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commences a little behind the posterior half of the pectoral, and the length of its base is two and one-fifth in the total length; the anterior rays are short and gradually increase in length to the twelfth which, with the thirteenth and fourteenth, is the longest in the fin, and about one-seventh longer than the snout; behind these the rays become abruptly shorter, so that the outer margin of the fin is concave behind them, and the posterior two or three rays appear to be distinctly elongated, the last being about equal to the eighteenth: the anal commences beneath the middle dorsal ray, and its shape is similar to that of the dorsal, the base of which is exactly twice the length of its base; the fifth ray is the longest, and is but a fraction shorter than the longest dorsal ray, while the distance between the base of the first ray and the origin of the caudal is contained one and one-fourth times in that between the same point and the extremity of the snout: the pectoral is small and rather pointed, the fourth to seventh rays the longest, two and one-seventh in the length of the head: ventrals small, equal in length to the snout: caudal deeply emarginate. Scales very small, each one pierced by a small, central, circular pore; opercle, sub- and inter-opercle scaly, the scales being of equal size to those on the body; rest of the head naked, covered with a thick and densely porous skin; vertical fins scaly over about two-thirds of their height. Lateral line forming a long curve to beneath the longest dorsal rays.

Colors.—Uniform brown, darkest above; the sides of the head washed with dull blue; the fins and opercles with gold.

Type.—In the Australian Museum.

The Australian Museum also possesses a specimen of *Pteraclis velifer*, a species previously unrecorded from New Zealand.

REVIEW OF THE GENUS *SCHEDOPHILUS*, COCCO,
AND ITS ALLIES.

BY J. DOUGLAS OGILBY.

The present paper was suggested by the occurrence on the coast of New South Wales of a specimen of *Schedophilus maculatus*, this being the first record for the genus from Australian waters, and the time has been deemed opportune to review the history, such as it is, of the various species, the more especially that these pelagic forms are liable to occur at any time upon any part of the

Australian coast, and, where so little is known of them, it is advisable that no opportunity should be lost of recording any fresh facts in connection with their distribution and mode of life.

The genus *Schedophilus* was originally placed by Günther among the *Coryphænina*, at that time considered to be a Group of the *Scombridæ*, but subsequently accorded family rank. The discovery, however, off the Pacific coast of North America of two closely allied forms, induced Professors Jordan and Gilbert to remove these fishes, respectively known as *Icosteus enigmaticus* and *Leicithys lockingtoni* to a separate family, for which they proposed the name *Icosteidæ*, and in which was included the *Bathymaster* of Cope, a genus which differs in a much greater degree from the typical *Icosteus* than does *Icosteus* from a typical *Schedophilus*, which latter genus is apparently omitted entirely from the family; the words of those authors, after diagnosing the *Icosteidæ*, being: "This group, as at present constituted, is composed of three very diverse genera, each of a single species, inhabiting the deeper waters of the North Pacific. It is probably most nearly related to the *Malacanthidæ*, from which it is distinguished by the presence of pyloric cæca, and by the non-labrid dentition."*

The formation of a new family for these fishes, and the consequent disruption of his *Coryphænidæ*, does not meet with Dr. Günther's approval, and he further holds that the splitting up of Cocco's genus is distinctly untenable; he remarks: "I fail to find in the description (of *S. lockingtoni*) characters which would warrant a generic separation from *Schedophilus*, or the creation of a distinct family *Icosteidæ*."† With the latter part of this opinion we are entirely in accord, for we cannot consider that such characters as the dentition and the absence of pseudobranchiæ, however useful in separating genera, can with propriety be applied to the differentiation of families.

With reference to the generic distinctions pointed out by Lockington, Jordan, and Gilbert, we cannot, however, so readily give in our adherence to Dr. Günther's views; such characters as the presence or absence of scales, of groups of epidermal spines, and of an airbladder‡ being of sufficient importance to make us hesitate before declining to accept the genera *Icosteus* and *Leicithys* proposed by the American ichthyologists. In this communication we shall, however, include all the known species under the common term *Schedophilus*, using the other names as signifying

* Synopsis, p. 619.

† Voy. Challenger, xxii. p. 46.

‡ This is apparently of less importance, and is of course well known in the true Mackerels.

natural subdivisions of the genus, which, when our knowledge of these pelagic forms is more thorough, may or may not be raised to full generic rank.

SCHEDOPHILUS.*

Schedophilus, Cocco, Giorn. Innom. Mess. Ann. iii. 1829.

Crius, sp. Valenc. in Webb & Berthel. Iles Canar. Poiss. p. 45, 1836.

Icosteus, Lockington, Proc. US. Nat. Mus. ii. p. 63, 1880.

Icichthys, Jordan & Gilbert, Proc. US. Nat. Mus. ii. p. 305, 1880.

Schedophilopsis, Steindachner, SB. Ak. Wien, lxxxvi. p. 82, 1882.

Branchiostegals six or seven : pseudobranchiæ present. Body oblong-ovate or ovate, strongly compressed. Cleft of mouth moderate. Preopercle spiniferous. A single series of small teeth in the jaws : vomer, palatines, and tongue edentulous. One dorsal fin, extending nearly along the whole back, formed by flexible rays, the anterior of which are more or less simple : anal similarly formed : ventrals thoracic, with one spine and four or five rays. Scales small and cyclid, or absent ; vertical fins with a basal scaly sheath. Airbladder present or absent.

Geographical Distribution.—Mediterranean ; tropical and subtropical parts of the Atlantic and Pacific Oceans ; not as yet recorded from the Indian Ocean, nor from the East Coast of America.

Synopsis of the species.

- A. Scales small ; branchiostegals seven ; ventral fins with five soft rays (ICICHTHYS)
 - a. Scales striated ; dorsal commencing above the margin of the opercle *I. maculatus*.
 - aa. Scales smooth.
 - b. Dorsal commencing behind the head.....*I. lockingtoni*.
 Dorsal commencing above the vertical margin of the preopercle*I. bertheloti*.

* Agassiz gives, as the derivation of Cocco's generic name, $\sigma\chi\acute{\epsilon}\delta\eta$, *scheda*, and $\phi\acute{\iota}\lambda\omicron\varsigma$, *amicus*. The former of these words means a leaf or tablet, and has therefore no significance in connection with the fish ; if, however, the name be derived from $\sigma\chi\acute{\epsilon}\delta\acute{\iota}\alpha$, the meaning of which is a raft or float, a recognised habit of the young *Schedophilii* would be felicitously expressed.

- B. Scales minute; branchiostegals six or seven. (SCHEDOPHILUS)
 a. Lateral line smooth; ventral fins with five soft rays, inserted in front of the base of the pectorals.....*S. medusophagus*.
- C. Scales absent; branchiostegals six.....(ICOSTEUS).
 a. Lateral line armed with groups of small spines; ventral fins with four soft rays, inserted behind the base of the pectorals.....*I. enigmaticus*.

In the above synopsis I have been obliged to place *S. bertheloti* along with *S. lockingtoni* and *S. maculatus*, because of the comparatively large size of the scales—as shown in Dr. Steindachner's figure—in comparison with those of *S. medusophagus*, as portrayed in Dr. Günther's figure, and as were present, if my memory serve me, in my Irish example of that species.

SCHEDOPHILUS MACULATUS.

Schedophilus maculatus, Gnth. Catal. Fish. ii. p. 412, 1860, and Journ. Mus. Godeffr. Fisch. p. 148, 1876.

Schedophilus marmoratus, Kner, SB. Ak. Wien, liv. p. 366, 1866.

B. vii. D. 9/27. A. 3/23. V. 1/5. P. 19. C. 17. L. lat. 105. L. tr. 22/47.

Length of head equal to its height at the hinder margin of the orbit, and 3.33 in the total length (without caudal); height of body 2.20 in the same. Eye large, with the supraorbital ridge well developed and overhanging, its diameter 3.10 in the length of the head, and equal to the interorbital space, which is almost flat; snout very short and obtuse, its length 1.50 in the diameter of the eye. Jaws equal: cleft of mouth moderate and oblique, the maxilla reaching to the vertical from the middle of the eye. Upper profile of the head rising almost vertically from the premaxillaries, thence sloping to the occiput, which, with the nape, is strongly convex, and compressed into a moderately sharp ridge. Both limbs of the preopercle armed with strong spines, those at the angle being the longest, and having their extreme tips curved upwards; those on the vertical limb straight, but directed dorsally: sub and interopercles spiniferous, the spines of the latter more strongly developed. Body oblong-ovate, and strongly compressed. A single series of small, rather distant, hooked teeth in the jaws. The dorsal fin commences above the margin of the bony opercle; its nine anterior rays are distinctly spinous; the last the highest, a little higher than the diameter of the eye; beyond the spinous portion the rays increase gradually in height to the middle of the fin, from whence they descend as gradually to the last, which is five sixths of the ninth spine, the outer

margin of the fin forming a gentle curve: the anal commences beneath the sixteenth dorsal ray, its origin being a little nearer to the tip of the snout than to the middle of the base of the caudal, and ends a trifle further back than the dorsal; its spines are stronger than those of that fin, the third the highest, two thirds of the dorsal spine: ventral well developed, inserted beneath the base of the pectoral, the second ray the longest, five sevenths of the distance between its origin and the vent, and five ninths of the length of the head; the spine is strong, equal in length to the third anal spine: pectoral rounded posteriorly, two thirds of the length of the head: the least height of the caudal peduncle is three fourths of its length. Scales small, cyclid, concentrically striated: cheeks, opercles, and occiput scaly; rest of head covered with a thick skin; a series of small pores surrounding the eye: bases of all the fins deeply scaly. Lateral line gently curved to beneath the posterior fourth of the dorsal fin, thence straight.

Colors.—Ground color pale yellowish brown, so densely covered with deep reddish brown blotches and bands, as to appear only as short, oblique or longitudinal stripes; dorsal fin with seven, anal with four blackish basal spots, which in the former are continued on to the rays above the basal sheath; in the latter are connected by a narrow band running along the outer margin of the sheath; caudal yellowish, with two large basal and three larger median dark brown spots.

Habitat.—Chinese Seas; South Seas; Coast of New South Wales.

The specimen from which the above description was taken, was obtained some years ago on Manly Beach by Mr. Henry Prince, and was, with his usual generosity, presented by him to the Australian Museum. Though washed ashore, it was in good condition, the only injury being a slight one to the tips of the caudal rays.

The length to the broken rays is three inches and a half.

SCHEDOPHILUS LOCKINGTONI.

*Icichthys** *lockingtoni*, Jordan & Gilbert, Synops. Fish. N. Am. p. 621, 1882.

Schedophilus lockingtoni, Gnth. Voy. Challenger, xxii. p. 46, 1887.

B. vii. D. 40. A. 28. V. 1/5. L. lat. 120. Cœc. pyl. 6.

Length of head 5.00, height of body 4.00 in the total length. Eye moderate, longer than the snout, its diameter 4.00 in the length of the head. Lower jaw prominent: cleft of mouth

* Derived from *έικω* to yield, and *ιχθύς* a fish, in allusion to the flexible skeleton.

moderate, slightly oblique, the maxilla, which is slender and scarcely widened at the tip, concealed beneath the preorbital, and extending to beyond the vertical from the front margin of the pupil. Upper profile of head slightly convex, the snout abruptly descending. Preopercle with radiating striæ, each of which terminates in a flexible point: opercle and subopercle crossed by similar striæ. Body oblong and somewhat compressed. Teeth in the jaws minute, sharp, closely and evenly set. The dorsal fin commences nearly midway between the vent and the origin of the ventrals; all the rays are soft and, with the exception of the first, branched; the anterior rays very low, the fin gradually rising posteriorly, the highest rays 3.00 in the length of the head: the anal fin commences slightly in front of the middle of the body, and ends just in front of the last dorsal ray: ventral short and small, inserted a little behind the pectorals, with one of the rays slightly filamentous, its length 3.00 in that of the head: pectorals rounded, small, not so long as the head: caudal broad and fan-shaped, the peduncle slender. Scales small, soft, and smooth, in one or two series on the preorbital.* None of the fin rays armed with spinules. Lateral line nearly straight, smooth. Airbladder wanting.

Colors.—Brown, paler below, somewhat punctulated.

Habitat.—Deep water off the coast of California.

Length seven inches and a half.

SCHEDOPHILUS BERTHELOTI.

Crius† *berthelotii*, Valenc. in Webb & Berthel. Iles Canar. Poiss. p. 45, pl. ix. f. 1, 1836.

Schedophilus berthelotii, Gnth. Catal. Fish. ii. p. 412, 1860.

Schedophilus botteri (Heck.) Steindachn. SB. Ak. Wien, 1868, lvii. p. 379, pl. ii. f. 2.

D. 36-38. A. 23-25. V. 1/5. P. 21. Cœc. pyl. 6.

Length of head‡ 3.75, height of body 3.00 in the total length. Eye large, its diameter 2.60 in the length of the head: snout short, but little more than half the diameter of the eye: interorbital space flat, 1.33 in the same. The maxilla extends to beneath the middle of the orbit. Snout very strongly convex; occiput convex; a shallow concave interspace. Preopercular teeth numerous, rather short,

* Other scales on the head, if any, lost on the typical example.

† From *κριός*, a ram.

‡ Calculated from Dr. Steindachner's description of a young example. I have not been able to consult Messrs. Webb & Berthelot's work, while Dr. Günther's notice, owing probably to the only specimen available to him being a half-grown skin, is valueless for comparison.

those on the vertical limb not (*according to Steindachner's figure*) directed upwards; the denticles of the interopercle moderately strong. Body oblong-ovate, compressed. Teeth in a single series, longer, less numerous, and blunter than in *S. medusophagus*, but similarly curved. The dorsal fin commences above the vertical margin of the preopercle: ventral well developed, inserted almost entirely in front of the base of the pectoral, and reaching as far as the first anal ray; its length 1.25 in that of the head. Scales small, cycloid.

Colors.—Body reddish violet, the head brownish; entire body sprinkled with numerous dark violet dots, the trunk having in addition ill defined blackish cross-bands, or band-like transverse spots, which extend on to the basal portion of the dorsal and anal fins; caudal with cross-bands posteriorly.

Habitat.—Canaries; coasts of Spain and Dalmatia.

SCHEDOPHILUS MEDUSOPHAGUS.

Schedophilus medusophagus, Cocco, Giorn. Innom. Mess. Ann. iii. No. 7, p. 57, 1829; Bonap. Faun. Ital. Pesc. c. fig.; Gnth. Catal. Fish. ii. p. 412, 1860, and Journ. Mus. Godeffr. Fisch. p. 149, 1876, and Trans. Zool. Soc. xi. p. 221, pl. xlvi. 1881; Steindachn. SB. Ak. Wien, 1868, lvii. p. 377; Lutken, Spol. Atlant. pp. 525, 602, pl. ii. fig. 9 (*juv.*) 1880; Gill, Science, i. p. 117, 1883; Day, Brit. Fish. ii. 1884, Add. p. 367 outline figure i. p. 120; Ogilby, Proc. Roy. Dub. Soc. p. 515, 1885.

B. vi.-vii. D. 45-50. A. 27-29. V. 1/5. P. 18. C. 21.

Length of head equal to its height, and rather less than 4.00 in the total length (without caudal); height of body, 2.66 in the same. Eye situated immediately below the upper profile of the head, its diameter nearly as long as the snout, which is obtuse, and 4.00 in the length of the head: interorbital space convex, 1.25 in the diameter of the eye. Lower jaw projecting: cleft of mouth of moderate width and oblique, extending to the vertical from the front margin of the eye; the maxilla rather narrow, widening towards its extremity, reaching to beneath the middle of the orbit. Both limbs of the preopercle armed with short spines, the upper ones on the vertical limb being a little the longer and directed obliquely upwards: interopercle spiniferous, the subopercle less so: opercle membranous; its upper portion with radiating osseous striæ, which project beyond the margin. Body elongate-ovoid, and strongly compressed. Teeth minute, implanted in a single series on the sharp edge of the jaws. The dorsal fin commences above the root of the pectoral, and terminates at a short distance from the caudal; it is rather low, the longest rays,

which are behind the middle of the fin, not erectile into a vertical position; the rays are slender and fragile: the anal commences a little behind* the middle of the length of the fish, and beneath the twenty third dorsal ray, and ends a little nearer to the base of the caudal than does the dorsal; there is no distinct spinuous portion to either the dorsal or the anal fin: ventral rather small and close together, inserted in advance of the base of the pectoral, its length (*in the figure*) two fifths of that of the head; pectoral with a broad base, the upper rays longer than the lower, its length (*in the figure*) two thirds of that of the head: caudal fin rounded, rather shorter than the head; the least height of the caudal peduncle about equal to its length. Scales minute, cyclid; on the head apparently present on the cheeks only. Lateral line curved to beneath the anterior third of the dorsal fin, thence straight.

Colors.—Pale greenish olive marbled with darker, the markings being in the form of spots on the upper and of irregular longitudinal bands on the lower half of the body: vertical fins spotted with blackish. Irides nearly white; a ring of small white pores encircling the eye.

This species has been obtained in the Mediterranean, the Mid-Atlantic, the Pacific near Samoa, on the east coast of Spain, and on the north-east coast of Ireland, the writer having the good fortune to secure the last-mentioned example immediately after its capture.

Length to nine inches and a half.

In Dr. Steindachner's description, the dorsal rays are said to vary between thirty five and forty seven, which, unless the smaller number should prove to be a printer's error for forty five, is a most unusual variation in such a species, and, taken in conjunction with the fact that some examples were found to have six, others seven, branchiostegal rays, would go far towards suggesting the possibility that two species have been confounded together under the name *Schedophilus medusophagus*.

SCHEDOPHILUS ENIGMATICUS.

Coosteus† *enigmaticus*, Lockingt. Proc. U.S. Nat. Mus. xxii. p. 63, 1881; Jordan & Gilbert, Synops. Fish. N. Am. p. 620, 1882; Steindachn. SB. Ak. Wien, lxxxvi. p. 82, 1882; Gnth. Voy. Challenger, xxii. p. 46, pl. xliv. 1887.

* A little before in Günther's figure in the Transactions (*q.v.*)

† Derived from *έίκω*, to yield, and *όστέον*, a bone; alluding to the soft and flexible nature of the bones.]

*Schedophilopsis** *spinus*, Steindachn. *loc. cit.* lxxxiii. p. 396, 1881.

B. vi. D. 52-55. A. 37-40. V. 1/4. L. lat. 110-120.

Length of head 5.00 (4.25 without caudal), height of body 3.50 in the total length. Eye small, its diameter 6.00 - 7.00 in the length of the head, 1.66 - 1.85 in the length of the snout, and 2.20 - 2.50 in the convex interorbital space. Jaws equal: cleft of mouth of moderate width, the maxilla reaching to beneath the middle of the eye: nostrils small, simple, approximate, situated nearer to the end of the snout than to the orbit. Preopercle with several small spinous processes on the margin. Body elongate-ovoid, much compressed; the upper profile rises abruptly from the interorbital space, and describes a gentle curve to the end of the dorsal fin. Teeth in the jaws in a single series, minute, those in the lower jaw rather the larger. The dorsal fin commences opposite to the base of the pectoral, and terminates on the same plane as the anal; the anterior rays are short and unbranched; the rays gradually increase in height posteriorly, and the longest, which are close to the end of the fin, reach nearly to the base of the caudal: the anal commences opposite to the twenty fourth to twenty seventh dorsal rays, and is similar in shape to the posterior half of the dorsal fin: ventral small and narrow, inserted a little behind the base of the pectoral, the second ray the longest, its length three sevenths of the distance between its origin and the vent, and four elevenths of that of the head: † pectoral broad, rounded, the middle rays the longest, equal to the postorbital portion of the head: caudal rounded, the least height of the peduncle less than its length, and about 5.50 in the height of the body. Scales absent. Lateral line gently curved above the anterior rays of the anal, thence straight, clothed along its entire length with groups of minute spines: all the fin rays with similar spines.

Colors.—Light yellowish brown, pellucid below the dorsal and above the anal fins: upper half of head and body ornamented with large blackish spots, irregular in shape, and smallest on the head and neck; they form a series along the base of the vertical fins, which are similarly spotted.

Habitat.—Pacific coast of the United States, in deep water.

Length up to twelve inches.

* From *Schedophilus*, and *opsis*, appearance.

† In the Challenger figure.