

The Blind Electric Rays of the Genus *Typhlonarke* (Torpedinidae)

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ABSTRACT

The G. *Typhlonarke* is endemic to New Zealand and is represented by two species, *T. aysoni* and *T. tarakea*. Both species are blind electric rays with concealed eyes, one dorsal fin, pelvics modified for walking or burrowing, and large electric organs with many fewer columns per organ than *Torpedo*. *T. aysoni* is circular in outline and the marginal part of the disc is thin. *T. tarakea* has an ovoidal disc with a thick rim. Both species are marine bottom-dwellers in shallow water.

Compared with other countries, the New Zealand elasmobranch fauna is relatively poor in both genera and species. It is all the more remarkable, then, that in the small number of skates and rays in these waters, there are two species of blind electric rays (*Typhlonarke aysoni* and *T. tarakea*). *T. aysoni* is a well-recognized species, but *T. tarakea* was regarded by Whitley (1940) as only a "nominal species" and has been omitted in Fowler's extensive account (1941). Elsewhere, blind electric rays are known from only two places, each with one species. Of these, *Benthobatis morcsbyi* Alcock 1898 has concealed eyes and comes from deep water off Southern India, and *Narke (Bengalichthys) impennis* (Annandale 1909), which has minute sunken eyes and lives in shallow water in the northern part of the Bay of Bengal. Both our species are as specialized as *Benthobatis*. Morphologically both are poor swimmers. It is doubtful that the thick-disc'd *T. tarakea* could swim at all, and in this species is found the greater independence of the pelvic appendage. In both species, the radial muscles of the pelvics are more heavily represented, particularly on the free appendage, than in *Torpedo fairchildi*. The mouth is apparently suctorial. The eyes are concealed by uninterrupted smooth skin, but, unlike *Benthobatis*, our species are from shallow water.

The G. *Typhlonarke* was established by Waite (1909) to contain *T. aysoni* (Hamilton 1902), originally placed in the G. *Astrape* but distinct in the form of the disc, junction of the disc and pelvics, the absence of functional eyes, and the short tail. Phillipps (1929) recognized a second species, oval in form and remarkable in the absence of a dorsal fin. In 1949, Phillipps states that a specimen taken on a "foul hook" at 130 fathoms in Cook Strait had a dorsal fin. Examination of the type in the Dominion Museum shows a definite scar at the site of the dorsal. Phillipps also states, on the evidence of Professor B. J. Marples, that both species occur off Otago Heads. Hamilton's original account actually includes both species, but clearly a specimen of *T. aysoni* as recognized by Waite (1909) was the first examined and is the basis for the species. This specimen is shown in Plate XII, Fig. B. The other figures in Hamilton's paper refer to *T. tarakea*. The confusion of the two species rests in the absence of functional eyes and the form of other striking features which apparently detracted attention from the quite definite distinctions between the two. Both species are blind, shallow water, obviously benthic, and with quaintly modified pelvics; but *T. aysoni* is circular in outline, the margin of the disc is thin, and the claspers do not reach beyond the margin of the disc. *T. tarakea* has an ovoidal disc with a heavy thick rim, and the claspers are visible in dorsal view. Other features common to both species, and not men-

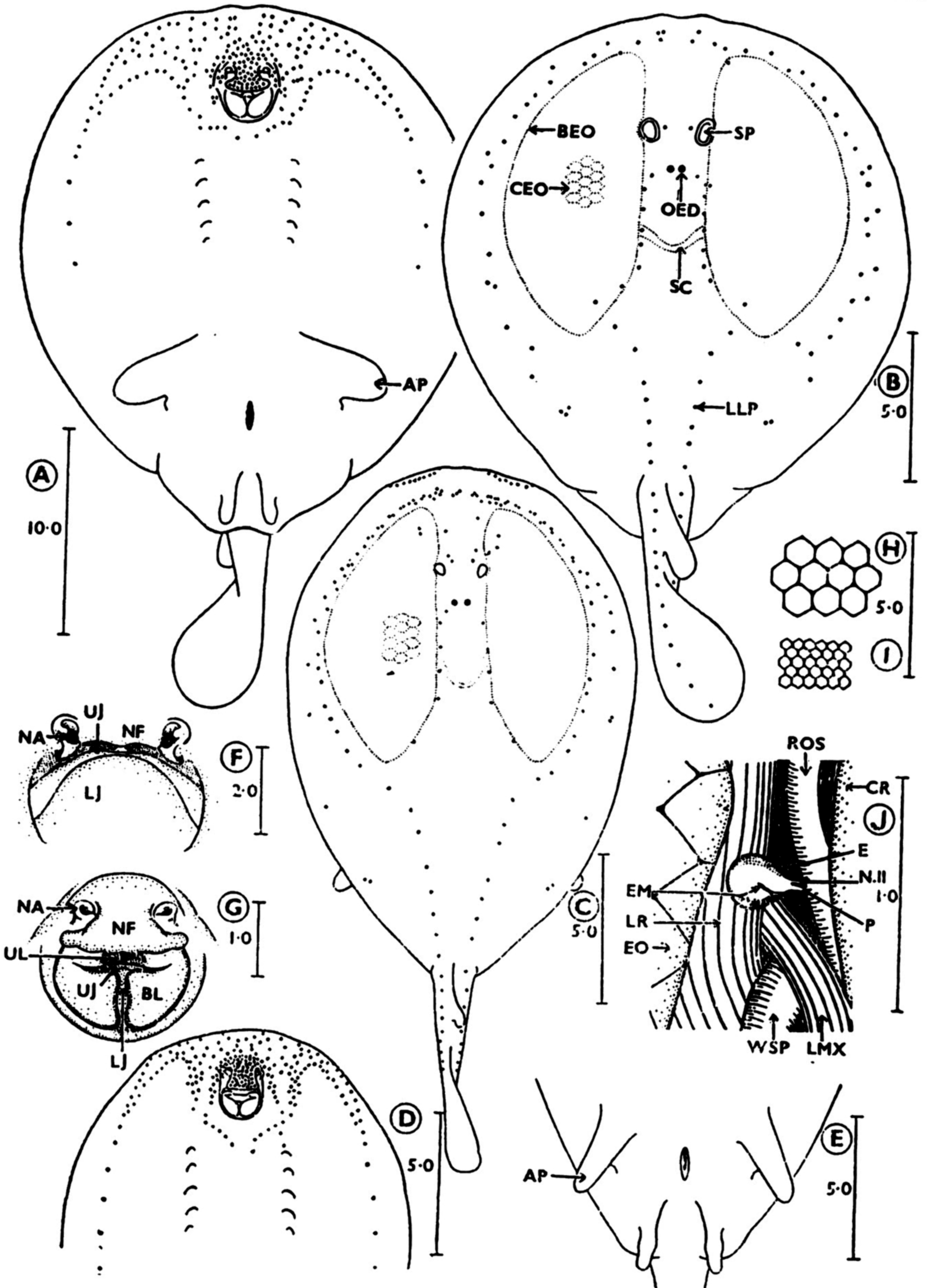
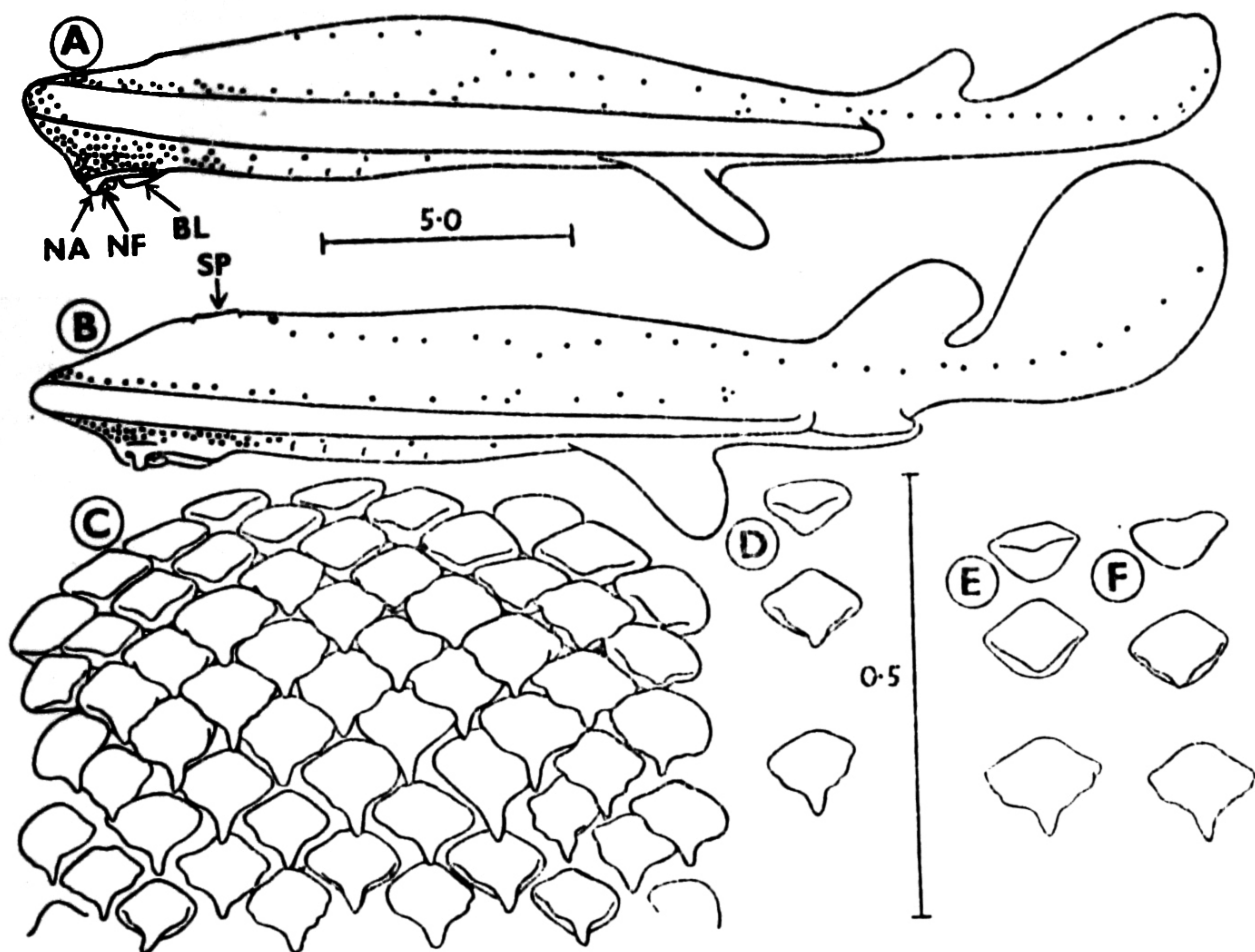


PLATE 1 (scale in cm.)

A: *T. aysoni*, ventral view. B: *T. aysoni*, dorsal view. C: *T. tarakea*, dorsal view. D, E: *T. tarakea*, ventral views. F: *Torpedo fairchildi*, mouth and nostrils. G: *T. aysoni*, mouth and nostrils. H: *T. aysoni*, columns of electric organ in dorsal view. I: *Torpedo fairchildi*, columns of electric organ in dorsal view. J: *T. tarakea*, superficial dissection of dorsal surface of head region on left side, to show reduced eye.



TEXT-FIGURE 1 (scale in cm.)

A: *T. tarakea*, lateral view. B: *T. aysoni*, lateral view. C: *T. tarakea*, tooth plate, upper jaw. D: *T. tarakea*, median teeth of first, third, and fifth rows, lower jaw. E, F: *T. aysoni*, median teeth of first, third, and fifth rows, upper and lower jaws.

Abbreviations: AP, pelvic fin appendage. BEO, boundary of electric organ. BL, lower lip. CEO, column of electric organ. CR, neurocranium. E, eye-ball. EM, ocular muscles. EO, electric organ. LLP, lateral line pore. LJ, lower jaw. LMX, m. levator maxillae. LR, m. levator rostri. NA, naris. NF, nasal flap. N.H., optic tract. OED, opening of the endolymphatic duct. P, pedicel. ROS, r. ophthalmicus superficialis. SC, dorsal extension of the scapula. SP, spiracle. UJ, upper jaw. UL, Upper lip. WSP, anterior wall of spiracle.

tioned by Waite in his generic description, are: the rostral cartilage, short and reduced to a median portion only; the anterior edge of the disc supported by greatly enlarged preorbital cartilages; the cranium lacks a formed orbit; the pectoral girdle extends as a complete ring around the vertebral column; on each side of the head there is a large electric organ, bounded medially by the trunk muscles and laterally by the propterygial elements; the columns forming the electric organ are very large, there being only 180 to 200 columns in each organ (*Torpedo marmorata* has about 450 columns per organ). Waite (1909) and Phillipps (1929) state that the eye is lacking in *Typhlonarke* though an optic nerve persists. Dissection of a number of specimens of both *T. aysoni* and *T. tarakea* shows (Plate 1, Fig. J) that the eye and optic nerve are present in both species, though the eye is not visible externally, being some 2.0 mm. under the surface of the skin in the subcutaneous fascia. Very delicate fibres inserted on the eyeball apparently represent vestiges of the ocular muscles.

Typhlonarke Waite 1909.

Disc sub-circular, its outline broken only by a notch under the tail. Eyes not discernible. Spiracles with entire edges. Tail short, with a slight lateral fold. Dorsal fin single. Anterior portion of ventrals modified for walking; posterior portion coalesced with the pectorals to form the hinder margin of the disc. Teeth confined to the anterior portion of the jaws, pavement-like, the hinder series with sharp cusps. Body naked.

Typhlonarke aysoni (Hamilton) 1902. (Pl. 1, Figs. A, B, G, I. Text Figs. B, E, F.)

Study material.—Male 354 mm. T.L., female 244 mm. T.L. Collected by trawl from Cook Strait area.

Description.—Body greatly depressed, almost circular. Skin smooth, lacking dermal denticles. Length of disc 1.4 in the total length. Greatest width of disc at level of the last gill-slit; 1.6 in the total length. Greatest depth of body at the pectoral symphysis, 8.0 in the total length. Disc very much thinner peripherally. Caudal peduncle stout and slightly compressed.

Distance from anterior edge of disc to spiracles slightly more than depth of the body. Spiracles irregularly oval, their long axes directed outwards anteriorly. Margins of the spiracles produced into a definite rim. Eyes not visible externally, though a white patch anterior to each spiracle indicates their approximate position. Eyes very small, lying 1.0 mm. to 2.0 mm. below the surface of the skin. Gill-slits small, crescentic. Distance from anterior edge of disc to first gill-slit, 4.5 in the total length. Distance between first and second slits slightly greater than that between fourth and fifth and less than that between second and third or third and fourth. Nostrils fairly closely set, their posterior valves expanded and curled round, forming a nearly complete tube. Anterior nasal valves confluent as a fleshy nasal flap expanded distally and secured between the nostrils by a thick median septum, so that its wider free end almost covers the mouth. The extension of the nostrils and nasal flap makes a distinct step in the profile. Mouth small, slightly curved, and deeply inset, almost hidden externally by the nasal flap and the greatly enlarged, deeply incised lower lips. Teeth arranged in mosaic, varying from 10/10 to 12/12 per row. The tooth plates very narrow, extending across the median part of the jaws with four to five rows of teeth functional. Teeth in the posterior rows each with a single median cusp, long and sharply pointed, directed posteriorly. Anterior teeth with cusps eroded; cusps almost lacking in the first row.

Dorsal fin originating above the posterior insertion of the pectoral fin. Rectangular in shape, its height 1.5 in its basis and 2.0 in the distance from anterior edge of disc to spiracles. Posterior edge rounded and extending behind the posterior insertion of the fin. Origin of caudal just anterior to the posterior edge of the dorsal, its height slightly less than its length, outline subcircular. Pectorals completely fused into the body, their margins smoothly curved. Paired electric organs present, reniform in shape, extending from midway between the anterior edge of disc and the eyes, to midway between the pectoral and pelvic symphyses. The greatest width of each organ equal to little more than one-fourth the width of the disc. Origin of pelvics not quite half of total length, from anterior edge of disc. Anterior portion of each pelvic free, and produced into a broad flat appendage which when appressed is directed obtusely to the long axis of the body. Width of the appendage about 2.5 in its length. Posterior portion of the pelvic fused with the pectoral as an extension of the disc without any notch between it and the pectoral, though there is a short thick web separating them. Lateral margin smoothly rounded and a slight notch at the posterior insertion. Claspers small

and somewhat flattened, not reaching to the posterior edge of the pelvics. Length of the claspers 1.8 in the length of appendage of the pelvic, and width 3.0 in the width of the same appendage. Cloacal aperture opposite the posterior insertion of the appendages of the pelvics.

Colour.—Upper surface brown, darker posteriorly. Under surface creamy-brown. Underside of pelvic fin appendage almost white.

Size.—Most specimens taken are under 400 mm. in total length, though Whitley (1940) states that Graham records one about 900 mm. wide, so that this must have exceeded 1100 mm. in total length.

Distribution.—Foveaux Strait; the coast of Otago; Cook Strait; 28 to 102 fathoms.

References and Synonymy.—*Astrape aysoni* Hamilton, A. (1902), Trans.N.Z. Inst., 34, p. 224, Pl. XII Fig. b (Pls. X, XI, and XII Fig. a are referable to *T. tarakea*). *Typhlonarke aysoni*: Waite, E. R. (1909), Rec.Cant.Mus., 1, No. 2, p. 146, Pl. XVIII; Phillipps, W. J. (1929), N.Z.J.Sci.& Tech., 11, No. 2, p. 100, Fig. 2; Whitley, G. P. (1940), Fishes of Australia, Part 1, p. 163, Fig. 184; Fowler, H. W. (1941), U.S.Nat.Mus.Bull., 100, vol. XIII, p. 353.

Typhlonarke tarakea Phillipps 1929. (Pl. 1, Figs. C, D, E, J. Text Figs. A, C, D.)

Study Material.—Male 266 mm. T.L., female 244 mm. T.L., female 206 mm. T.L. Collected by trawl from Cook Strait area.

Description.—Body greatly depressed, ovate in outline, tapering towards the peduncle. Skin smooth, lacking dermal denticles. Length of disc 1.4 in total length. Greatest width of disc at the level of the last two gill-slits, 2.0 in total length. Greatest depth of body at level of the last gill-slit, 7.5 in total length. Disc thinner peripherally but with a thick margin which is about 3.0 in the depth of the body. Caudal peduncle stout, slightly compressed.

Distance from anterior edge of disc to spiracles almost equal to the depth of body. Spiracles oval, their long axes directed outwards anteriorly. Eyes not visible externally, though a white patch anterior to each spiracle indicates their approximate position. Eyes very small, lying 2.0 mm. to 3.0 mm. below the surface of the skin in the subcutaneous fascia. Gill-slits small, crescentic. The first and fifth slits smaller than the others. Distance between first and second slits equal to that between fourth and fifth, and three-quarters to four-fifths of that between second and third or third and fourth. Nostrils very closely set, their posterior valves expanded and curled round, forming a nearly complete tube. Anterior nasal valves confluent as a fleshy nasal flap, slightly expanded distally and secured between the nostrils by a thick median septum, so that its wider free end almost covers the mouth. The extension of the nostrils and nasal flap makes a distinct step in the profile. Mouth small, slightly curved, and deeply inset, almost hidden externally by the nasal flap and the greatly enlarged, deeply incised lower lips. Teeth arranged in mosaic, 11/11 per row. Tooth plates very narrow, extending across the median part of the jaws, with four to five rows teeth functional. Teeth in the posterior rows each with a single median cusp, long and sharply pointed, directed posteriorly. Anterior teeth with cusps eroded so that in the first row cusps are almost lacking.

One small dorsal fin originating slightly anterior to the posterior edge of the pelvics. Posterior edge rounded, extending behind the posterior insertion of the fin. Height of the fin 2.0 in its basis and 3.5 in the distance from anterior edge of disc to spiracles. Origin of the caudal just behind the posterior edge of the dorsal.

Outline rounded except for two small indentations, one dorsal, the other posterior. Height of fin 1.5 to 1.8 in its length. Pectorals very thick, fused into the body so that the margin is a smooth curve. Paired electric organs present, reniform in shape, extending from midway between anterior edge of disc and eyes, back to the pelvic symphysis. The greatest width of each organ slightly less than one-third the width of the disc. Origin of pelvics not quite half of total length, from anterior edge of disc. Pelvics free anteriorly where they are produced into long finger-like appendages, which when appressed are directed acutely to the long axis of the body. Length of each appendage equal to distance from anterior edge of the disc to spiracles, width about 3.0 in their length. The posterior portions of the pelvics completely fused on to and extending the disc, but with no notch between them and the pectorals. Claspers rod-like, extending behind the posterior edge of the pelvics. Width of the claspers 2.0 in width of the appendage of the pelvic, and length 1.5 in the length of the same appendage. Cloacal aperture opposite the posterior insertion of the pelvic fin appendages.

Colour.—Brownish-black above. Periphery of disc and ventral surface light brown. Lips, nostrils, and lower surfaces of the free parts of the pelvics, white. Cloacal aperture and openings of the endolymphatic ducts ringed with white.

Size.—Most specimens taken are under 300 mm. in total length, though a specimen 362 mm. long was trawled off Otago Heads (Hamilton, 1902).

Distribution.—Otago Heads; Cook Strait; down to 130 fathoms.

References and Synonymy.—*Astrape aysoni* Hamilton, A. (1902), Trans.N.Z. Inst., 34, Pls. X, XI, and XII Fig. a (*T. tarakca*, not *T. aysoni*). *Typhlonarke tarakca* Phillipps, W. J. (1929), N.Z.J.Sci.& Tech., 11, p. 101, Fig. 3. Whitley, G. P. (1940), Fishes of Australia, Part 1, p. 163, Fig. 185; Phillipps, W. J. (1949), Trans.Roy.Soc.N.Z., vol. 77, p. 289.