens, one alive and two in spirit; collected by G. Howes, Esq.

***Geoplana suteri*, Dendy.**

Invercargill (bush).—One specimen; collected by G. Howes, Esq. The species is immediately recognised by the peculiar arrangement of the six narrow dark lines on the dorsal surface. The present specimen (in spirit) shows a differentiation of the ventral surface into three longitudinal zones of about equal width, the outer ones distinguished by a brownish tint and very sharply defined from the paler median zone. Traces of a similar differentiation are visible in one of my spirit specimens from Dunedin.

Toitoti, Southland.—Coll., Miss J. G. Rich. Two specimens in a bad state of preservation (in spirit), but showing clearly the differentiation of the ventral surface into three longitudinal zones of about equal width, the two outer being of a darker tint than the median one. Body nearly oval in transverse section.

***Geoplana cooperi*, n. sp.**

Body (in spirit) more or less oval in section, more or less flattened both dorsally and ventrally; rather blunt at both extremities. The larger of the two specimens measures about 18 mm. in length by 3.5 mm. in breadth, with the genital aperture 6.5 mm. and the peripharyngeal aperture 7.5 mm. from the posterior extremity. Eyes numerous, arranged much as usual in the genus.

The colour of the dorsal surface (in spirit) is brownish-yellow, with five conspicuous, nearly black, longitudinal stripes equidistant from one another. The median dark stripe is more intense in colour, better defined, and may be somewhat broader than the others; it appears to be made up of two parallel stripes placed close together side by side, there being (at any rate in one specimen) an indication of an extremely fine pale line down the middle. The outer edge of the outermost stripe is marginal. The bands of ground-colour between the dark stripes are about equal in width to the stripes themselves, and contain a few irregularly scattered minute specks of the darker colour by more or less intense concentration of which the dark stripes themselves seem to be made up.

The true ventral surface is pale-yellow without markings, but it is separated from the dorsal surface by well-defined lateral bands about half as wide as the ventral surface, and distinguished by a fine dusting of minute brown specks, visible under a lens.

This is a well-characterized species, but it appears to be related to *G. suteri* and *G. subquadrangulata*. I am indebted for the two specimens to Mr. H. Suter.

Locality.—Omaha (Auckland Province). Coll., Charles Cooper, Esq. Two specimens.

Geoplana mariæ, Dendy.

Near Mr. Garvey's House, Clinton Valley, Head of Lake Te Anau.—I found one small specimen which is probably a young individual of this species. The colouration and the shape of the body in spirit agree closely with the typical form, but I was unable to make out the eyes and apertures. The living animal is thus described in my notes: "When crawling long and narrow. Triangular in section, dorsal surface forming a prominent ridge, ventral flat, tapering gradually in front and behind. Dorsal surface yellow speckled with olive-brown, the brown specks concentrating on each side of a narrow median stripe of yellow, up the middle of which runs a row of very minute indistinct pale-brown spots. Anterior tip slightly pinkish. Ventral surface pale yellow flecked with minute specks of pale brown, which are absent in the middle line."

In spirit the body exhibits the characteristic convexity of both surfaces and uniformity of diameter almost to the extremities.

ART. XXV.—*Notes on Salmonidæ and their New Home in the South Pacific.*

By A. J. RUTHERFURD, Chairman of the Wellington Acclimatisation Society.

[Contributed to the Wellington Philosophical Society, 15th January, 1901.]

THE following notes were read by Mr. A. J. Rutherford, Chairman of the Wellington Acclimatisation Society, at the quarterly meeting of that body on the 3rd December. The subjects dealt with are chiefly a description of the waters into which salmon and trout have been introduced in New Zealand, and the results likely to be obtained owing to the change in their surroundings:—

I. ENVIRONMENT.

Situated between latitudes 34° and 47° S., in the Pacific Ocean, about a thousand miles from the main Australian Continent, the islands of New Zealand form an exceedingly interesting group, with their unique flora and fauna. They