

Synonymy of the Fish Families  
Cheilobranchidae (=Alabetidae) and  
Gobiesocidae, with Descriptions  
of Two New Species of *Alabes*

VICTOR G. SPRINGER  
and  
THOMAS H. FRASER

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 234

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SMITHSONIAN INSTITUTION PRESS  
City of Washington  
1976



## ABSTRACT

Springer, Victor G., and Thomas H. Fraser. Synonymy of the Fish Families Cheilobranchidae (=Alabetidae) and Gobiesocidae, with Descriptions of Two New Species of *Alabes*. *Smithsonian Contributions to Zoology*, number 234, 23 pages, 14 figures, 3 tables, 1976.—The genus *Alabes*, monotypic representative of the Cheilobranchidae, shares a large number of specializations with the members of the Gobiesocidae, including one not known to occur in any other fishes: the supracleithrum bears a shallow, concave process at its distal end that articulates with a convex condyle on the anterior surface of the cleithrum. A vestigial, papillae-bearing "sucking disc" occurs in some specimens of *Alabes dorsalis*. On the basis of shared specializations, we consider the Cheilobranchidae to be highly specialized gobiesocids. The osteologies of *Alabes dorsalis* and the gobiesocid *Trachelochismus pinnulatus* are illustrated. Four species are recognized in *Alabes*: *dorsalis* (widespread in southern Australia and Tasmania), *parvulus* (widespread in southern Australia, Tasmania, and Norfolk Island), *brevis* (new species from Western Australia), and *hoesei* (new species from New South Wales, South Australia, and Tasmania).

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year*. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

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### Library of Congress Cataloging in Publication Data

Springer, Victor Gruschka, 1928—

Synonymy of the fish families Cheilobranchidae (=Alabetidae) and Gobiesocidae.

(Smithsonian contributions to zoology ; no. 234)

Supt. of Docs. no.: SI 1.27:234

1. *Alabes*. 2. Gobiesocidae. 3. Fishes—Classification. I. Fraser, Thomas H., joint author. II.

Title. III. Series: Smithsonian Institution. Smithsonian contributions to zoology ; no. 234.

QL1.S54 no. 234 [QL638.G6] 591'.08s [597'.58] 76-608046



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# Synonymy of the Fish Families Cheilobranchidae (=Alabetidae) and Gobiesocidae, with Descriptions of Two New Species of *Alabes*

*Victor G. Springer*  
and *Thomas H. Fraser*

## Introduction

The relationships of the genus *Alabes* (= *Cheilobranchus* Richardson, 1835) have been a source of confusion to ichthyologists since *Alabes* was described by Cloquet (1816).<sup>1</sup> *Alabes* was originally placed next to the synbranchid eels under the Anguilliformes (Cuvier, 1817). Swainson (1838), somewhat presciently, considered *Alabes* to be intermediate between the eels and the Cyclopteridae, which at that time embraced the Gobiesocidae, but he included *Alabes* in the Muraenidae, even though his observations should have caused him to place it in his Synbranchidae. Swainson's cyclopterid lead was not pursued by later authors. Richardson (1845) considered his *Cheilobranchus* (he was apparently unaware of *Alabes*) to be a synbranchiform, and all authors for the next 60

years treated it, and *Alabes*, as a synbranchiform or a genus of questionable relationships. Vaillant (1905a, 1905b), in the most detailed study of *Alabes* to that date, assigned *Alabes* to the Blenniidae, but Gill (1906) disagreed, stating that *Alabes* was neither a blenniid nor an eel and that its true relationships would have to await a comparative study of its osteology. Regan (1912) performed such a study, albeit superficially, and returned *Alabes* to the synbranchiforms, and there it rested until Gosline (1968) stated that *Alabes* was possibly closely related to the congrogadoids, which he included in his suborder Blennioidei. Gosline, however, preferred to leave *Alabes* provisionally in the Synbranchiformes, assuming that it was "so specialized (degenerate) as to have obscured any real evidence of relationship." Rosen and Greenwood (in press), in a study of the Synbranchiformes, again excluded *Alabes* from close relationship with that group and suggested that it was, perhaps, more similar to the blennioids, based on certain gill-arch specializations. This last study was probably the basis for Greenwood's (1975) inclusion of the Alabetidae (junior synonym of Cheilobranchidae) in the suborder Blennioidei.

It is the purpose of our study to elucidate the relationships of *Alabes* and to assign it to what we believe is its proper family, the Gobiesocidae. In addition, we revise the species of *Alabes*.

<sup>1</sup> The authorship of *Alabes* has most often been attributed to Cuvier (1817), who is actually responsible for the name. Cuvier, however, furnished Cloquet with the name and description, and Cloquet's publication anticipated Cuvier (who used the term *alabes* only in the vernacular sense) by just a few months. The type-species of the genus is *Alabes cuvieri* Vaillant, 1905a, 1905b, by subsequent monotypy.

*Victor G. Springer*, Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560. *Thomas H. Fraser*, Environmental Quality Laboratory, 590-D Olean Boulevard, Port Charlotte, Florida 33952.



**METHODS.**—Specimens used for the osteological study were prepared by the enzyme method (Taylor, 1967). Springer prepared the base drawings for the osteological illustrations using a Wild M-5 microscope and camera lucida. The final drawings (Figures 1-10) were inked and labelled by P. K. Hollingsworth. The osteological illustrations of *Alabes dorsalis* and *Trachelochismus pinnulatus* are based on a single specimen of each species (see osteological material list). Three specimens of *Alabes dorsalis* and one of *A. parvulus* were examined to determine osteological consistency. A large number of *Alabes* specimens were examined radiographically. Information on vertebrae, pectoral and pelvic-fin girdles, and certain skull features are easily discerned on radiographs. Only one osteological preparation of *Trachelochismus* was examined.

Vertebral counts, including those of the posteriormost vertebra bearing an epipleural rib, on non-osteologically prepared specimens were taken from radiographs. Vertebral counts were not recorded for specimens exhibiting apparent fusions among vertebrae, with the exception of the penultimate vertebra, which in *Alabes* appears to be aberrant more often than not.

The synonymies include only references to original descriptions.

The following institutional abbreviations are used: AMNH = American Museum of Natural History; AM = Australian Museum, Sydney; BMNH = British Museum (Natural History); MNHN = Museum National d'Histoire Naturelle, Paris; NMNH = National Museum of Natural History, Smithsonian Institution; NMNZ = National Museum of New Zealand, Wellington; QM = Queensland Museum, Brisbane; USNM = former United States National Museum (Specimens in NMNH); WAM = Western Australian Museum, Perth.

A list of the osteological preparations examined is given in the next section; non-prepared specimens of *Alabes* are listed under the general systematic accounts of the various species. For the gobiesocids, we attempted to examine the osteology of one species in at least one genus in each of the eight subfamilies recognized by Briggs (1955). We had no osteological material of Briggs' Diplo-

crepiniae; however, our specimen of *Gastrocymba*, which genus Briggs placed in the Trachelochisminae, has only three gills and would fit Briggs' definition of the Diplocrepiniae. Briggs reported that the Trachelochisminae had three and one-half gills. He had but one specimen of *Gastrocymba*, which he was unwilling to dissect, and possibly he erred in his belief that it had three and one-half gills. In addition to the osteologically prepared specimens, we examined many other gobiesocid species externally and by radiographs; these species are not listed.

**OSTEOLOGICAL MATERIAL EXAMINED** (*Alabes* and the Gobiesocidae).—*Alabes dorsalis*, USNM 201415, Kangaroo Island, South Australia, about 60 mm TL (osteology illustrated in Figures 1, 3-7, and 9); USNM 214100, Green's Beach, Tasmania, 28 mm TL; AMNH 31306, North Point, Western Australia, about 100 mm TL; *Alabes parvulus*, AM IA.1253, Long Reef, New South Wales, about 45 mm TL; *Apletodon pellegrini*, USNM uncatalogued, Algoa Bay, South Africa, 2: 19.8-20.8 mm SL; *Aspasma minima*, USNM uncatalogued, Japan, 36.2 mm SL; *Chorisochismus dentex*, USNM uncatalogued, Skoenmarkers Wreck, South Africa, 37.1 mm SL; *Comidens laticephalus*, USNM 213838, Taiwan, 3: 15.5-25.3 mm SL; *Diademichthys lineatus*, USNM 213595, New Caledonia, 3: 26.5-41.0 mm SL; *Diplecogaster bimaculata*, USNM 213839, Tunisia, 24.5 mm SL; *Eckloniaichthys scylliorhini-ceps*, USNM uncatalogued, Salt Vlei, South Africa, 25.2 mm SL; *Gastrocymba quadriradiata*, NMNZ 3330, Auckland Island, 24.5 mm SL; *Gobiesox nigripinnis*, USNM 213594, Dominica, 3: 17.0-40.5; *Gouania wildenowi*, USNM uncatalogued, Genoa, Italy, about 32 mm SL; *Lepadichthys erythraeus*, USNM 213593, Gulf of Aqaba, 3: 20.0-30.6; *Lepadogaster lepadogaster*, USNM uncatalogued, Genoa, Italy, 44.1 mm SL; *Rimicola muscarum*, USNM uncatalogued, San Simeon, California, about 30 mm SL; *Sicyases sanguineus*, USNM 213846, Monte Mar, Chile, 3: 22.9-30.6 mm SL; *Tomicodon fasciatus*, USNM 192157, Havana, Cuba, 3: 16.5-33.5 mm SL; *Trachelochismus pinnulatus*, USNM uncatalogued, Chatham, New Zealand, about 50 mm SL (osteology illustrated in Figures 2-6, 8, and 9).

**ACKNOWLEDGMENTS.**—We wish to express our appreciation to the following individuals: for loan or donation of specimens—D. E. Rosen (AMNH), D. F. Hoese (AM), P. J. Whitehead (BMNH), M. L. Bauchot (MNHN), G. Allen (WAM), J. Moreland (NMNZ), R. H. Green and E. O. G. Scott (Queen Victoria Museum and Art Gallery of Tasmania); for curatorial assistance—E. N. Gramblin and J. F. McKinney (NMNH); for reviewing the manuscript—R. H. Gibbs, Jr., and S. H. Weitzman (both NMNH), and D. E. Rosen (AMNH).

### Osteology of *Alabes* and the Gobiesocidae

Unless indicated otherwise, wherever the terms "gobiesocids" or "Gobiesocidae" are mentioned in the osteological discussions, they refer only to those genera and species in the osteological material list.

The osteology of *Alabes* was treated superficially and often erroneously by Regan (1912). Among the gobiesocids, Guitel (1888) treated most of the gross anatomy of *Lepadogaster gouani* (= *L. lepadogaster*) in considerable detail; Starks (1905) described the osteology of *Caularchus meandricus* (= *Gobiesox meandricus*); Briggs (1955) gave limited osteological information on almost all the genera; Runyan (1961) imperfectly illustrated the osteology of *Gobiesox strumosus* but gave useful information on variation in meristic osteological characters; Leray (1961) described and illustrated the osteology of the skull of *Gouania wildenowi*; and Rosen and Patterson (1969) illustrated much of the osteology of *Gobiesox funebris* (but we believe that they have introduced several errors in their labels and drawings).<sup>2</sup>

**CRANIUM** (Figures 1 and 2).—The cranium of *Alabes* and the gobiesocids is broad and depressed. The toothless vomer<sup>3</sup> is relatively broad and concave anteriorly. The parasphenoid lacks ascending processes; hence, the prootics enter the postorbital area unimpeded. The following bones are not present: basisphenoid, orbitosphenoid, pterosphenoids, and intercalars. The socket for articulation with the dorsoanterior condyle of the hyomandibular is formed entirely by the sphenotic (rather

than being formed by the sphenotic dorsally and prootic ventrally, as in many fishes). The supraoccipital lacks a dorsal crest. There is a sensory canal with three branches in the frontal: an anterior branch that connects with the canal of the nasal bone; a medial branch (commissure) above the orbit that is continuous with the same branch from the opposite frontal (commissure incomplete in one of three specimens of *Diademichthys*); and a posterior or posterolateral branch that, in all but one of the gobiesocids and *Alabes*, is continuous with the canal passing through the sphenotic and pterotic. In *Alabes dorsalis*, *A. parvulus*, and *Gouania* there are no sphenotic and pterotic sensory canals; however, based on the presence of a postocular pore (Figure 10) in the skin lateral to the sphenotic or pterotic, *A. brevis* and *A. hoesei* probably have a sphenotic or pterotic canal. Neither *Alabes* nor the gobiesocids possess a supra-temporal sensory canal.

The otoliths were not observed in *Alabes* or most of the gobiesocids. In *Trachelochismus* the sagitta and lapillus are of about the same size; the asteriscus was not seen. The sagitta was fragile and hollow, as was about one-third of the volume of the asteriscus.

**SUPERFICIAL BONES, JAWS, AND SUSPENSORIUM** (Figure 3).—*Alabes* and all the gobiesocids lack the following bones: mesopterygoids, metapterygoids, sesamoid articulators, extrascapulars (supratemporals), and infraorbitals (except the lacrymal, which is always present; however, the lacrymal is greatly reduced in *Diademichthys*). Both *Alabes* and the gobiesocids also lack a rostral cartilage (a sphere of cartilage attached to the dorsoposterior surfaces of the premaxillary ascending processes). The nasal bone is relatively long, and in the gobiesocids varies widely in shape; it lies parallel to the long ascending process of the premaxillary. A lacrymal sensory canal is present except in *Gouania* and some specimens of *Alabes parvulus*. The lacrymal lies lateral to the maxillary and is attached to the lateralmost process of the lateral ethmoid. It may be remote anteriorly from the lateral ethmoid (*Alabes* and some gobiesocids) or attached closely to that bone (other gobiesocids). The toothless palatine is well developed and bears a maxillary process in all the gobiesocids, but in *Alabes* the palatine is reduced to a splint of bone without a maxillary process. The palatine is not in bony

<sup>2</sup>In their figure 4F, Rosen and Patterson indicated that the parhypural is fused to hypurals 1 and 2, that the uroneural is autogenous, and that there is no epural. In our specimens of *Gobiesox nigripinnis* the parhypural and epural are present, autogenous, and cartilaginous (Rosen, pers. comm., believes that the structure we call a parhypural is not that but a "procurrent cartilage"; we do not agree). We have not found an autogenous uroneural in any gobiesocid nor are we able to determine if the uroneurals have been lost or fused to the urostylar complex in gobiesocids. In their figure 9F they labelled the ectopterygoid as part of the quadrate. In their figure 53E the frontals, which are not labelled, appear to be continuous (fused) with the sphenotics. In their figure 58B they did not indicate whether cartilaginous basibranchials were present because they were only interested in structures that were ossified. The basibranchials are cartilaginous in our specimens of *G. nigripinnis*.

<sup>3</sup>Scott (1974) reported that teeth were present on the vomer, but we have not found this to be true of any of our specimens.

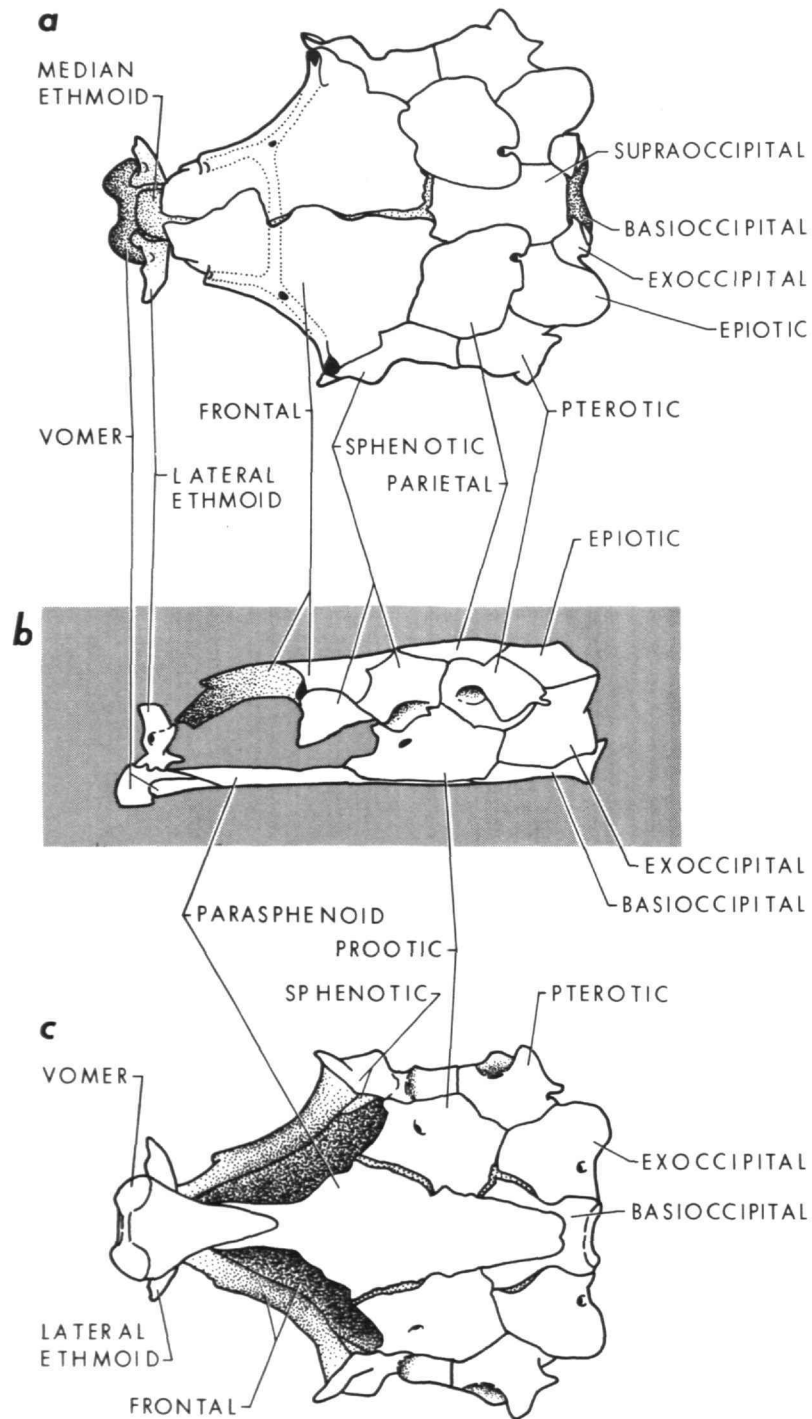


FIGURE 1.—*Alabes dorsalis*, cranium: a, dorsal view; b, lateral view; c, ventral view.



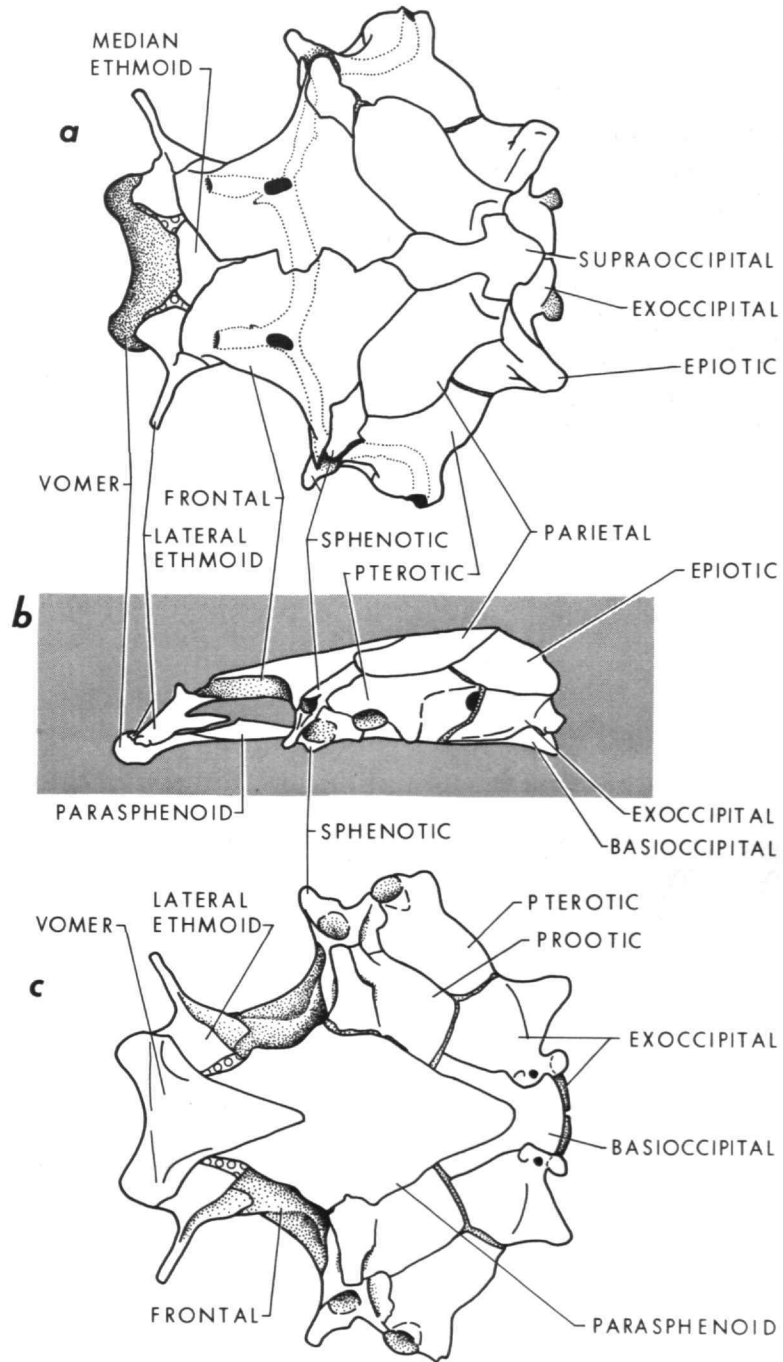


FIGURE 2.—*Trachelochismus pinnulatus*, cranium: *a*, dorsal view; *b*, lateral view; *c*, ventral view.

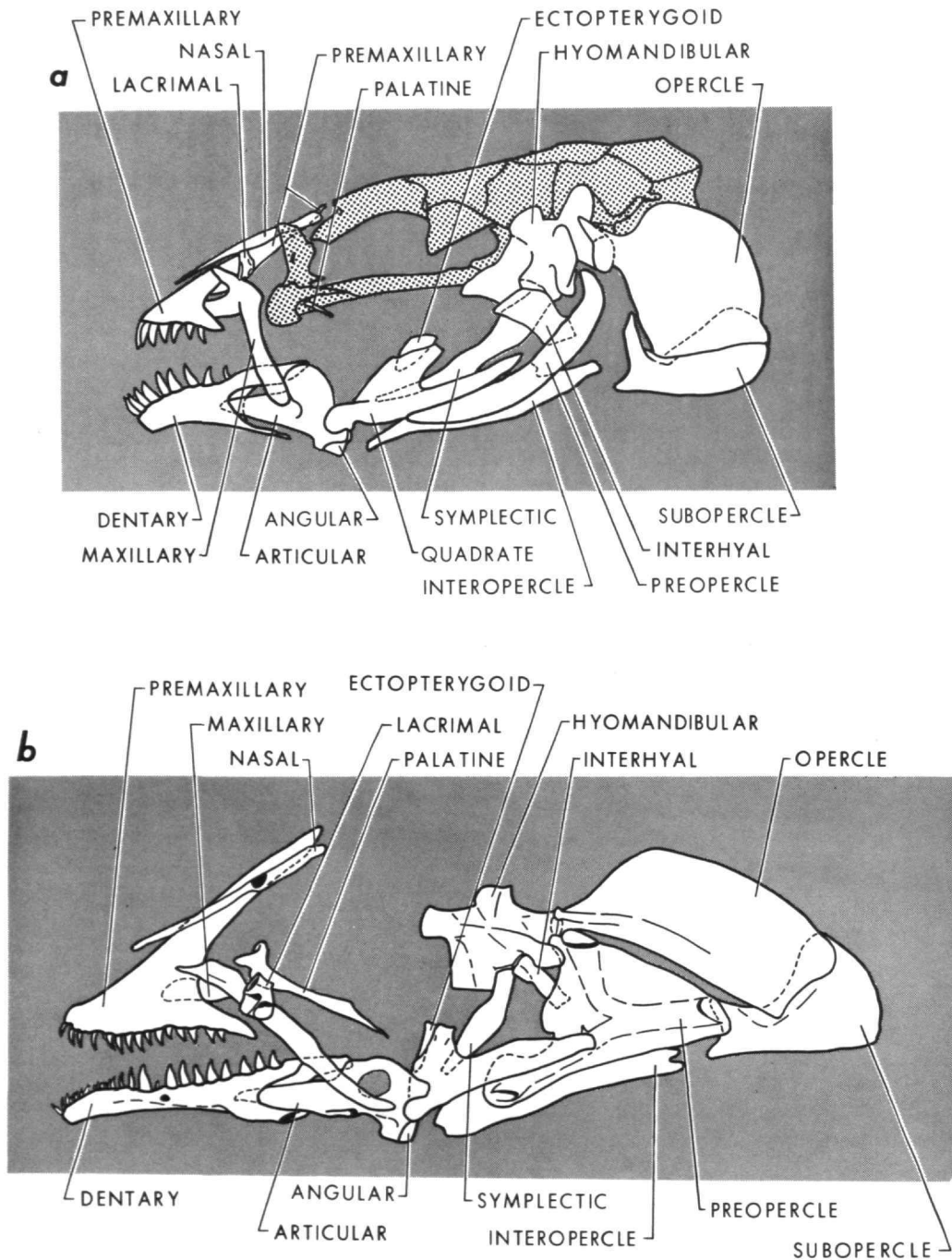


FIGURE 3.—Superficial bones, jaws, and suspensorium: *a*, *Alabes dorsalis* (cranium also indicated); *b*, *Trachelochismus pinnulatus*. (Articular and angular bones are synonymous with anguloarticular and retroarticular bones of recent authors.)

contact with the ectopterygoid in *Alabes* or the gobiesocids, and is well separated from the ectopterygoid in all but *Diademichthys*, *Conidens*, and *Gastrocymba*. The ectopterygoid is reduced to a relatively small blade of bone in *Alabes* and all the gobiesocids except *Diademichthys*, where it is quite large, and usually lacks an anteriorly extending process (a short process is present in *Conidens*, *Gastrocymba*, and *Diplecogaster*). The interopercle is entirely or predominantly medial to the ventral portion of the preopercle and is well separated from, though connected by a cordlike ligament to, the subopercle in *Alabes* and all the gobiesocids except *Lepadichthys*, *Aspasma*, and *Chorisochismus*, in which the interopercle and subopercle almost meet.

A large foramen perforates the posterior end of the articular (anguloarticular) in *Trachelochismus*, but is not present in *Alabes* or the other gobiesocids.

In *Alabes dorsalis* and the gobiesocids there is a bioconcave disc of cartilage between the anterolateral head of the vomer and the anteromedial surface of the maxillary. This cartilage occurs in a wide variety of perciform fishes; however, the cartilage is ossified on both sides of the single specimen of *A. parvulus* examined.

Neither the gobiesocids nor *Alabes* have scleral bones in the eyes.

There is no preoperculomandibular sensory canal in *Alabes*. Among the gobiesocids, only *Gastrocymba* lacks this canal completely, but *Aspasma*, *Diademichthys*, *Diplecogaster*, and *Lepadichthys* lack the mandibular portion of the canal.

GILL ARCHES (Figure 4) AND HYOID APPARATUS (Figures 5 and 6).—*Alabes* and the gobiesocids appear to lack the following structures, either as bone or cartilage: basibranchial 1 (inasmuch as the basihyal has a posterior process extending posterior to the hypohyal—but anterior to hypobranchial 1—and to which the urohyal attaches, it is possible that basibranchial 1 is fused with the basihyal); basibranchial 2 (it is possible that basibranchial 2 is fused with basibranchial 3 because in *Alabes* and some of the gobiesocids the element herein termed basibranchial 3 often has a short anterior process that extends anterior to the medial end of hypobranchial 2); infrapharyngobranchial 1; an uncinate process on epibranchial 1. In addition, there

is only one infrapharyngobranchial (which is toothed) and one hypohyal on each side. It is not known whether the infrapharyngobranchial is infrapharyngobranchial 3 or a complex element representing a fusion of some or all of infrapharyngobranchials 2–4 (toothplate); nor is it known whether the hypohyal represents a fusion of the dorsal and ventral hypohyals, or a loss of one hypohyal.

In *Alabes*, basibranchial 3 is cartilaginous; among the gobiesocids it may be cartilaginous or ossified (one or the other in any taxon for which more than one specimen was examined), but is possibly absent in *Gastrocymba*. In *Alabes* and all the gobiesocids except *Diademichthys*, basibranchial 4, where present, is cartilaginous. In *Diademichthys* basibranchial 4 is ossified. Basibranchial 4 is possibly fused with basibranchial 3 in *Apletodon* and appears to be absent in *Gastrocymba*, *Tomicodon*, *Gobiesox*, *Rimicola*, and *Sicyases*.

Hypobranchial 1 is absent in *Alabes* and ossified in all the gobiesocids except *Gastrocymba* and *Eckloniaichthys*, where it is absent. Hypobranchial 2 is partially ossified in *Alabes dorsalis*, cartilaginous in *A. parvulus*, and, when present in the gobiesocids, is usually at least partially ossified, but is cartilaginous in *Eckloniaichthys* and possibly absent in *Gastrocymba* and *Diademichthys*. Hypobranchial 3 is partially ossified in *Alabes dorsalis*, unossified in *A. parvulus*, and is usually ossified when present in the gobiesocids, but is cartilaginous in *Eckloniaichthys* and *Diademichthys*, absent in *Lepadichthys*, and possibly absent in *Gastrocymba*.

Ceratobranchials 1–5 and epibranchials 1–4 are present and ossified in *Alabes* and all the gobiesocids.

The basihyal is present and ossified in *Alabes* and all gobiesocids, but its relative development is variable. In *Alabes* and nine of the gobiesocids the basihyal has an ossified process that extends well anterior to the anterior level of the hypohyals; in two other gobiesocids the process is entirely cartilaginous, and in five of the gobiesocids, no portion of the basihyal is anterior to the hypohyals. The basihyal extends posterior to the level of the joint between the basihyal and urohyal in nine of the gobiesocids, but in four of these the extension is only slight; it does not extend posterior to the joint in *Alabes* and the other gobiesocids.



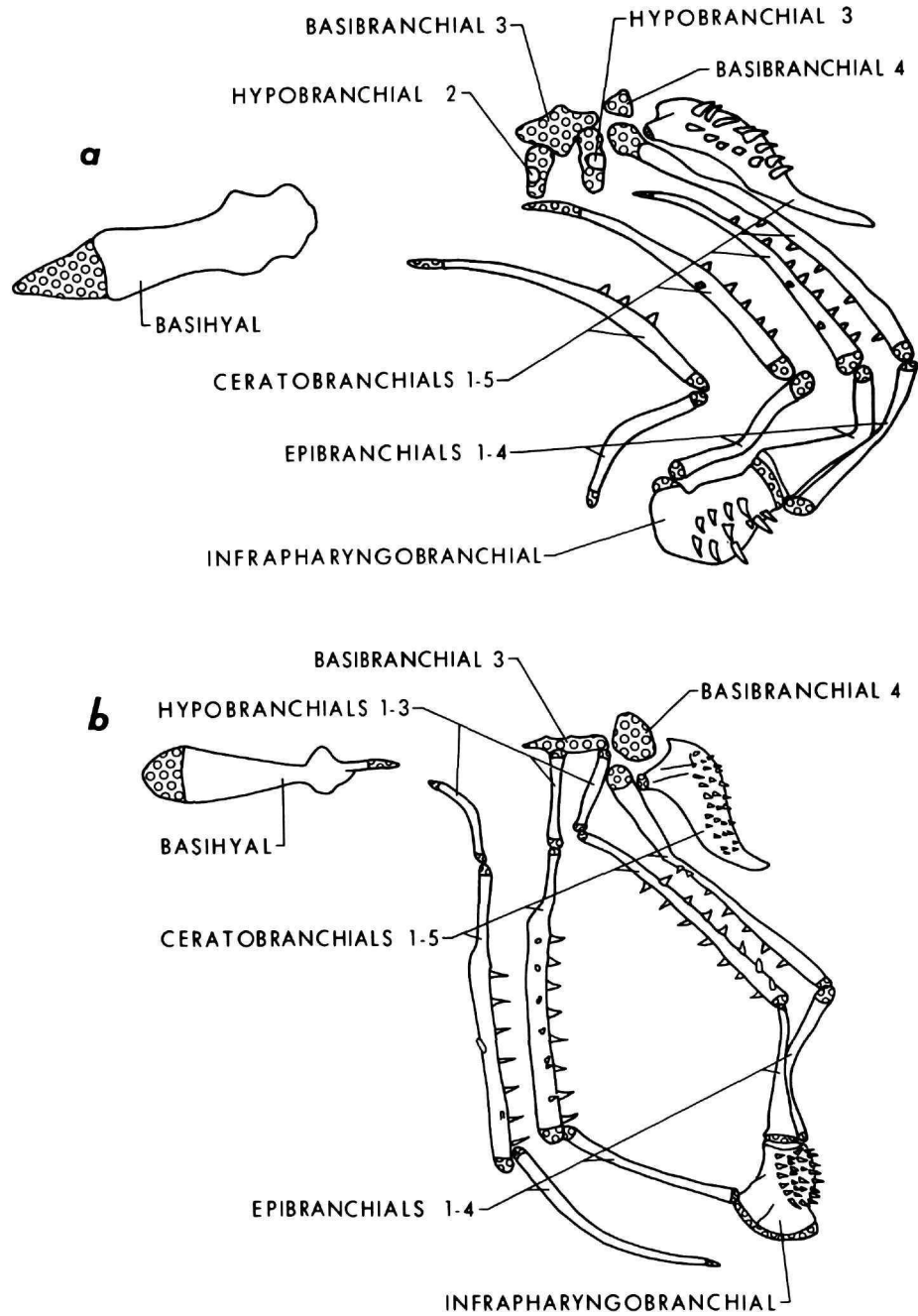


FIGURE 4.—Dorsal view of left gill arches and unpaired median elements (cartilage indicated by pattern of small, open circles; epi- and infrapharyngobranchials folded back, relative positions especially distorted in *b*; gill rakers and teeth indicated but not labeled; position of basihyal relative to more posterior median elements indicated): *a*, *Alabes dorsalis*; *b*, *Trachelochismus pinnulatus*.

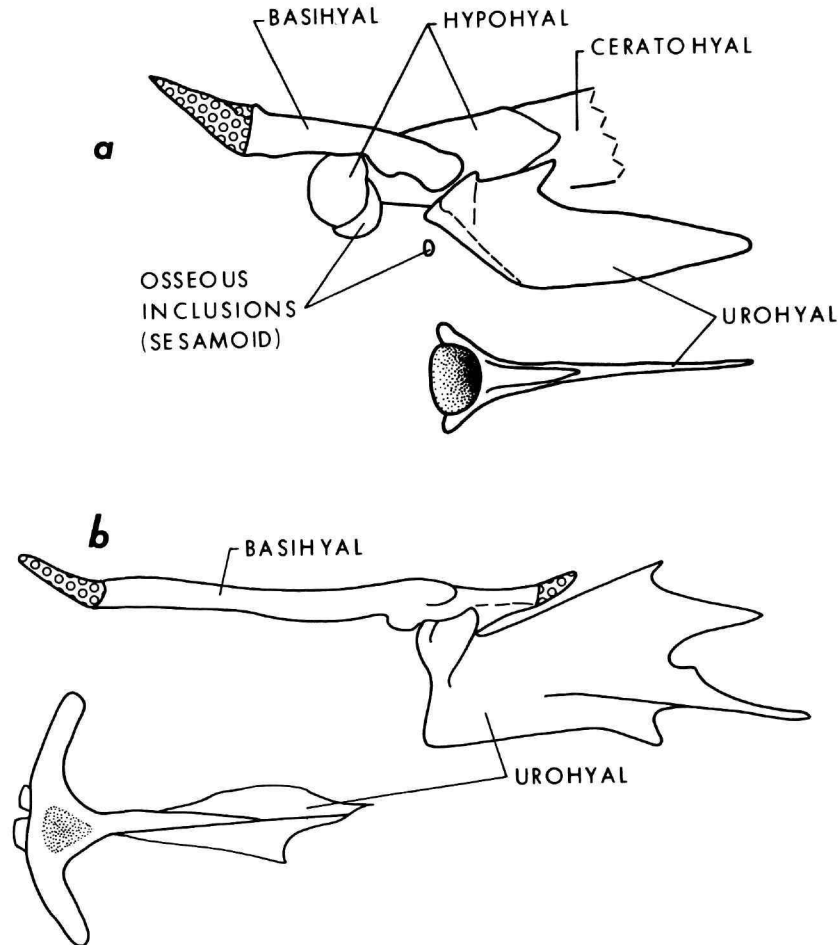


FIGURE 5.—Lateral view of basihyal and urohyal and dorsal view of urohyal (cartilage indicated by pattern of small, open circles): *a*, *Alabes dorsalis* (relationship of adjacent bones on right side indicated; extraneous osseous inclusions indicated); *b*, *Trachelochismus pinnulatus*.

The joint between the epihyal (posterior ceratohyal) and ceratohyal (anterior ceratohyal) is non-sutured in *Alabes* and all the gobiesocids.

The number of branchiostegals is always three in all species of *Alabes* (all articulate with the ceratohyal) and normally five or six in the gobiesocids (most species in the Gobiesocidae—entire family considered—have six, with seven in variant specimens), but the articulations of the branchiostegals are quite variable. For instance, all six articulate with the ceratohyal in *Aspasma*, five with the cera-

tohyal and one with the epihyal in *Diplecogaster*, and four with the ceratohyal and two with the epihyal in *Gobiesox*. Where five branchiostegals are present (*Gastrocymba*, *Eckloniaichthys*), it is the anteriormost branchiostegal that is absent.

Osseous inclusions (sesamoid bones) in various ligaments in the anterior region of the hyoid apparatus were noted in *Alabes* (Figure 5) and several of the gobiesocids.

VERTEBRAL COLUMN (Figures 7 and 8).—*Alabes* has 18–25 precaudal, 39–55 caudal, and 60–78 total

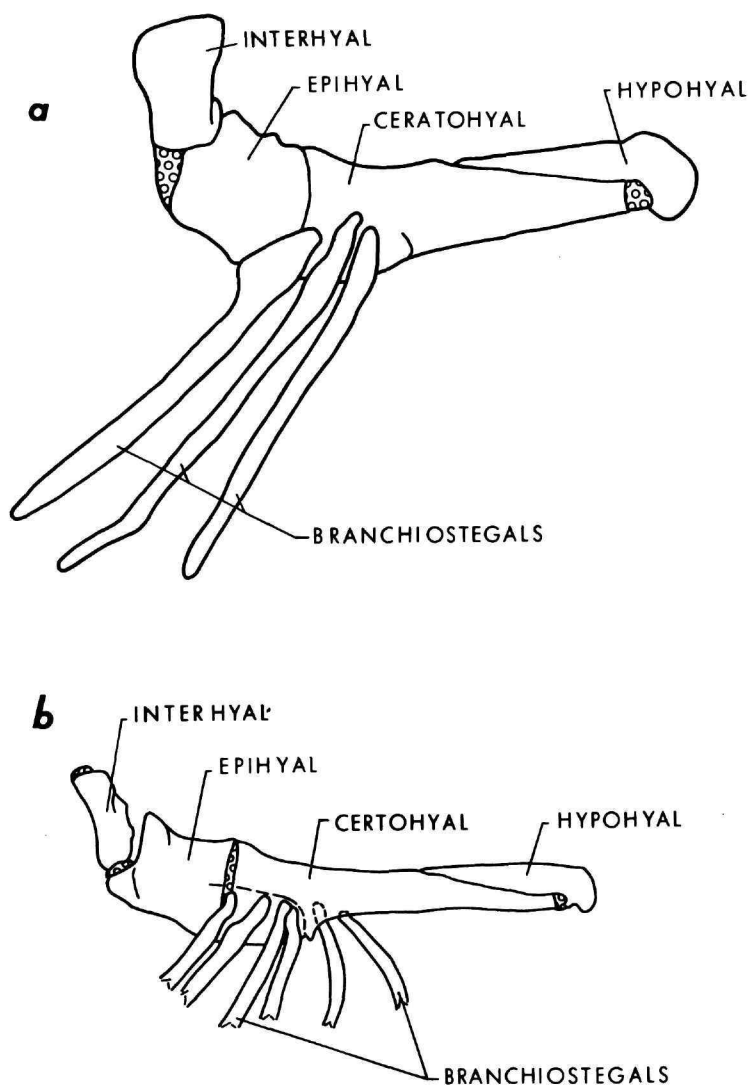


FIGURE 6.—Right hyoid arch (cartilage indicated by pattern of small, open circles): *a*, *Alabes dorsalis*; *b*, *Trachelochismus pinnulatus* (branchiostegals truncated).

vertebrae (see Tables 2 and 3). The number of precaudal or caudal (but not total) vertebrae is difficult to determine, especially from radiographs, and our figures should be considered only as approximations. The last one or two precaudal vertebrae have complete hemal arches but no hemal spines. The epipleural ribs begin on the third

from anteriormost vertebra and extend no farther posteriorly than the third caudal vertebra. All but the posteriormost epipleural ribs attach directly to the constricted portions of their respective centra; there are no pleural ribs.

The gobiesocids have 11–20 precaudal, 13–33 caudal, and 25–54 total vertebrae. There are 0–3

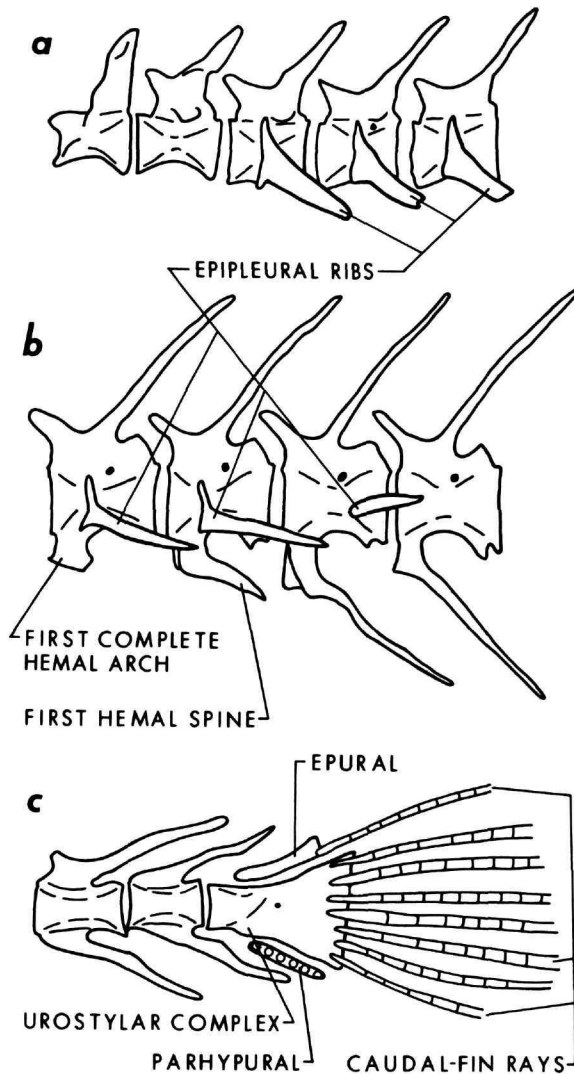


FIGURE 7.—*Alabes dorsalis*: a, five anteriormost precaudal vertebrae; b, posteriormost precaudal and anteriormost three caudal vertebrae; c, posteriormost three caudal vertebrae and caudal-fin rays (rays truncated, parhypural cartilaginous).

precaudal vertebrae with complete hemal arches. The epipleural ribs begin on the second or third from anteriormost precaudal vertebrae and extend as far posteriorly as the last precaudal to the tenth caudal vertebra. The articulation of the epipleural ribs varies from all ribs attaching to the constricted portions of their respective centra to only the pre-

caudal ribs attaching to the constricted portions of the centra, with the caudal ribs gradually being displaced ventrally and attaching to the hemal arches. All gobiesocids have pleural ribs that attach to the epipleural ribs well proximal to the distal ends of the epipleural ribs (an uncommon condition in fishes, where the epipleural ribs, except for the anteriormost one or two, ordinarily attach to the pleural ribs). The pleural ribs begin on the epipleural ribs of the third from anteriormost precaudal vertebra and extend no farther posteriorly than the third from posteriormost to the posteriormost precaudal vertebra.

Vertebral fusions and anomalies are common in *Alabes*, but not in the gobiesocids.

**PECTORAL AND PELVIC FINS, GIRDLES, AND SUPPORTS** (including sucking disc) (Figures 9 and 11).—In *Alabes* and all the gobiesocids the posttemporal lacks a ventral arm, but has in its place a strong ligament that attaches to the exoccipital. The posttemporal is somewhat sigmoid in shape and its longitudinal axis is nearly perpendicular to the longitudinal axis of the skull (in most, if not all, other acanthopterygian fishes the longitudinal axis of the posttemporal is nearly parallel to the longitudinal axis of the skull).

In *Alabes* and all the gobiesocids, the supracleithrum bears a shallow, concave process on its distal end that articulates with a convex condyle on the anterior surface of the cleithrum. The joint between these two bones is not duplicated in other fishes, where the supracleithrum is a compressed, blade-like bone whose medial surface is joined (appressed) to the flattened lateral surface of the cleithrum. Furthermore, the longitudinal axis of the supracleithrum is roughly perpendicular to the longitudinal axis of the posttemporal, whereas in other acanthopterygian fishes the axes of these two bones are parallel.

*Alabes* lacks a scapula and pectoral-fin radials and rays. The coracoid of *A. dorsalis* is reduced to a small, rod-like bone with a relatively large cartilage on its posterior surface; all the other species of *Alabes* lack coracoids. The gobiesocids have essentially normal scapulae and coracoids, four radials, and 16–31 simple pectoral-fin rays.

*Alabes* lacks postcleithra; *Gastrocymba quadri-radiata*, *Gastroscyphus hectoris*, and, according to Böhlke and Robins (1970), *Gymnoscyphus ascitus* lack dorsal postcleithra; but all the other genera

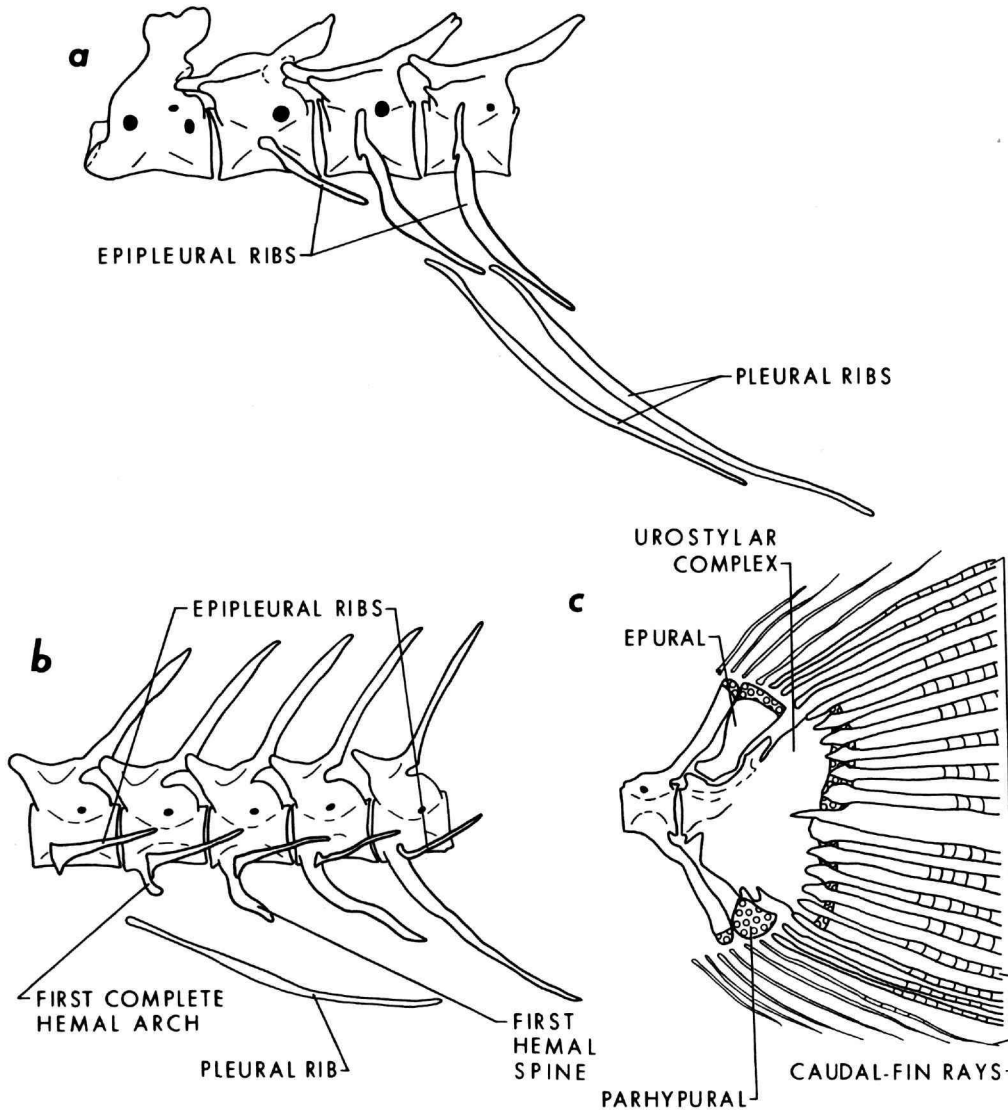


FIGURE 8.—*Trachelochismus pinnulatus*: *a*, four anteriormost precaudal vertebrae; *b*, posteriormost two precaudal and anteriormost three caudal vertebrae; *c*, posteriormost two caudal vertebrae and caudal-fin rays (segmented rays truncated; cartilage indicated by pattern of small, open circles).

(entire Gobiesocidae considered) apparently have both dorsal and ventral postcleithra.

The pelvises (pelvic bones) of *Alabes dorsalis* are greatly reduced with relatively large cartilaginous anterior ends, and each pelvis supports three greatly reduced fin rays; it was not possible to de-

termine if any of the three represent a spine. All the other species of *Alabes* lack pelvises and pelvic-fin rays. The pelvises of the gobiesocids are well developed, but highly modified for support of the sucking disc; each pelvis supports a modified spine and four simple, segmented rays.

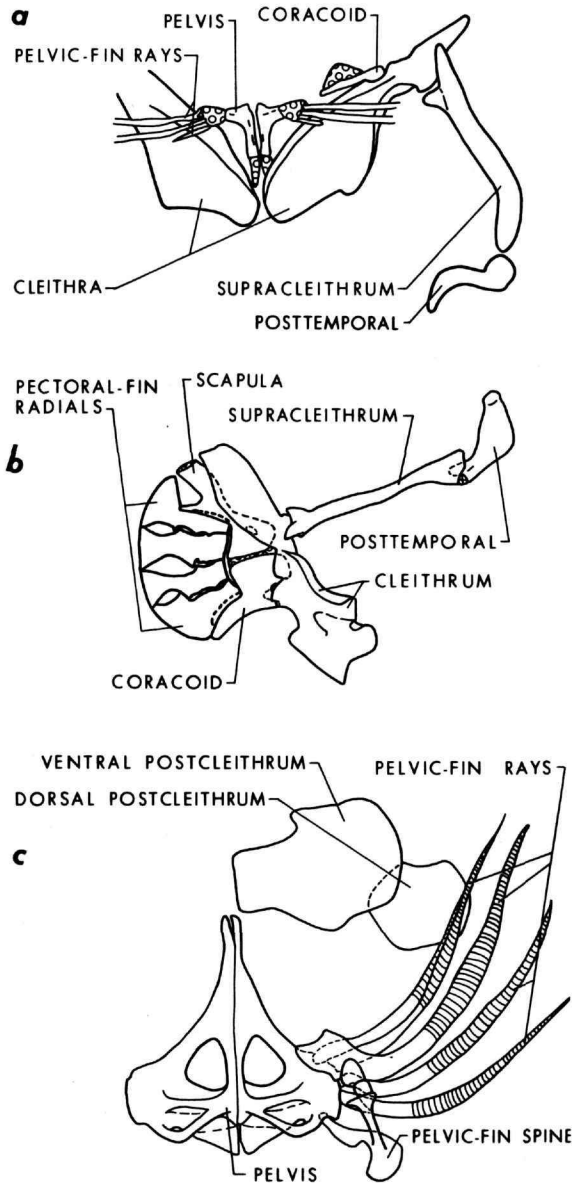


FIGURE 9.—*a*, *Alabes dorsalis*, ventral view of pelvic and pectoral-fin girdles; *b*, *Trachelochismus pinnulatus*, lateral view of pectoral-fin girdle (fin rays omitted); *c*, *Trachelochismus pinnulatus*, ventral view of pelvis and right pelvic fin and postcleithra (cartilage indicated by pattern of small, open circles).

The postcleithra, pelvises, and pelvic-fin rays of gobiesocids function in support of the ventral suck-

ing disc, which characterizes the Gobiesocidae. Externally, the sucking disc bears fleshy papillae (one exception is *Gymnoscyphus ascitus*, according to Böhlke and Robins, 1970). *Alabes dorsalis* has, at most, a vestigial sucking disc, which was present in only nine of more than 150 specimens examined. In these nine specimens the skin between the pelvic fins forms a fold, which is covered with tiny papillae that are extremely difficult to see. The fold may be the result of shrinkage during preservation. The vestigial sucking disc is illustrated in Figure 11d; the usual appearance of the region around the pelvic fins is illustrated in 11e. None of the other species of *Alabes* showed evidence of a sucking disc.

**CAUDAL FIN.**—In *Alabes* the entire caudal fin is greatly reduced in size relative to the rest of the body and relative to its development in the gobiesocids. All of the hypurals are fused into a fan (which is, in turn, fused to the urostylar complex) and are indistinguishable individually. In *A. dorsalis* there is no diastema separating the dorsal and ventral halves of the hypural fan, although a tiny foramen (see Figure 7c) representing a vestigial diastema may be present in the hypural plate. The parhypural is autogenous and cartilaginous; there is a single epural, which is ossified; the uroneurals are either absent or fused indistinguishably with the urostylar complex. All of the fin rays are segmented and there are a total of 8–11 rays, of which 7 or 8 articulate with the hypural fan; there may be 0–2 dorsal procurrent rays and 0–1 ventral procurrent rays. The neural spine of preural centrum 2 is long. The caudal fin of *A. brevis* appears to be similar to that of *A. dorsalis*, but there is a diastema present. The caudal fins of the other species are quite variable, but usually are not well developed and often appear to be aberrant.

In the gobiesocids the caudal fin is better developed than in *Alabes*, but does vary from greatly reduced (*Gastrocymba*) to not much reduced (*Trachelochismus*) in size relative to the rest of the body. The condition of the hypurals and uroneurals is similar to that of *Alabes*, but a diastema always separates the dorsal and ventral halves of the hypural fan. The parhypural, when present, is reduced to a distal plate that is autogenous and either ossified or cartilaginous (both conditions occur in a single species of *Tomicodon*). In *Gastrocymba*, *Aspasma*, and *Rimicola* it was not possible



to determine if the parhypural is present, but if present it is cartilaginous and greatly reduced or fused to the hypural fan. There is a single epural, which may be ossified or cartilaginous (both conditions occur in a single species of *Conidens*). It was not possible to determine if an epural is present in *Gastrocymba*, *Eckloniaichthys*, and *Rimicola*, but if present it is cartilaginous and greatly reduced. The fin rays comprise both segmented (principal and procurrent) and non-segmented (procurrent) simple rays totaling 16–27 rays, of which 8–14 articulate with the hypural fan. There may be 3–7 dorsal procurrent rays and 3–8 ventral procurrent rays. The neural spine of preural centrum 2 is long.

#### Miscellaneous Remarks

*Alabes* has three gills; the gobiesocids have three or three and one-half gills. The gill opening of *Alabes* consists of a common opening to both gill chambers. The opening is situated on the midventral side of the head. In *A. dorsalis* it extends dorsally on either side to, or slightly dorsal to, the dorsal level of attachment of the pelvic-fin membrane to the body. In the other species of *Alabes* the gill opening is restricted entirely to the midventral area.

In the gobiesocids there are two types of gill opening. One type consists of a common opening similar to that of *Alabes* except that the opening extends much farther dorsally on either side (as far as the dorsal margin of the pectoral-fin base). In the other type, there is a separate opening to the gill chamber on each side of the fish.

Neither *Alabes* nor the gobiesocids have scales or lateral-line canals on the body. Both *Alabes* and the gobiesocids have a genital (urogenital?) papilla just posterior to the anus.

Waite (1923) noted that *Alabes dorsalis* is green with darker spots when alive, but that the color changes to red in certain preservatives (the same change takes place in *Alabes parvulus*). We have noted that certain gobiesocids (*Diademichthys*, *Lepadichthys*) also turn red or pink when placed in formalin.

#### Discussion

*Alabes* shares at least one specialized osteological

character with gobiesocids that is not found in other fishes: the structure of the joint between the supra-cleithrum and cleithrum. The angle at which the posttemporal articulates relative to the longitudinal axis of the skull may also be unique to *Alabes* and the gobiesocids.

There are many additional, specialized characters (mostly reductional and osteological) that *Alabes* shares with some or all the gobiesocids. None of these characters is unique to *Alabes* and the gobiesocids, but the number and combination of these characters is not duplicated in any other group of fishes. Included among these specializations are the following (\* indicates conditions in *Alabes* and some gobiesocids). *Absence of*: scales; basisphenoid; orbitosphenoid; pterosphenoid; intercalar; ascending processes on parasphenoid; supraoccipital crest; dermosphenotic; metaptery-

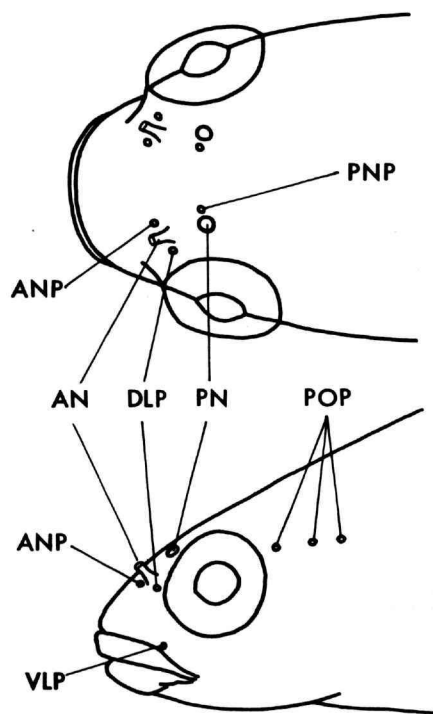


FIGURE 10.—Diagrammatic illustration of sensory canal pores in *Alabes*. (Abbreviations: AN = anterior nostril; ANP = anterior nasal canal pore; DLP = dorsal lacrymal canal pore; PN = posterior nostril; PNP = posterior nasal canal pore; POP = postocular pores; VLP = ventral lacrymal canal pore.)

goid; mesopterygoid; sesamoid articular (cornomeckelian); infraorbitals (except lacrymal); lateral or median extrascapulars; scleral bones; vomerine and palatine teeth; Baudelot's ligament; rostral cartilage; infrapharyngobranchial 1; uncinat process on epibranchial 1; hypobranchial 1\*; basibranchials 1 and 2 (except that basibranchial 1 is possibly fused to the basihyal); ventral process on posttemporal; ribs on first vertebra; ribs on second vertebra\*; autogenous hypurals or uroneurals; lateral-line canals on body; and supratemporal, infraorbital (except lacrymal), and preoperculomandibular\* sensory canals. *Presence of*: only one hypohyal; no more than one epural; cartilaginous parhypural\*; eight principal caudal-fin rays\*; and a long neural spine on preural centrum 2. *In addition*: the socket for articulation with the dorsoanterior condyle of the hyomandibular is formed entirely by the sphenotic; most of the epipleural ribs attach directly to the constricted portion of their respective centra; infrapharyngobranchials 2, 3, and the toothplate of 4 are represented by a single toothed bone (the composition of which is unknown); the interopercle is mostly medial to the preopercle and is not in bony contact with the subopercle; the palatine is not in bony contact with the ectopterygoid; and there are only three gills\*.

*Alabes* differs most prominently from the gobiesocids in exhibiting the following specializations. *Absence of*: dorsal, anal, and pectoral-fin rays, pterygiophores, and radials; maxillary process on the palatine; pleural ribs; postcleithra (the dorsal postcleithrum is absent in some gobiesocids); and scapulae. *Reduction in*: number of branchiostegals and pelvic-fin rays; size and/or structure of pelvises, sucking disc, coracoids, and gill opening. *Increase in*: number of vertebrae.

No specialization was found that unites all the gobiesocids to the exclusion of *Alabes*. This statement is based on our assumption that the most specialized state for a character must be considered as having passed through (and hence embodying) all the character states leading to it. For instance whereas all gobiesocids have at least one pair of specialized postcleithra modified for support of the sucking disc, *Alabes* has no postcleithra. We believe that evolution of the postcleithra has gone from two to one to no pairs of postcleithra in gobiesocid-*Alabes* phylogeny.

## Conclusions

Inasmuch as (1) *Alabes* exhibits at least one specialization found otherwise only in the gobiesocids, (2) it shares a large number of other specializations with all or some gobiesocids, (3) all the other specializations of *Alabes* (except number of vertebrae) can be derived by reduction from gobiesocid character states (many of which show tendencies toward reduction even among the gobiesocids), and (4) the gobiesocids share no specialization not also found in *Alabes*, we believe that *Alabes* is a gobiesocid. We, therefore, synonymize the Cheilobranchidae Gill (1872, emended from the original Chilobranchidae; = Alabetidae Gill, 1906, occasionally spelled Alabidae in the literature) with the Gobiesocidae Bleeker (1860, emended from the original Gobiesocioidei).

## Intrafamilial Relationships of *Alabes*

The relationships of *Alabes* to the other genera are difficult to assess because of the extreme state of reduction in *Alabes* of most of the characters ordinarily used to relate gobiesocids. We agree with Böhlke and Robins (1970) that Briggs' (1955) subfamilial classification is in need of major revision, but we prefer not to attempt that extensive task. The brief discussion that follows is a distillation of our impressions based on examination (varying from superficial to detailed) of numerous gobiesocid genera and species.

With the exception of number of vertebrae, *Alabes* appears to have followed an overall path of reduction, much more so than any other clingfish genus. As far as we know, the genus *Gastrocymba*, among the other gobiesocids, exhibits the greatest overall degree of reduction (for example: no preoperculomandibular sensory canal or pores, only one pair of postcleithra, only five branchiostegals, epipleural ribs begin on third vertebra). In addition, *Gastrocymba* has more vertebrae (total: 53-54) than any other gobiesocid except *Alabes* (total: 60-78). A high number of vertebrae appears to be a specialization in gobiesocids; hence, the general trend toward reduction in *Gastrocymba*, together with an increase in number of vertebrae, indicates two paths of specialization coupled otherwise only in *Alabes*. While the data are admittedly

scanty, we propose that *Gastrocymba* is the genus most closely related to *Alabes* (that is, the two genera form a sister group).

### The Species of *Alabes*

We recognize four species in *Alabes*, two of which we describe as new. For purposes of identification, we provide a table of diagnostic characters (Table 1) for the species rather than a key. The table also serves as the primary description of each species, and many of the characters are not repeated in the formal descriptions.

#### *Alabes dorsalis* (Richardson)

FIGURE 11

*Cheilobranchus dorsalis* Richardson, 1845 [NW coast of Australia, BMNH 1848.3.18.37, 4 syntypes].

*Cheilobranchus aptenodytum* Richardson, 1845:51 [above highwater mark on Penguin Island, 72°S latitude, BMNH 1848.3.18.75, holotype].

*Chilobranchus rufus* Macleay, 1881:266 [Port Jackson, AM I.16264-001, 14 syntypes, and Tasmania, AM I.16265-001, 17 syntypes].

*Alabes cuvieri* Vaillant, 1905a:149; 1905b:1714 [Nouvelle-Hollande = Australia, MNHN 2181, 3 syntypes].

The diagnostic characters of this species are given in Tables 1 and 2 and are not repeated here.

REMARKS.—Variation in numbers and number of posteriormost vertebra bearing an epipleural rib is reported in Table 2. In eastern Australia there is a tendency for average numbers of vertebrae to increase from north to south, with the exception that specimens from South Australia have lower averages than might be expected from the longitudinal position of the localities. The trends in the average number of the posteriormost vertebra bearing an epipleural rib are not clear, but the highest averages are found in populations from the area (Tasmania) also having the highest average numbers of total vertebrae.

NOMENCLATURE DISCUSSION.—Richardson differentiated his *C. aptenodytum* from his *C. dorsalis*

TABLE 1.—Comparison of the diagnostic characters of the species of *Alabes*

Characters	<i>dorsalis</i>	<i>brevis</i>	<i>parvulus</i>	<i>hooesii</i>
Pelvic fins.....	Present, obvious	Absent, fin-fold questionably present	Absent	Absent
Pelvises and pelvic-fin rays.....	Present	Absent	Absent	Absent
Coracoids.....	Present	Absent	Absent	Absent
Gill-opening width.....	≥ eye diameter	≈ eye diameter	<< eye diameter	<<< eye diameter
Posterior nasal canal pore*.....	Absent	Usually absent (present unilaterally in 1 specimen)	Usually absent (present unilaterally in 3 and bilaterally in 1 specimen)	Present (absent unilaterally in 2 specimens)
Dorsal and ventral lacrymal canal pores*..	Present	Present	Usually present	Present
Postocular sensory canal pores*.....	1	2 (3 unilaterally in 1 specimen)	1	2
Vertebrae.....	66-78	60-61	63-74	67-71
Posteriormost epipleural rib on vertebra.....	21-28	21	16-20	14-16
Diastema in hypural plate.....	Absent	Present	Present or absent	Present or absent
Longest specimen (TL)	120 mm	23 mm	47 mm	44 mm
Number of specimens examined.....	over 150	3	39	11

\*See Figure 10 for pore terminology

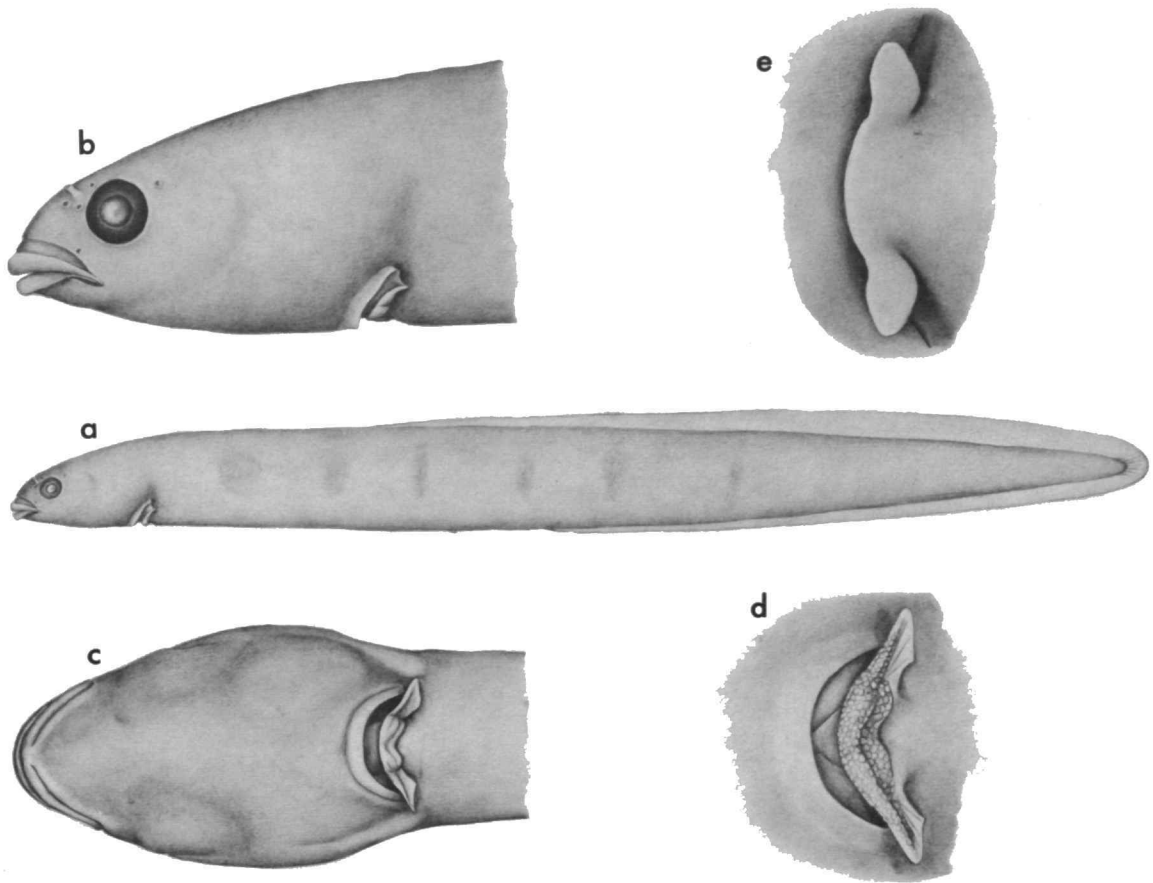


FIGURE 11.—*Alabes dorsalis*: a, lateral view; b, lateral view of head region; c, ventral view of head region; d, ventral view of gill opening, pelvic fins, and vestigial sucking disc; e, ventral view of gill opening and pelvic fins. (a–d, USNM 201415, Kangaroo Island, South Australia, ca. 77 mm TL; e, USNM 214499, Green's Beach, Tasmania; drawn by Jack R. Schroeder.)

on the basis of some trivial, proportional differences (body less compressed, back and belly more obtuse, gill opening more distant from snout). Günther (1870) considered the two species to be synonymous and we find no basis for considering them distinct. We are dubious of the correctness of the type-localities of both species. We know of no other records of *Alabes* from northwestern Australia, which would be rather warm relative to those localities where *Alabes* is known with reasonable certainty to occur. *Alabes dorsalis* appears to be uncommon in Western Australia, from where only one specimen (from the southern coast)

is definitely known to have been collected. The type-locality of *C. aptenodytum* from 72°S latitude is most suspicious. The specimen supposedly was taken on land and had presumably passed undamaged through the gut of a penguin. Aside from these peculiar circumstances, we know of no littoral species or genus of fish that is common to both Antarctica and Australia.

Macleay distinguished his *Chilobranthus rufus* from *Cheilobranthus dorsalis* on the basis of the former's having dark spots on the body, which the latter lacked. The presence or absence of the spots in *A. dorsalis*, as well as their number, is variable.

TABLE 2.—Frequency distributions for number of vertebrae and posteriormost vertebra bearing an epipleural rib in *Alabes dorsalis*

Localities	Vertebrae														Posteriormost vertebra bearing an epipleural rib								
	66	67	68	69	70	71	72	73	74	75	76	77	78	$\bar{x}$	21	22	23	24	25	26	27	28	$\bar{x}$
Queensland.....					2	-	1							70.7	1	1	2	1					22.6
New South Wales																							
Ulladulla.....			1	1	1	1	2							70.3		2	3	1					22.8
Bradley's Head.....					1	-	2							71.3		2							22.0
Pittwater.....			1	-	-	1								69.5		1	1						22.5
Victoria																							
Port Phillip Bay.....				1	3	2	2		1	-	-	1	1	72.2	1	1	-	4	4	1			24.1
Bell's Beach.....					1	-	1							71.0				1	1				23.5
Altona.....				1	1	3	1	1						71.0			3	2	2				23.8
South Australia																							
Moonta.....		1	2	-	-	1								68.5			1	2	1				24.0
Kangaroo Island.....	1	2	6	10	6	2	1							69.0	1	7	9	8	2				23.1
Robe.....		1															1						
Fiddler's Bay.....			1	1										68.5		1	1						22.5
Tasmania																							
Green's Beach.....				4	3	10	8	3	1					72.2			7	9	7	3	1		24.3
Ulverstone.....					1	1	1	1						72.5		1	2	1					23.0
Davenport.....							1																
Oyster Bay.....					1	1	3	5	2					73.5			1	7	4	1			24.4
Maria Island.....									1								1						
Eaglehawk Neck.....																	1						
Port Arthur.....						1											1						
Hobart.....					2	2	5	3	-	2				73.2	1	-	3	5	5				25.4
Mt. Esperance.....						1	1	1						74.0		1	-	1	1				23.7
D'Entrecasteaux Channel.....									6	-	-	1		75.4				1	3	3			25.3
Wedge Bay.....									1											1			
Great Taylor Bay.....						1	1	-	3					74.0			2	-	3				24.2
South Port.....						1	2	-	1					74.2		1	2	1					23.0
Western Australia																							
North Point.....													1										1
Type specimens																							
<i>dorsalis</i> (northwest coast of Australia)...						2	-	-	2					72.5				1	3				24.8
<i>aptenodytum</i> (Penguin Island, 72°S lat.)...					1												1						
<i>rufus</i> (Tasmania).....						1	4	5	4	1				73.0		2	5	4	4				23.7
<i>cuvieri</i> (Australia).....						1											1	1					23.5

Scott (1974) reported 0-9 spots per side in Tasmanian specimens. There is also a tendency for spots to be absent in long preserved specimens, indicating that they fade. Both males and females exhibit the spots.

Vaillant distinguished *A. cuvieri* on the basis of its having the dorsal-fin fold origin well posterior to the head rather than near the nape (Scott, 1974, distinguished *Chilobranchnus rufus* from *Cheilobranchnus dorsalis* using the same character). The origin of the fin folds in *A. dorsalis* are difficult to determine, but we have seen no specimen in which we would consider the dorsal fold as originating close to the head (including one specimen identified by Scott as *A. dorsalis*). During preservation, shrinkage appears to cause the formation of pseudo-folds in the skin, and these folds may appear to be continuous with the natural fin fold.

The dorsal-fin fold origin in *A. dorsalis* varies in position from slightly in advance to slightly posterior to a vertical from the anus.

MATERIAL EXAMINED.—AUSTRALIA: MNHN 2181 (3 syntypes of *Alabes cuvieri*); NW coast, BMNH 1848.3.18.37 (4 syntypes of *Cheilobranchnus dorsalis*). Queensland: QM I.8951-55 (5). New South Wales: Pittwater, AM IA.5447 (2); Bradley's Head (Sydney), AM IB.4507 (3); Ulladulla, AM I.18519-001 (6). Victoria: Altona, AM IA.5930 (4), IA.5910 (3); Bell's Beach, AM I.16981-007 (1), I.16982-012 (1); Port Phillip Bay, AM I.7618 (1), I.9003 (4), BMNH 1884.11.12.1 (1), 1887.10.10.12-15 (2), 1890.9.16.32-33 (2), WAM P.4579 (1). South Australia: Robe, AM I.13730 (1); Kangaroo Island, AM IA.7 (4), IA.8 (4), IA.10 (4), IA.11 (4), IA.12 (4), USNM 87361 (6), 201415 (2, including one cleared and stained); Moonta, AM IA.7090 (4); Fiddler's Bay, AM I.17615-005 (2). Western Australia: North Point, Boulder Hill, AMNH 31306 (1, cleared and stained). Tasmania: AM I.16265-001 (17 syntypes of *Chilobranchnus rufus*); Cole's Bay, AM I.17553-019 (1); Green's Beach, USNM 214100 (2, including one cleared

and stained), 214497 (11), 214498 (2), 214499 (10), 214500 (1); Ulverstone, AM I.6260-63 (4); Davenport, AM IB.4564 (1); Oyster Bay, AM I.1103 (8), I.10620-2 (6); Maria Island, AM IA.8065 (1); Eaglehawk Neck, AM I.17545-010 (1); Port Arthur, AM IB.2902 (1); Hobart, AM I.14207 (6), IB.2481 (4), QM I.265 (1), I.8948-50 (3); Mt. Esperance, AM I.12284 (3); D'Entrecasteaux Channel, AM IA.4110 (4), IA.4111 (3); Wedge Bay, AM I.17193-003 (1); Great Taylor Bay, AM IB.1291 (5); South Port, AM IA.3617 (4). PENGUIN ISLAND (supposedly 72°S latitude): BMNH 1848.3.18.75 (holotype of *Cheilobranchus aptenodytum*).

*Alabes brevis*, new species

DESCRIPTION.—The diagnostic characters of this species are given in Tables 1 and 3 and are not repeated here. The three known specimens are quite small, not in good condition, and are probably juveniles. No evidence of color pattern is present on any of the specimens. The caudal fin is well developed for an *Alabes*, and there are 9 or 10 caudal-fin rays, 8 articulating with the hypural fan, which has a diastema separating the dorsal and ventral portions.

COMPARISONS.—*Alabes brevis* is distinguishable from all the other species of *Alabes* by its low number of vertebrae, and from all but *A. hoesei* in having 2 postocular pores. Aside from number

of vertebrae, it differs from *A. hoesei* in usually lacking a posterior nasal canal pore, having more epipleural ribs, and a larger gill opening.

ETYMOLOGY.—The specific epithet is from the Latin, meaning "short," and refers to the reduced number of vertebrae that characterizes the species.

HOLOTYPE.—WAM 24385: 20 mm TL; Green Island, Rottneest, Western Australia; among weed and rock, limestone reef platform; collected by L. M. Joll, 25 April 1972.

PARATYPES.—WAM 24386-7: 2 specimens, 16-23 mm TL; same data as holotype.

*Alabes parvulus* (McCulloch)

FIGURES 12 AND 13

*Cheilobranchus parvulus* McCulloch, 1909:316 [rock pools near Sydney; AM I.9954, lectotype, designated in account below].

The diagnostic characters of this species are given in Tables 1 and 3 and are not repeated here.

REMARKS.—The disposition of the sensory canal pores in *A. parvulus* is variable and to some extent related to geography. Specimens from New South Wales and South Australia have lacrymal canal

TABLE 3.—Frequency distributions for number of vertebrae and posteriormost vertebra bearing an epipleural rib in *Alabes brevis*, *A. parvulus*, and *A. hoesei*

Species	Vertebrae														Posteriormost vertebra bearing an epipleural rib																
	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	x	14	15	16	17	18	19	20	21	x						
<i>Alabes brevis</i>																															
Western Australia																															
Rottneest.....	1*	2															60.7									3*	21.0				
<i>Alabes parvulus</i>																															
New South Wales																															
Ulladulla.....															72.0									18.3							
Manly.....															70.2	1	1	11*	7	1					18.7						
Long Reef.....	1	-	-	2	1	-	-	1	4*	4	2	1					71.6	1	2	2					17.5						
South Australia																															
Fiddler's Bay.....															1									1							
Tasmania																															
Cole's Bay.....															1									1							
Western Australia																															
Seal Island.....															66.7	2	1					16.3									
Norfolk Island																															
Emily Bay.....															1									1							
<i>Alabes hoesei</i>																															
New South Wales																															
Manly.....															1									1							
South Australia																															
Robe.....															70.0	1	3*	2					15.2								
Fiddler's Bay.....															1									1							
Tasmania																															
Cole's Bay.....															69.0	2	1					15.7									

\*Denotes count for holotype or lectotype



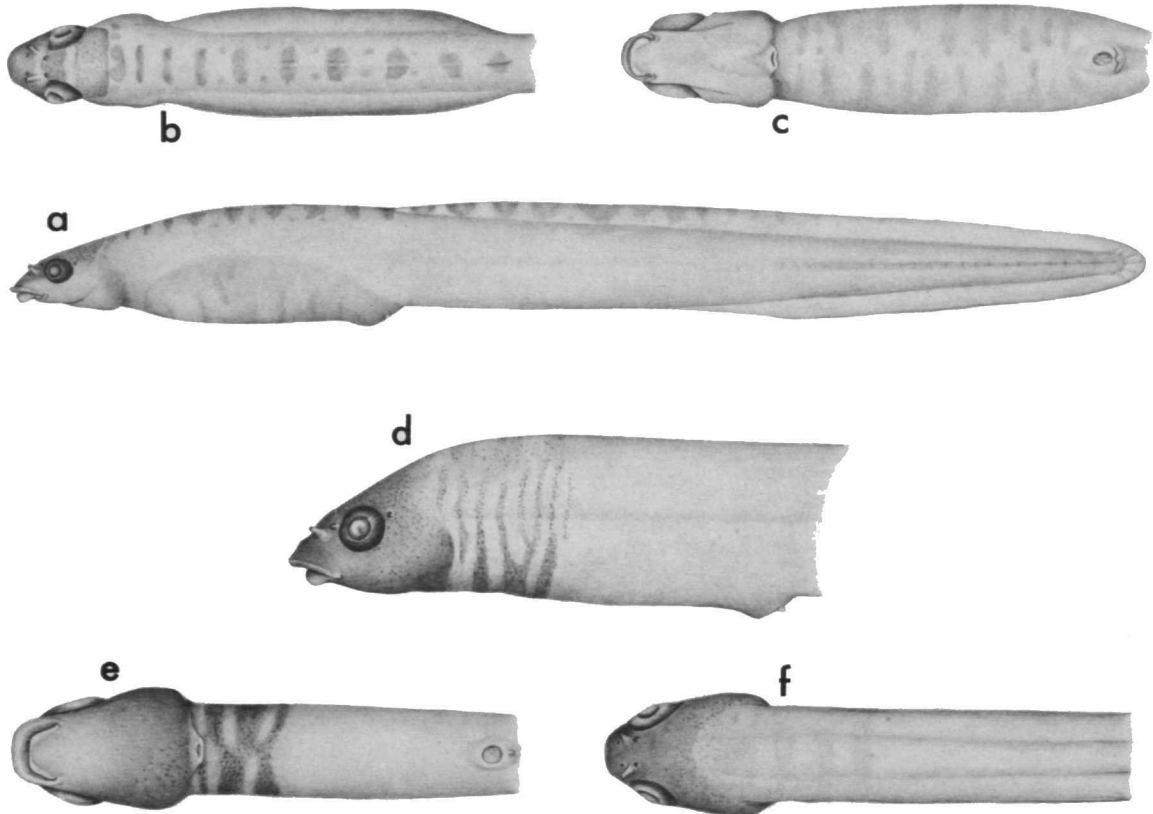


FIGURE 12.—*Alabes parvulus* (a-c, female, 42 mm TL; d-f, male, 38 mm TL): a, lateral view; b, dorsal view; c, ventral view; d, lateral view; e, ventral view; f, dorsal view. (WAM P.25365-001, Seal Island, Western Australia; drawn by Jack R. Schroeder.)

pores and occasionally have posterior nasal canal pores. Specimens from Tasmania, Western Australia, and Norfolk Island lack lacrymal canal pores and none have posterior nasal canal pores (some specimens from Tasmania and Western Australia exhibit blind porelike depressions unilaterally in the positions where the dorsal or ventral lacrymal canal pores ordinarily occur).

There are indications that numbers of vertebrae and epipleural ribs vary geographically (Table 3).

The one available Norfolk Island specimen (male) has a slightly different color pattern (Figure 13) from that of either the male or female Western Australian specimens (Figure 12), which agree closely with McCulloch's (1909) description of the color pattern of New South Wales specimens. (All

we saw were faded; McCulloch's description appears to be based on both sexes.) The dorsal-fin fold origin of the Norfolk Island specimen is much farther posteriorly than that of any other *Alabes* specimen we have seen, and it is possible that the Norfolk Island species will merit description if additional specimens exhibit the same differences shown by our single specimen. The caudal region of the Norfolk Island specimen is malformed.

**LECTOTYPE DESIGNATION.**—McCulloch did not designate a holotype or specify the number of specimens he had examined when he described *C. parvulus*, but he did indicate that he had "many." He gave, however, the total length of only one specimen (47 mm) in the descriptive account, although he mentioned under "observa-

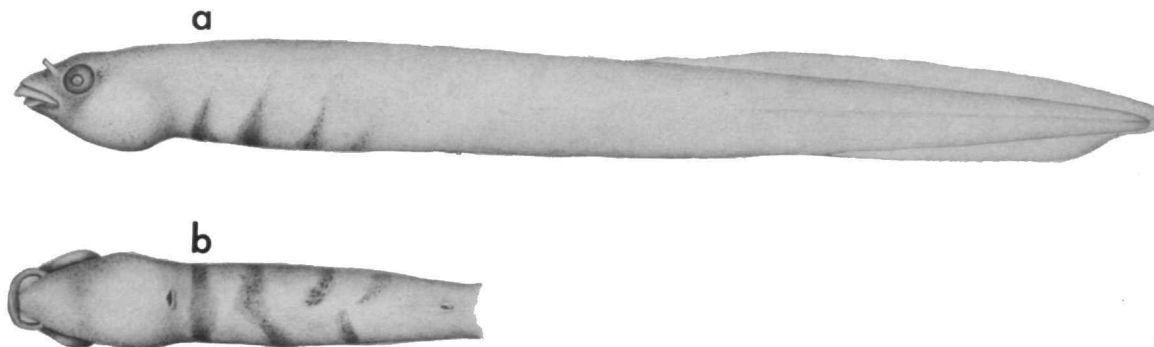


FIGURE 13.—*Alabes parvulus* (male, 32 mm TL): a, lateral view; b, ventral view. (AM I.18470-002, Emily Bay, Norfolk Island; drawn by Jack R. Schroeder.)

tions" that females had large eggs at 37 mm. The only specimen among the syntypes that is close to 47 mm is contained in a lot of four specimens collected at Freshwater Bay, Manly, by Basset Hull, during May 1909, and bearing the catalog number AM I.9954-5. This specimen, which is 47 mm TL, is here designated the lectotype of *C. parvulus* and assigned the catalog number I.9954. The three other syntypes in the lot now bear the catalog number I.9955.

There are a considerable number of other syntypes (of which we have seen only 20) at AM bearing the catalog number I.9266, also collected by Hull at Manly, but dated January 1908. One syntype formerly in I.9266 has been recataloged as I.18471-001, as it represents an undescribed species; it is designated a paratype of *Alabes hoesei* under the description of that species.

**MATERIALS EXAMINED.**—New South Wales: Ulladulla, AM IB.447 (3); Long Reef, AM IA.1253 (2, including one cleared and stained), IA.5892 (2), I.17019-026 (1); Manly, Freshwater Bay, AM I.9266, in part (20 syntypes, others at AM not examined), I.9954 (lectotype), I.9955 (3 syntypes). South Australia: Fiddler's Bay, AM I.17615-004 (1). Tasmania: Cole's Bay, AM I.17553-005 (1). Western Australia: Safety Harbor, WAM P.25465-001 (4). Norfolk Island: Emily Bay, AM I.18470-002 (1).

#### *Alabes hoesei*, new species

FIGURE 14

**DESCRIPTION.**—The diagnostic characters of this species are given in Tables 1 and 3 and are not

repeated here. Only two specimens showed evidence of a color pattern (Figure 14); the other specimens were faded. The color pattern closely resembles that of the female *A. parvulus* in Figure 12a.

**REMARKS.**—*Alabes hoesei*, *A. parvulus*, and *A. dorsalis* have all been obtained in the same collection from Cole's Bay, Tasmania.

**COMPARISONS.**—*Alabes hoesei* resembles *A. brevis* in having two postocular pores (the other two species have only one), but differs from *A. brevis* in having a posterior nasal canal pore (unilaterally present in one of the three specimens of *A. brevis*), more vertebrae, fewer epipleural ribs, and a smaller gill opening. *A. hoesei* is probably most closely related to *A. parvulus*; both have highly restricted gill openings. *A. hoesei* differs from *A. parvulus* in having two postocular pores, posterior nasal canal pores (rarely present in *A. parvulus*), and modally fewer epipleural ribs.

**ETYMOLOGY.**—Named for Dr. D. F. Hoese (AM) who provided much of the material upon which our study is based.

**HOLOTYPE.**—AM I.18470-001: 34 mm TL; Robe, South Australia; rock platform; collected by D. F. Hoese, K. and R. Meguro, and R. Kuronuma, 3 October 1975 (original number DFH 75-212).

**PARATYPES.**—AM I.18470-002: 5 specimens, 26-28 mm TL; same data as holotype. AM I.17615-003: 30 mm TL, Fiddler's Bay, South Australia. AM I.18471-001: 25 mm TL, Freshwater Bay, Manly, New South Wales (formerly a syntype of *Cheilobranchus parvulus*). AM I.17553-017: 44 mm TL, Cole's Bay, Tasmania. AM I.17553-018: 34 and 38 mm TL, Cole's Bay, Tasmania.

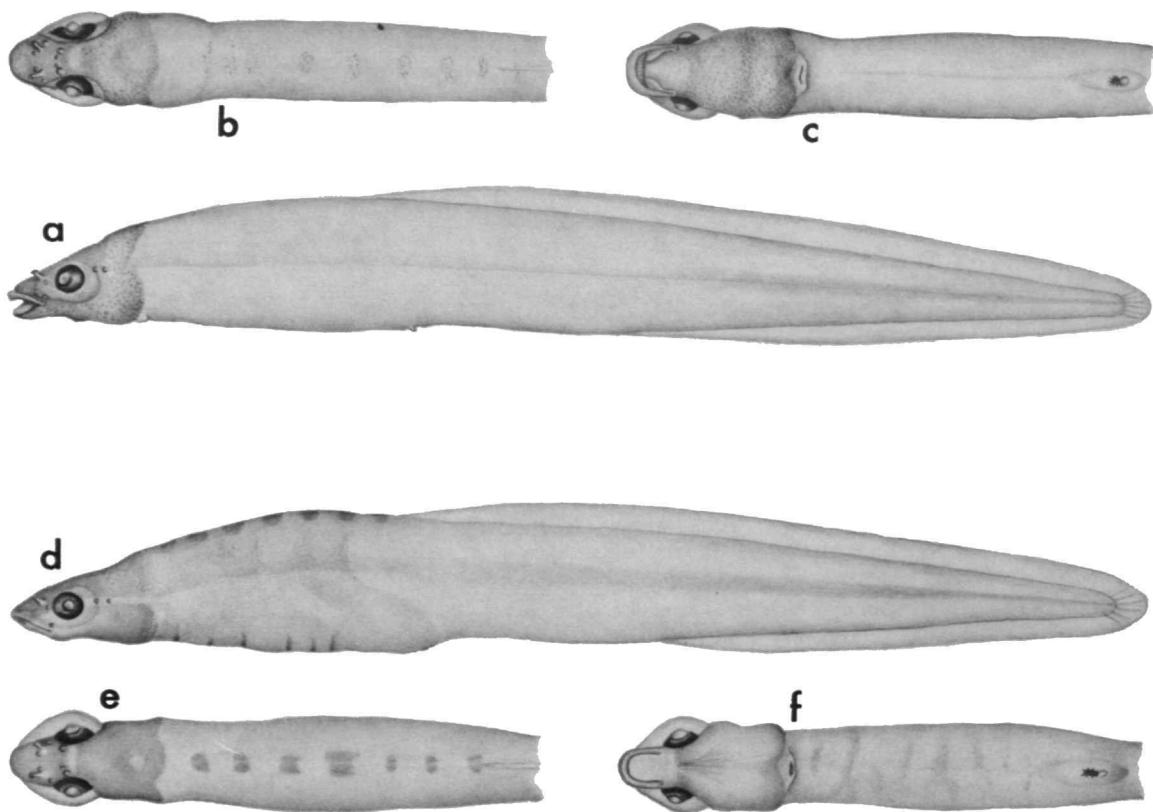


FIGURE 14.—*Alabes hoesei* (a-c, holotype, 34 mm TL; d-f, paratype, 28 mm TL): a, lateral view; b, dorsal view; c, ventral view; d, lateral view; e, dorsal view; f, ventral view. (Robe, South Australia; a-c, AM I.18470-001; d-f, AM I.18470-002; drawn by Jack R. Schroeder.)

## Literature Cited

- Bleeker, P.  
1860. Over eenige Vischsoorten van de Kaap de Goede Hoop. *Natuurkundig Tijdschrift voor Nederlandsch-Indië*, 21:49-80.
- Böhlke, J. E., and C. R. Robins  
1970. A New Genus and Species of Deep-dwelling Clingfish from the Lesser Antilles. *Notulae Naturae*, 434:1-12.
- Briggs, J. C.  
1955. A Monograph of the Clingfishes (Order Xenopterygii). *Stanford Ichthyological Bulletin*, 6:1-224.
- Cloquet, H.  
1816. Alabes. Pages 99-100 in supplement of volume 1 of *Dictionnaire des Sciences Naturelles*.
- Cuvier, G. L. F. C. D.  
1817. *Le Règne Animal*. Volume 3, xviii + 532 pages. Paris.
- Gill, T.  
1872. Arrangement of the Families of Fishes or Classes Pisces, Marsipobranchii, and Leptocardii. *Smithsonian Miscellaneous Collections*, 247: xlv + 49 pages.  
1906. The Fish Genus *Alabes* or *Cheilobranchus*. *Science*, new series, 23(589):584-585.
- Gosline, W. A.  
1968. The Suborders of Perciform Fishes. *Proceedings of the United States National Museum*, 124(3647): 1-78.
- Greenwood, P. H.  
1975. *J. R. Norman's A History of Fishes*. Third edition, xxv + 467 pages. New York: John Wiley and Sons.
- Guitel, F.  
1888. Recherches sur les lepadogasters. *Archives de Zoologie Expérimentale et Générale*, series 2, 6:423-647, plates 24-37.
- Günther, A.  
1870. *Catalogue of the Fishes in the British Museum*. Volume 8, xxv + 549 pages. London.
- Leray, C.  
1961. Contribution a l'étude osteologique de *Gouania wildenowi* Risso (teleosteans) (squelette cephalique et ceintures). *Cahiers de Biologie Marine*, 2(1):41-52.
- Macleay, W.  
1882. Descriptive Catalogue of the Fishes of Australia, part 3. *Proceedings of the Linnean Society of New South Wales*, 6(2):202-386.
- McCulloch, A. R.  
1909. Studies in Australian Fishes, number 2. *Records of the Australian Museum*, 8(4):315-321, plates 90-91.
- Regan, C. T.  
1912. The Anatomy and Classification of the Symbranchoid Eels. *Annals and Magazine of Natural History*, series 8, 9:387-390, plate 9.
- Richardson, J.  
1845. Ichthyology of the Voyage of H. M. S. Erebus and Terror. Pages 17-52 in number [2] in volume II of J. Richardson and J. E. Gray, editors, *The Zoology of the Voyage of H. M. S. Erebus and Terror . . . 1839-1843*. London.
- Rosen, D. E., and P. H. Greenwood  
In press. [A study of the Synbranchiformes—title indefinite].
- Rosen, D. E., and C. Patterson  
1969. The Structure and Relationships of the Paracanthopterygian Fishes. *Bulletin of the American Museum of Natural History*, 141(3):357-474, plates 52-78.
- Runyan, S.  
1961. Early Development of the Clingfish. *Gobiesox strumosus* Cope. *Chesapeake Science*, 2(3-4):113-141.
- Scott, E. O. G.  
1974. Observations on Some Tasmanian Fishes, part XX. *Papers and Proceedings of the Royal Society of Tasmania*, 108:171-197.
- Swainson, W.  
1838. *The Natural History of Fishes, Amphibians, and Reptiles, or Monocardian Animals*. Volume 1: vi + 368 pages; volume 2: vi + 452 pages. London.
- Starks, E. C.  
1905. The Osteology of *Caularchus maeandricus* (Girard). *Biological Bulletin*, 9(5):292-303.
- Taylor, W. R.  
1967. An Enzyme Method of Clearing and Staining Small Vertebrates. *Proceedings of the United States National Museum*, 122(3596):1-17.
- Vaillant, L.  
1905a. Description de poissons nouveaux ou imparfaitement connus de la collection du Muséum D'Histoire Naturelle: Le Genre *Alabes* de Cuvier. *Nouvelles Archives du Muséum D'Histoire Naturelle*, series 4, 7(1):145-152; and (2):153-158.  
1905b. Le genre *Alabes* de Cuvier. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, 140:1713-1715.
- Waite, E. R.  
1923. *The Fishes of South Australia*. 243 pages. Adelaide: Government Printer.



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