

shining, but front and mesothorax dull; mandibles bright red at apex, orange in middle, dark at base; labrum and margin of clypeus dark; antennæ comparatively short and thick, like those of a female; scape black, flagellum dull ferruginous beneath; scutellum shining green; area of metathorax shining, with irregular rugæ not covering the surface; tegulæ testaceous. Wings clear, nervures and stigma reddish sepia; venation of *Chloralictus*, but first r. n. entering extreme base of third s.m. Legs black, with the knees, anterior tibiæ, apices of the other tibiæ, and all the tarsi ferruginous. Abdomen only moderately narrow. The compound microscope shows:—Front very minutely cancellate, not striate; mesothorax coarsely lineolate or subtessellate, with scattered punctures.

Hab. Kuranda, Cairns, Queensland, March 1902 (*Turner*). British Museum. Also a co-type from Cape York, May 1902 (*Turner*).

Superficially much like *H. saycei*, but the differences in colour and sculpture show that it cannot be its male.

Halictus paracolletinus, Cockerell.

A male from Kuranda, Cairns, April 1902 (*Turner*), shows that this sex resembles the female, with the following principal sexual differences:—Face much narrower, front and sides of face densely covered with orange hair; lower half of clypeus and a wedge reaching upper margin pale yellow; antennæ very long, flagellum ferruginous beneath; anterior knees, tibiæ, and tarsi ferruginous, the tibiæ clouded with dusky.

XXXIX.—*The Anatomy and Classification of the Symbranchoid Eels.* By C. TATE REGAN, M.A.

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[Plate IX.]

IN most recent systems of classification the Symbranchii appear as an order (or suborder) which is placed near the Apodes. It seems probable, however, that they are derived from some group of acanthopterous physoclists and that the resemblances to the true Eels are not due to relationship, since in *Alabes* the præmaxillaries have long posterior

pedicels and jugular pelvic fins are present. Vaillant (Comptes Rend. cxl. 1905, p. 1713) has recently expressed the opinion that the affinities of *Alabes* are with the Blennioids rather than with the Symbranchidæ, and, indeed, its external similarity to the Scytalinidæ and Zoarcidæ is rather striking; but in its osteology *Alabes* differs widely from the Blennioids, and although it also differs sufficiently from the Symbranchoids to be made the type of a separate suborder, its relationship to them is quite clear; the more important characters common to *Alabes* and the Symbranchoids are given in the ordinal diagnosis, and the differences between them will be seen on comparison of the subordinal diagnoses in the following systematic account.

Order SYMBRANCHII.

Eel-shaped Teleosts, with the caudal fin very small, 8- to 10-rayed, and continuous with the dorsal and anal, which are rayless folds of the skin; no pectoral fins; pelvics, if present, jugular. No air-bladder. Mouth non-protractile, bordered above mainly by the præmaxillaries; lower jaw of dentary, articulare, and angulare. Gill-membranes united and gill-openings confluent below, but more or less restricted from above, typically appearing as a transverse ventral slit. Palatine without maxillary process; no mesopterygoid; metapterygoid extending upwards to sphenotic; hyomandibular two-headed; symplectic present; opercles normal. Upper surface of skull without crests or ridges; no basisphenoid, alisphenoid, orbitosphenoid, or opisthotic; sphenotic with a rather prominent projection directed outwards and somewhat forwards; exoccipital condyles widely separated; nasals long, separated by the ethmoid; a præorbital, but no suborbitals. Only the membrane bones of the pectoral arch developed, the coracoids and radials absent. Vertebral centra co-ossified with the arches; no ribs, but a series of epipleurals.

Suborder 1. ALABETOIDEA.

Vent in the anterior half of the length of the fish. Dorsal and anal well developed; pelvic fins present, very small, 2-rayed, just behind the gill-opening. Mouth small; palate toothless. Præmaxillaries with strong posterior pedicels which reach the frontals; palatines separated by the vomer; pterygoid slender, remote from the frontal; operculum rhomboidal. Skull short, broad, depressed; parasphenoid and frontal separated by an interspace; parietals not meeting

above the supraoccipital. Pectoral arch attached to the skull by a forked post-temporal. Caudal vertebræ more numerous than the præcaudals; posterior præcaudals with downwardly directed parapophyses; epipleurals sessile.

Family 1. Alabetidæ.

This family includes the single genus *Alabes*, Cuv. (*Chilobranchus*, Richards.), little fishes of the coasts of Australia, known as "Shore Eels." The body is naked; the snout is blunt and the eyes are placed far forward; the mouth is small, terminal, and the blunt compressed teeth are arranged in a single series in the jaws. In *A. dorsalis* I count 75 vertebræ (23+52); parapophyses are developed on the last 8 præcaudals only, they are downwardly directed and gradually increase in length until they form closed hæmal arches in the caudal region.

Suborder 2. SYMBRANCHOIDEA.

Vent in the posterior half of the length of the fish. Dorsal and anal vestigial; no pelvic fins. Mouth moderately large; palate with a crescentic band or series of teeth on the palatines and pterygoids. Præmaxillaries without posterior pedicels; palatines meeting below the vomer; pterygoid expanded, attached throughout its length to the frontal; operculum subtriangular. Skull elongate; parasphenoid and frontal united by a long suture; parietals meeting above the supraoccipital. Præcaudal vertebræ more numerous than the caudals; all the præcaudals (except the first) and the anterior caudals with transverse processes bearing the epipleurals; posterior præcaudals also with downwardly directed parapophyses, which are replaced by closed hæmal arches in the caudal region.

Family 1. Symbranchidæ.

There are no respiratory sacs and the pectoral arch is attached to the skull by a forked post-temporal; the body is naked.

Synopsis of the Genera.

I. Eyes developed; gill-opening small; teeth in bands.

Gills well developed, on 4 branchial arches;

vertebræ 127-137 (76-80+51-57) 1. *Symbranchus*.

Gills vestigial, on 3 branchial arches only;

vertebræ 188 (100+88) 2. *Monopterus*.

- II. Eyes vestigial; gill-opening wide, extending upwards above the middle of the side; teeth in a single series, minute on the præmaxillaries, well developed and obtusely conical on the palate and lower jaw; gills as in *Symbranchus*; vertebræ about 100.

3. *Macrotrema*, gen. nov.

Symbranchus includes three species from the fresh and brackish waters of tropical countries—one from Central and South America, another from West Africa, and the third from the East Indies. *Monopterus* comprises a single species widely distributed in the rivers of southern and eastern Asia. The new genus *Macrotrema* is established for *Symbranchus caligans*, Cant., which differs from *Symbranchus* not only in structural characters, but in its smaller size and marine habit. Cantor's type from Pinang, 200 mm. in total length, is in the British Museum; also a second specimen of 160 mm. from Singapore.

Family 2. Amphipnoidæ.

Amphipnous cuchia, from the fresh and brackish waters of tropical Asia, differs from the Symbranchidæ especially in the development of a pair of respiratory sacs, diverticula of the pharynx which lie on each side of the vertebral column above the gills and between the skull and the pectoral arch. All the other features in which *Amphipnous* differs from the Symbranchidæ, except the presence of scales on the body, are connected with the presence of these sacs; thus the skull is shorter, the operculum and suboperculum are produced backwards into very thin, almost membranous laminae, and the pectoral arch is separated from the skull, with consequent reduction or disappearance of the post-temporal. Gills are developed on the second branchial arch only. The vertebræ number 171 (106 + 65).

EXPLANATION OF PLATE IX.

Figs. 1-4. *Monopterus javanensis*. 1, jaws, suspensorium, and opercles; 2, skull from above; 3, skull from the side; 4, skull from behind.

Figs. 5-8. *Alabes dorsalis* (5 and 6 $\times 2$, 7 and 8 still more enlarged). 5, skull from above; 6, skull from below; 7, upper jaw; 8, lower jaw.

pmx, præmaxillary; *mx*, maxillary; *den*, dentary; *ar*, articulare; *an*, angulare; *pal*, palatine; *pt*, pterygoid; *q*, quadrate; *mt*, metapterygoid; *hm*, hyomandibular; *sy*, symplectic; *pop*, præoperculum; *op*, operculum; *sop*, suboperculum; *iop*, interoperculum; *n*, nasal; *eth*, ethmoid; *leth*, lateral ethmoid; *v*, vomer; *psp*, parasphenoid; *f*, frontal; *p*, parietal; *spo*, sphenotic; *pto*, pterotic; *epo*, epiotic; *pro*, pro-otic; *soc*, supra-occipital; *eoc*, exoccipital; *boc*, basioccipital; *t*, temporal plate.



Regan, C. Tate. 1912. "The anatomy and classification of the symbranchoid eels." *The Annals and magazine of natural history; zoology, botany, and geology* 9, 387–390.

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