Studies on New Zealand Elasmobranchii. Part XIII

A New Species of Raja from 1,300 Fathoms *

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Abstract

A new species of *Raja* based on a mature female from Cook Strait completely lacks large thorns but is uniformly covered above and below with minute spine-like denticles; the head is broad (least fleshy interorbital distance 2.5 in width of disc at same level); tail short (half the disc-length), teeth raptorial, and colour light grey above and below but with some white markings on the lower surface.

BIOLOGICAL investigations of Cook Strait by the Department of Zoology, Victoria University of Wellington, have included the use of long-lines in deep water. Most of the fishing has been in 200 to 800 fathoms, but on two occasions lines were set in 1,300 fathoms in the region south of Cape Palliser. The lines used on these two attempts had 100 hooks each on the groundline, which was weighted to keep all the hooks on the bottom. A small funnel-entranced, baited fish-trap was also attached to one end of the groundline. On the first occasion the line was set about equal numbers of mackerel and squid baits were used, but no fish were taken although the mackerel baits were mostly eaten. The second attempt was made on the following day (March 31, 1956) a few miles further south; only mackerel baits were used. This line when hauled had only one fish on the hooks, a large female skate about 38 inches wide, but there was also a second fish, a gyrinomimid, in the trap as well as some invertebrates. The large skate proves to be a new species, and is the subject of the account below.

Although the new skate has several strikingly distinctive features, it fits clearly into the genus *Raja* on the following characters: disc rhomboid with a firm, continuous, rostral cartilage reaching to tip of snout; tips of anterior pectoral rays reaching only 83% of distance from level of anterior margin of eye to tip of snout; pectoral fin overlapping pelvic, and with a distinct inner posterior margin; pelvic fin bilobed, but the anterior lobe not an elongate, separate, finger-like process as in *Cruriraja*; tail with a narrow ventrolateral fold along each side, and two dorsal fins; disc and tail covered with dermal denticles. The tip of the tail of the specimen is missing and the second dorsal fin is incomplete (Text-fig. 1, H), but what remains does not suggest any novelty in the second dorsal or caudal fins.

The most unusual feature of the specimen is a total lack of the large, usually recurved thorns which are characteristic of nearly all other skates, and generally found in one or more rows on the tail, and very often on the upper surface of the disc in the orbital, nuchal and scapular regions. Although no such thorns are present in my specimen, the upper and lower surfaces of the disc are uniformly covered with minute, stellate-based, spine-like, dermal denticles (Text-fig. 1, I), spaced to give the skin a loosely granular texture in appearance and to the touch. These denticles are uniform in size, and are the only expression of the dermal skeleton on the disc. The tail is similarly covered above and below with denticles, but is also provided with a middorsal row of ovoid cutaneous structures, scarcely raised from

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the surface, and somewhat scar-like in appearance. Some of these ovoid structures have at their centres a small, low, mound-like tubercle (Text-fig. 1, G), but the others lack hard parts except that all carry dermal denticles like those elsewhere on the tail, though somewhat larger and more widely spaced.

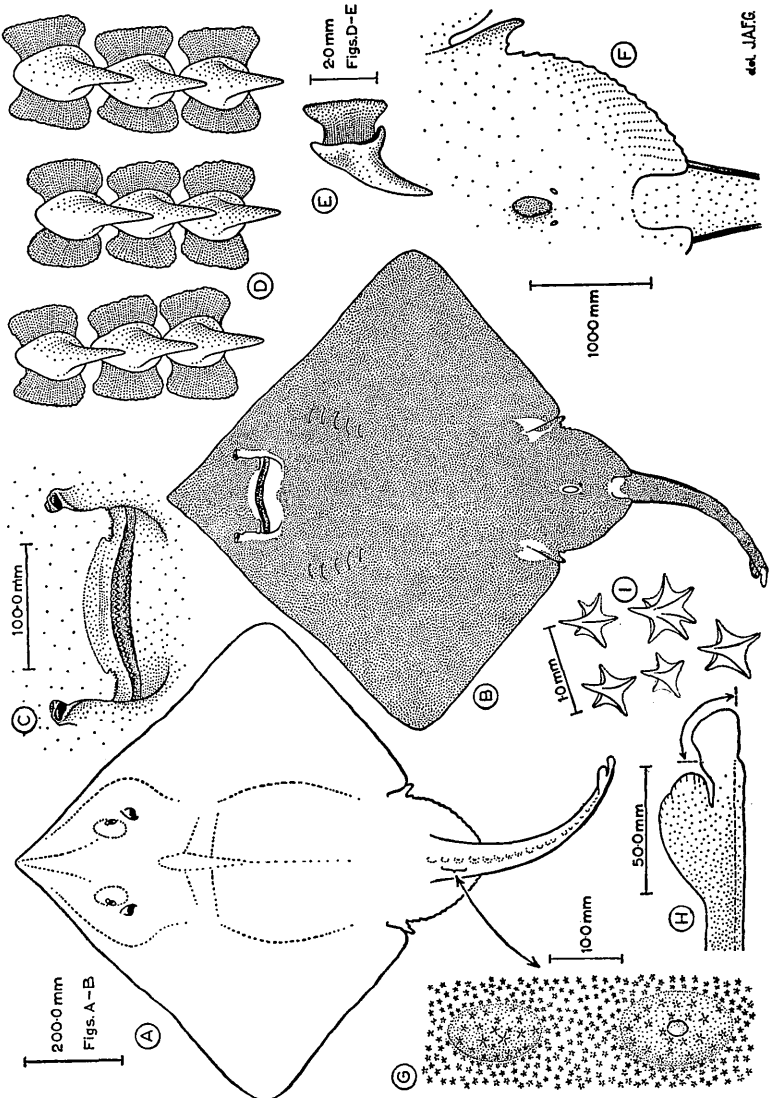
Other notable features of the Palliser specimen are its relatively broad interorbital region and mouth, its teeth, its short tail, and its colour. The least fleshy interorbital distance is equal to the width of mouth, 2.5 in the width of disc at the same level, and 6.3 in the greatest width of disc. Comparable figures for 34 species of *Raja* from New Zealand, Japan and Western North Atlantic show ranges of 3.0–5.5 (aver. 4.2) and 6.0–10.0 (aver. 8.1) for the least fleshy interorbital in width of disc at same level and in greatest width respectively. The teeth are strongly raptorial, relatively few in number $\frac{14\text{-}1\text{-}16}{14\text{-}1\text{-}13}$ and hence well-spaced in the wide mouth, and arranged more nearly in transverse rows than in quincunx. The tail measured from centre of cloaca to origin of 1st dorsal fin is only half the length of disc measured from the snout tip to centre of cloaca. The colour of the specimen in life was uniform pale grey above, slightly darker grey on the posterior pectoral margins, on the undersurface of the disc and on the tail. On the undersurface small but conspicuous white areas border the mouth and nasal flap, the gill-openings and cloaca, and are at the origin of the pelvic fin, and at the base and tip of tail.

There is no danger of confusion between the Palliser specimen and the two species of *Raja* previously recorded from New Zealand—viz., *R. nasuta* Muller and Henle, 1841, and *R. lemprieri* Richardson, 1846, since both these latter species have strong tail thorns and some thorns on the disc; virtually smooth undersurfaces; narrower interorbits and mouths (least fleshy interorbital distance about 5.2 in the width of disc at the same level in *R. nasuta*, 3.5 in *R. lemprieri*); and are dark brown or grey above but white or mottled white below.

The nine species of *Raja* recorded by Bigelow and Schroeder (1953, p. 145) as occurring in depths of 800 fathoms or greater (five of them deeper than 1,000 fathoms, and the deepest from 1588 fathoms) are similarly readily separable from the Palliser specimen, for excepting *R. mollis* Bigelow and Schroeder, 1950, all have thorny tails* as well as differing in other respects. *R. mollis*, known only from a juvenile male off Nova Scotia, lacks obvious tail thorns but does have a few orbital, nuchal and scapular thorns on the disc. It is also narrow across the head (least fleshy interorbital distance 5.6 in the width of disc at same level—2.5 in the Palliser specimen); long-tailed (distance from centre of cloaca to 1st dorsal origin about equal to distance from snout tip to centre of cloaca—only half the latter distance in the Palliser specimen); and free of denticles on the lower surface of disc.

More than 110 species of *Raja* are known throughout the world from depths shallower than 800 fathoms, but of these only *R. spinacidermis* Barnard, 1923 and *R. ogilbyi* Whitley, 1939, resemble the Palliser specimen in lacking or apparently lacking tail thorns. Even apart from this character, most of the species can be distinguished from the Palliser specimen by their narrower heads, smooth or relatively smooth ventral surfaces, and colour patterns. *R. spinacidermis*, recorded only from the type, a 600 mm female taken off South Africa, comes closest to the Palliser specimen in a total lack of thorns, and in having the upper surface of the disc, and most of the tail covered with small dermal denticles. These denticles are described by Barnard (1923, p. 440) as "closely set fine setiform spinules", which does not agree with those of the Palliser specimen, and are largely absent from the lower surface of the disc. In the Palliser specimen there is almost as complete a covering on the lower surface as on the upper. Other differences which leave no doubt of

* An unidentified skate observed from the Bathyscaphe F.R.N.S. III at a depth of 2,200 metres off the coast of Portugal likewise had thorns on the tail (*Bull. L'Inst. Oceanogr. Monaco.* No. 1092, 1957).



Text-fig. 1.—*Raja richardsoni* n.sp., type, female 1331 mm long. Fig. A—Dorsal view. Fig. B—Ventral view, stippled to show colour pattern. Fig. C—Mouth, nostrils and nasal flap. Fig. D—Upper teeth, right side. Fig. E—Lateral view of upper tooth. Fig. F—Left pelvic fin. Fig. G—Skin from middorsum of tail showing two of the ovoid cutaneous structures. The lower of the two has a small, low, mound-like tubercle at its centre. Fig. H—Tip of tail showing 1st dorsal fin and damaged 2nd dorsal. Arrows show extent of damaged area. Fig. I— Denticles from dorsal surface of disc.

the specific distinction of the Palliser specimen are in the width of head (least fleshy interorbital distance about 5.7 in width of disc at same level in *R. spinacidermis* but only 2.5 in the Palliser specimen) and the teeth (60 in *R. spinacidermis*, $\frac{31}{28}$ in the Palliser specimen of twice the size of Barnard's specimen).

R. ogilbyi of New South Wales, Australia, based on the skin of a large female with the tail missing is described (Whitley, 1939, p. 251) as having "Whole of top and bottom of disc with spaced spines making the skin very rough", which rather agrees with the Palliser specimen. However, it has "one or two enlarged spines on middle of back between ventral fins" which are not on the Palliser specimen, and which may have been continued on the tail. In a later account, Whitley (1940, p. 186) also identifies as *R. ogilbyi* a small female from South Australia having three rows of tail thorns; if this specimen is in fact *R. ogilbyi*, the distinction of the Palliser specimen is obvious. Other features which establish the type of *R. ogilbyi* as separate from the Palliser specimen are: a narrower head in *R. ogilbyi* (least fleshy interorbital distance about 4.0 in width of disc at same level or 1.6 in snout length measured to eye, compared with 2.5 and 1.3 respectively in the Palliser specimen); disc with a more sinuous anterior margin and a more convex posterior margin in *R. ogilbyi*; a greater number of teeth ($\frac{46}{40}$ as against $\frac{31}{28}$ in the Palliser specimen) and these with much shorter cusps; and colour (dark reddish brown above, lighter below in *R. ogilbyi* but light grey above and below in the Palliser specimen).

On the basis of the above I have no hesitation in naming the Palliser specimen as a new species, with particular reference to its lack of thorns, uniform covering of denticles above and below the disc and tail, broadness of head, and its colour including the pattern on its lower surface. I name the species *Raja richardsoni* in honour of Professor L. R. Richardson of this department, for his extensive contribution to deep water research in New Zealand, and especially in Cook Strait where the type specimen was taken.

Raja richardsoni n.s. Text-fig. 1, A-I.

STUDY MATERIAL: Female 1331 mm long, type (V.U.W. Coll., Dom. Mus. No. 1898) lined from 1,300 fathoms, south of Cape Palliser, Cook Strait (47° 7′ S., 174° 57′ E.) on March 31, 1956.

DESCRIPTION.

Proportional dimensions in per cent of total length. Since the tip of the tail including part of the 2nd dorsal fin, is missing, the total length used here is an approximation; the 2nd dorsal fin is regarded as being of the same size as the 1st, and no allowance is made for a caudal fin; this gives an estimated total length of 1354 mm.

Disc: extreme breadth 70.8
length (not incl. pelvics) 59.5
Snout length in front of: eye 13.6
mouth 14.0
Eye: horizontal diameter 1.7
least fleshy distance between 11.2
Spiracle: length 2.2
distance between 12.9
Mouth: breadth 11.4
Nostrils: distance between inner ends 10.9
Gill-openings: lengths; 1st 1.9
3rd 2.2
5th 1.8
distance between inner ends; 1st 21.4
5th 16.6
1st dorsal fin: vertical height 1.5
length of base 2.9
2nd dorsal fin: (damaged)

Pelvic: anterior margin 6.3
Distance from: snout tip to centre of cloaca 61.8
centre of cloaca to 1st dorsal origin 30.6
Interspace between: 1st dorsal base and 2nd dorsal origin 0.7

Disc thick, about $\frac{1}{8}$ its length, rhomboid, broader than long, its length 1.2 in its breadth; *maximum anterior angle in front of spiracles* about 90°; tip of snout only slightly blunted; anterior margin rather sinuous, weakly concave near snout tip, slightly bulging lateral to eye and spiracle, then broadly concave before reaching the lateral corner where it is weakly convex; lateral corner abruptly rounded; posterior outer margin nearly straight; posterior corner subangular; posterior inner margin short, its length about 3.5 in the snout measured to eye. Pelvic fin divisible into a noticeably short, finger-like anterior lobe and a large posterior lobe. Tail very short, its length from centre of cloaca to 1st dorsal origin 50% of distance from centre of cloaca to tip of snout. Tail tapered, flat below, rounded above, almost twice as wide as deep anteriorly, but scarcely wider than deep posteriorly. Width of tail at posterior tip of pelvics 3.0 in snout measured to eye; width of tail at 1st dorsal origin 9.0 in snout. Tip of tail, including posterior part of 2nd dorsal fin is missing in the specimen. Tail with a narrow ventrolateral fold along each side from the insertion of the pelvic base rearwards to the middle of the 2nd dorsal base; the folds are visible from above only in the posterior $\frac{1}{3}$ of the tail where each fold is 3.5 mm wide; anteriorly each fold is scarcely more than 1 mm wide.

Disc above and below, and tail, more or less uniformly covered with small, close-set dermal denticles in the form of low, erect spines with stellate bases. The lips, the distal margins of the fins, and the extreme tip of the tail are the only smooth regions. On the ventral surface, the denticles are somewhat sparser than they are dorsally. On the tail there is a mid-dorsal row of spaced oval structures, scarcely raised from the surface; these are formed of skin, though some of them also have a small central mount-like tubercle of enamel, and all are sparsely covered with larger dermal denticles than elsewhere on the tail.

Snout measured to eye 1.2 times as great as the least fleshy inter-orbital distance, and just less than the preoral length. Least fleshy interorbital distance 6.3 in breadth of disc. Preoral length 1.3 times as great as distance between exposed inner ends of nostrils. Eye about twice as long as high, its length 6.7 in least fleshy interorbital distance. Spiracle oblique, ovoid, its length slightly more than horizontal diameter of eye. First gill-openings posterior to mouth by a distance just greater than half the preoral length. Distance between 1st gill-openings almost 1.3 times as great as that between 5th gill-openings, and about twice as great as distance between exposed inner ends of nostrils. First gill-opening 1.2 times as long as 3rd, subequal to 5th, and about $\frac{1}{2}$ as long as breadth of mouth. Nasal flap with a distinct lobe at each posterolateral corner, the lobes with several short, pointed processes. Outer margin of each nostril smooth. Mouth slightly arched, broad, its width 1.2 in the preoral distance and 6.2 in breadth of disc. A maxillary velum present, its hind edge sinuous and fimbriated.

Teeth $\frac{14\text{–}1\text{–}16}{14\text{–}1\text{–}13}$, each with a long, sharply pointed, conical cusp arising from a longitudinally oval plate on the surface of the dental membrane; in a dried preparation the oval plate can be seen as the external end of a stout pedicle, the latter borne on an irregular, wide, dumb-bell shaped base set deeply in the dental membrane. Teeth loosely spaced and arranged more nearly in transverse rows than in quincunx. Two to three rows of teeth functional in each jaw.

First dorsal brush-shaped but with rounded corners, its height 1.8 in its base and equal to the width of tail at the same level. Interspace between 1st and 2nd dorsals 4.0 in length of 1st dorsal base. Second dorsal apparently similar to 1st, judging by what remains of it. Pelvics strongly divided laterally to form a short anterior lobe and a large posterior lobe. Anterior lobe finger-like, tapered, subcircular in section; its anterior margin poorly defined but at least twice as long as the posterior margin; while the latter is only about $\frac{1}{7}$ the length of outer margin of posterior lobe. Posterior lobe large, its outer margin strongly convex and serrated or scalloped due to projecting radial cartilages: rear tip of posterior lobe subangular; inner margin short, its length about $\frac{1}{3}$ the width of tail at the same level.

Anterior rays of pectorals extending forward 83% of distance from level of anterior margin of eye to tip of snout. Median rostral cartilage extending forward to tip of snout.

Colour: In life, light grey above, slightly darker grey on the posterior pectoral margins, on the lower surface of the disc and on the tail; small but conspicuous white areas bordering the mouth, nasal flap, gill-openings and cloaca, at the origin and insertion of the pelvic fin, and at the tip of the tail; iris grey-blue, pupil light translucent green; inside of mouth white. In formalin the specimen is slightly brownish-grey.

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