

**STUDY OF THE DORSAL GILL-ARCH MUSCULATURE
OF TELEOSTOME FISHES, WITH SPECIAL
REFERENCE TO THE ACTINOPTERYGII**

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**Appendix: Phylogenetic Analysis of 147 Families of Acanthomorph Fishes
Based Primarily on Dorsal Gill-Arch Muscles and Skeleton**

Victor G. Springer and Thomas M. Orrell

PLATES

“Art survives long after ideas go extinct—particularly if the art is good and the ideas less consistently so.”
Joel Achenbach (2000), *Smithsonian Magazine*, 32(1):123.

This study was initiated about 1996 as the primary effort of the first author (VGS), who had long been interested in determining the interrelationships of the acanthomorph family Pholidichthyidae. Springer and Freihofner (1976) last discussed the problematic interrelationships of the then monospecific family (Springer and Larson, 1996, described a second *Pholidichthys* species). Subsequently, Stiassny and Jensen (1987), expanding on the work of Kaufman and Liem (1982), hypothesized the composition and interrelationships of an acanthomorph suborder Labroidae. Stiassny and Jensen based their hypothesis on a relatively broad selection of acanthomorph fishes and almost exclusively on a limited number of gill-arch characters. Referring only to Springer and Freihofner's (1976) study, they noted similarities of the gill-arch skeleton of *Pholidichthys* to that of the labroids.

Johnson (1993:9–10) discussed errors of oversight and commission in Stiassny and Jensen's (1987) study and noted, critically, that, other than characters associated with pharyngognathy, there was none that corroborated monophyly of the labroids. VGS re-examined *Pholidichthys* in light of Stiassny and Jensen's and Johnson's studies, and noted problems with both, although he agreed with Johnson's general criticism. As a result, VGS, with the assistance of GDJ, undertook to survey a wide variety of acanthomorph fishes to determine the distribution of the states of the muscle characters used by Stiassny and Jensen. VGS expanded the study to include a broad spectrum of non-acanthomorph fishes because of problems in determining muscle homologies among the acanthomorphs.

Darrow joined the project as full-time illustrator in the fall of 1997 and remained on the project until mid-2000, after which she continued on contract and then as volunteer until late 2003, when all the gill-arch muscle illustrations were completed.

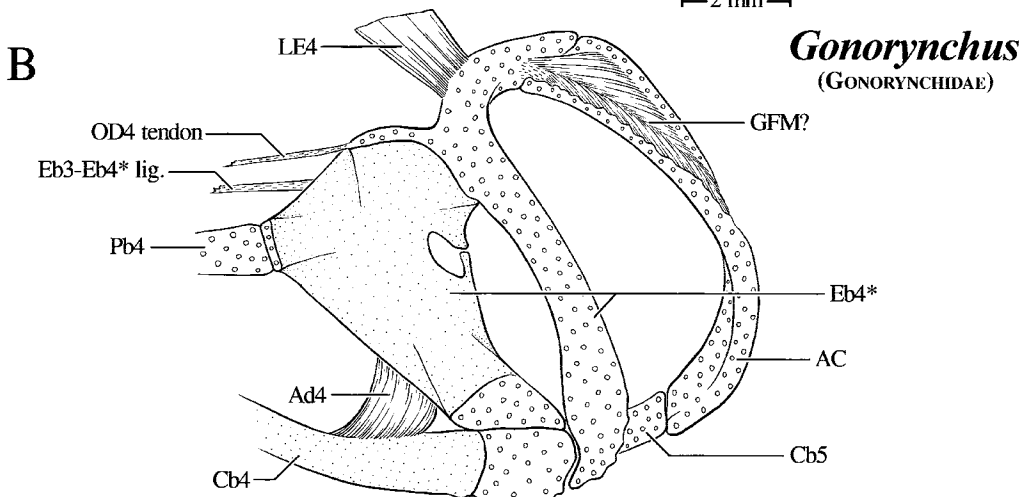
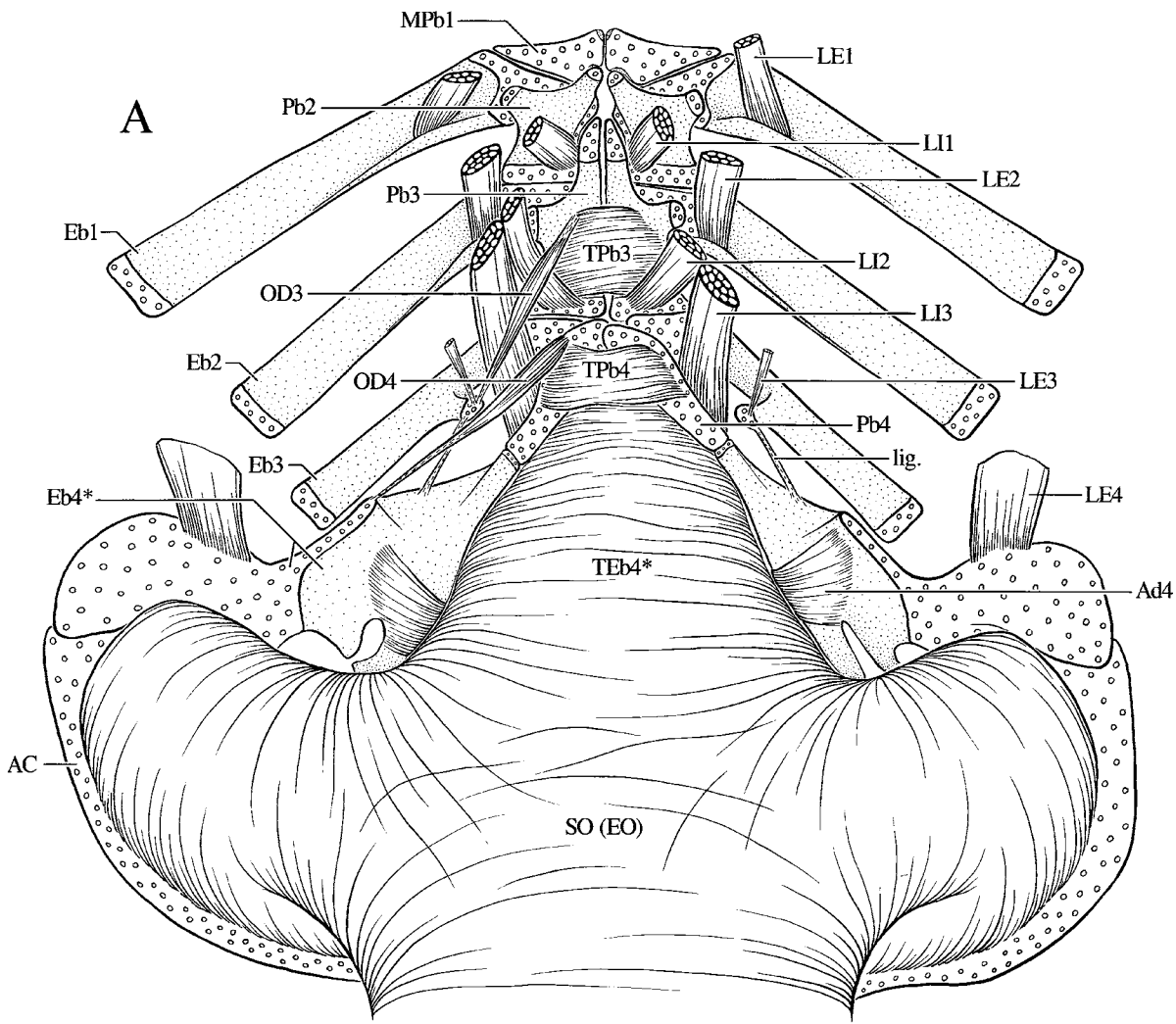
VGS contracted with Tom Orrell to run PAUP program analyses of a limited number of acanthomorph taxa beginning in 2002, but in 2003 involved him in the preparation of the major cladistic analysis forming our co-authored Appendix to the present study.

After essentially completing the actinopterygian pre-acanthomorph portion of the study, including an

analysis of the data, and much of the descriptive portion of the acanthomorphs, joint efforts with GDJ ceased in early 2002 at the sole instigation of VGS.

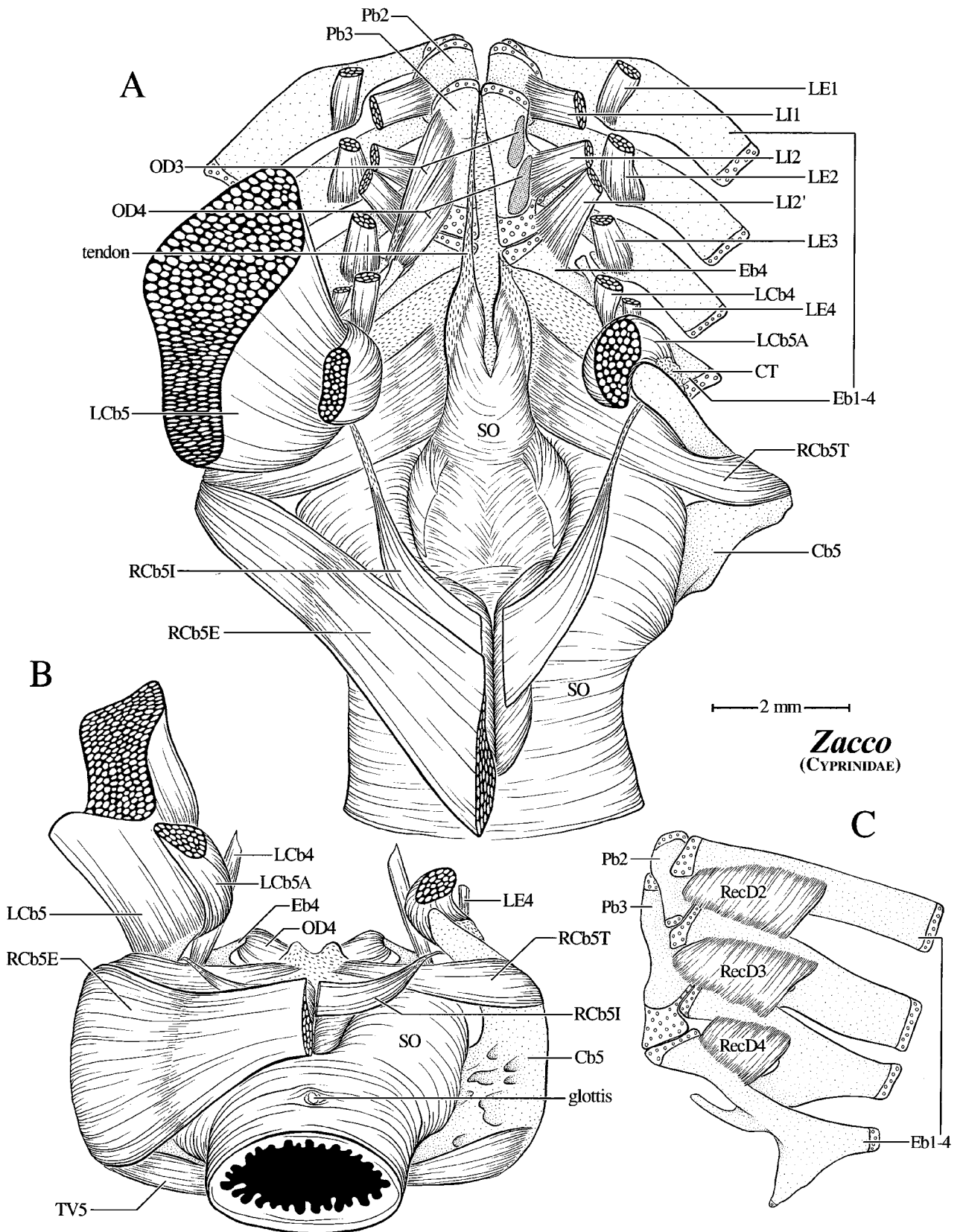
VGS is responsible for selecting most of the taxa used in the study, preparing a large majority of the dissections, all the descriptions, supervision of preparation of all the illustrations, the partially new system of nomenclature used to designate the muscles, the interpretation and results of the non-acanthomorph portion of the study, most of the acanthomorph interrelationships, discussions that are not outgrowths of the cladistic analyses, all of the choices of taxa, characters, and character codes for the cladistic analyses, and preparation of all preliminary and final drafts of the entire manuscript. *I, VGS, therefore, accept full responsibility for all errors, factual or otherwise, and eccentricities that this study embodies.* On the other hand, I gladly share with my co-authors responsibility for any favorable aspects of the study. I especially want to thank them for their input: GDJ for his early encouragement and important suggestions for taxa to include, ready and comprehensive knowledge of the existing classifications of many groups of fishes and their defining characters, and his often constructive challenges, his critical reading of an early complete draft of the pre-acanthomorph section of the actinopterygian portion of the study, early drafts of a large number of the acanthomorph descriptions and discussions, commenting on a near final draft of the pre-Appendix portion of the manuscript, and very importantly, for bringing Karie Darrow to my attention; Karie Darrow for her dedication to the project, even after monetary compensation ceased, and the unstinting use of her great illustrative talents, as well as for the numerous occasions on which she caught my descriptive mistakes; and to Tom Orrell for his insightful and knowledgeable handling of the PAUP program used in the phylogenetic analysis, important suggestions for the preparation and interpretation of the output, and patience under stress of my importunities.

In the pre-Appendix portion of the text that follows, the editorial "we" and "our" are used to accord with authorship, but their use is not intended to imply agreement by the second author.



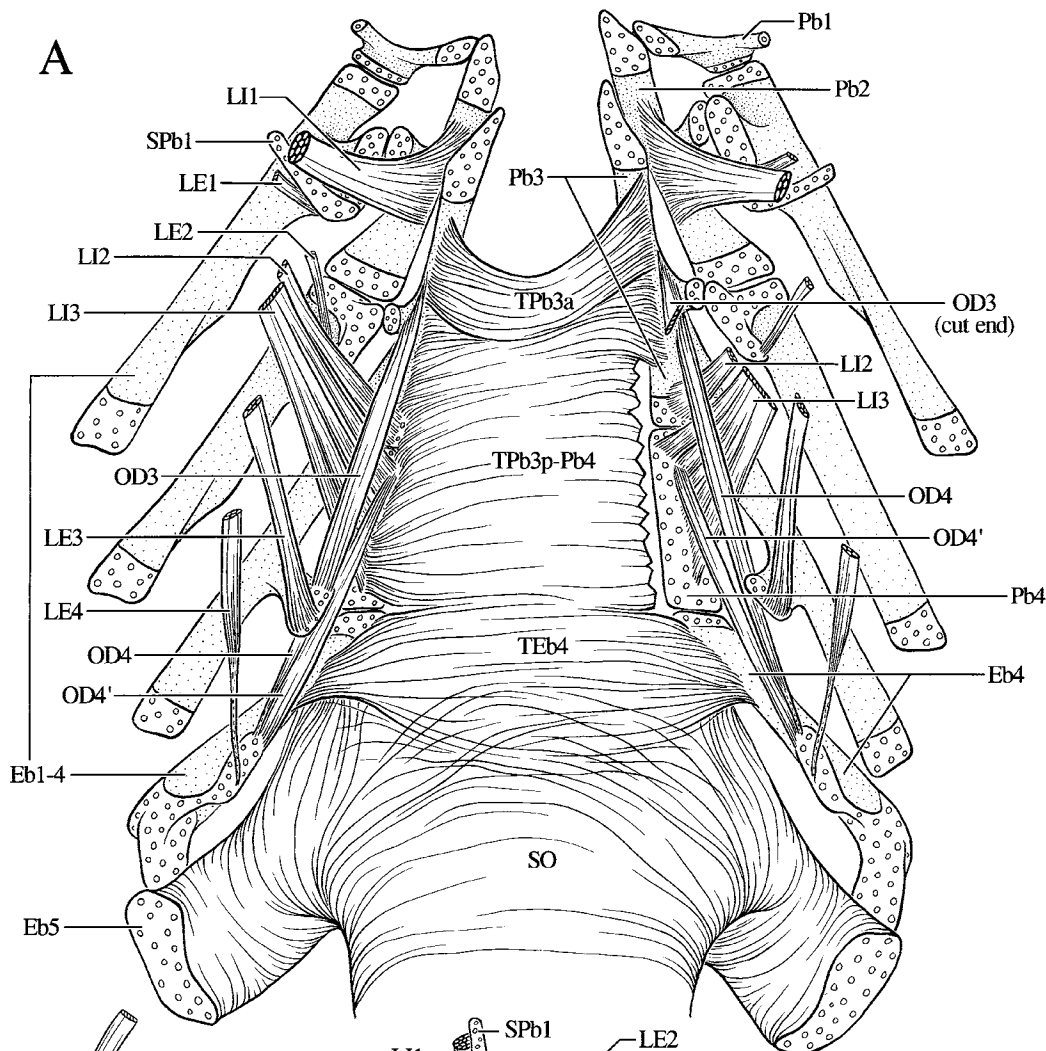
Gonorhynchus
(GONORYNCHIDAE)

Plate 31. *Gonorhynchus moseleyi* Jordan and Snyder, USNM 354590: A, dorsal view, esophagus truncated, right-side OD3 and OD4 removed, sparse SO longitudinal fibers extending anteriorly from below TPb4 to below TPb3 not shown; B, lateral view, posterior gill-arch skeleton to show AD4. Identification of LE4 questionable; see remarks following LP in species description.

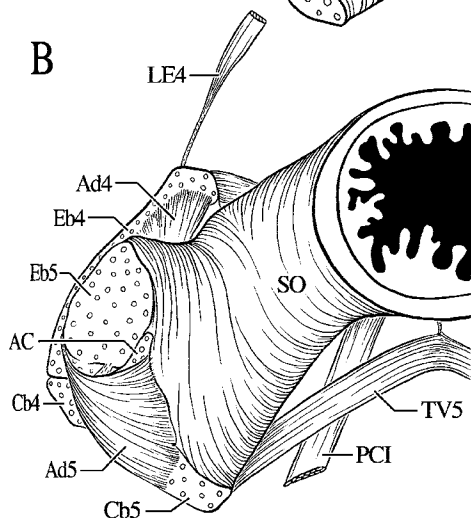


Plates 32.1, 32.2. *Zacco platypus*, USNM 336890: A, dorsal view: right-side Rcb5E, LCb5, OD3, and OD4 removed (OD origins on Pb3 indicated by shaded areas); fascia covering dorsoanterior SO extensions greatly simplified, cut back on right side; SO longitudinal muscle layer not shown; B, posterior view, right-side Rcb5E and LCb5 removed; C, ventral view, right-side dorsal gill-arch skeleton showing Recd2, 3, and 4; D, lateral view, left side. (enlarged inset shows autogenous bone, AB, at dorsal tip of Eb4 levator process).

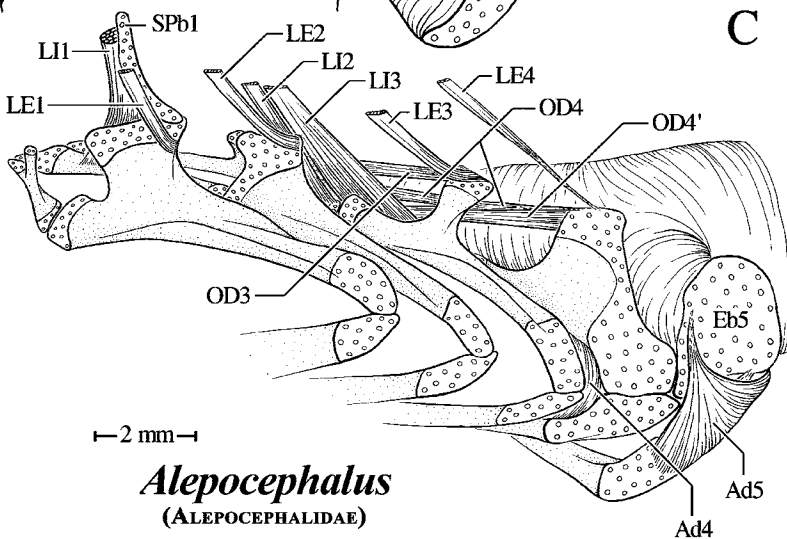
A



B

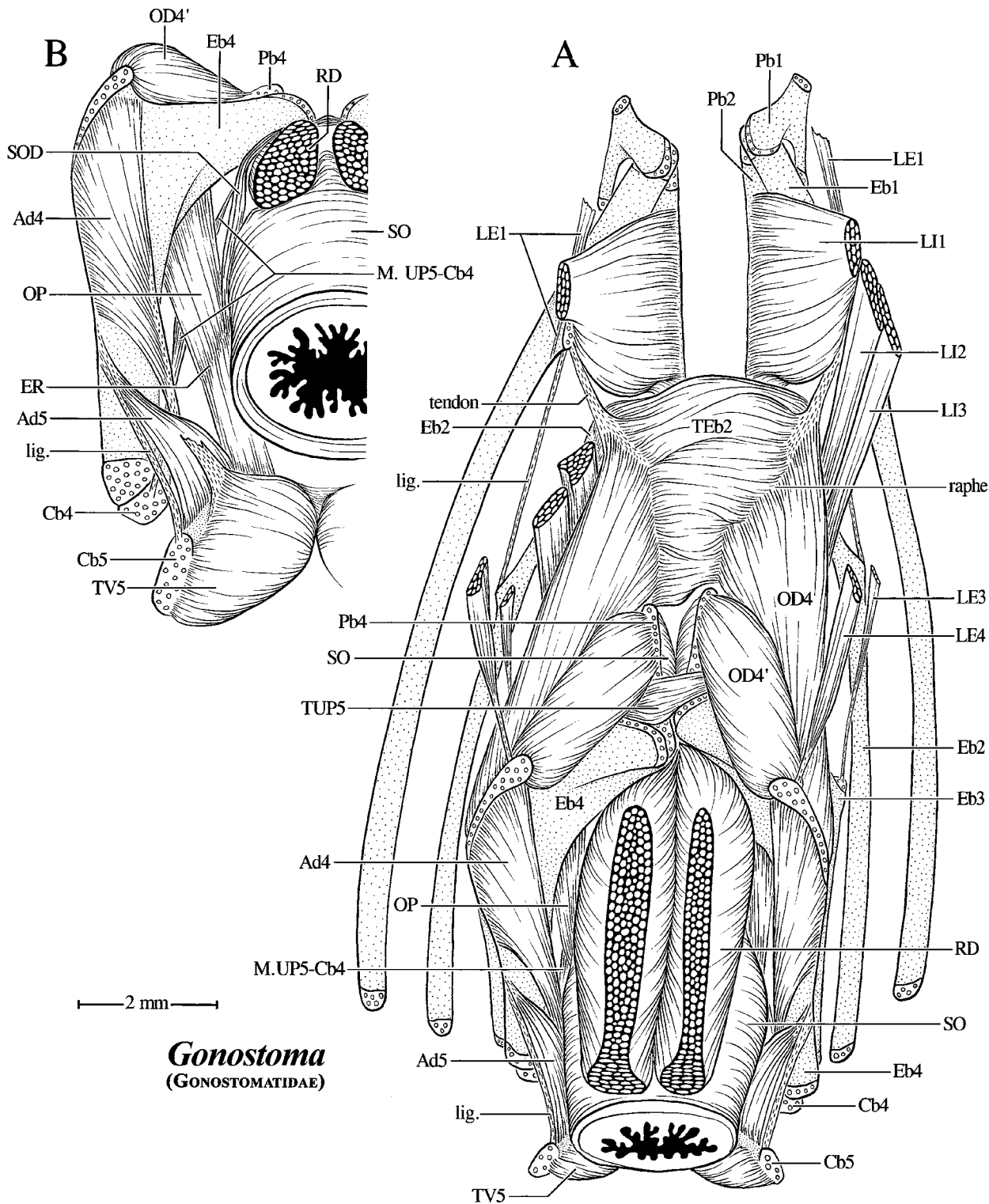


C

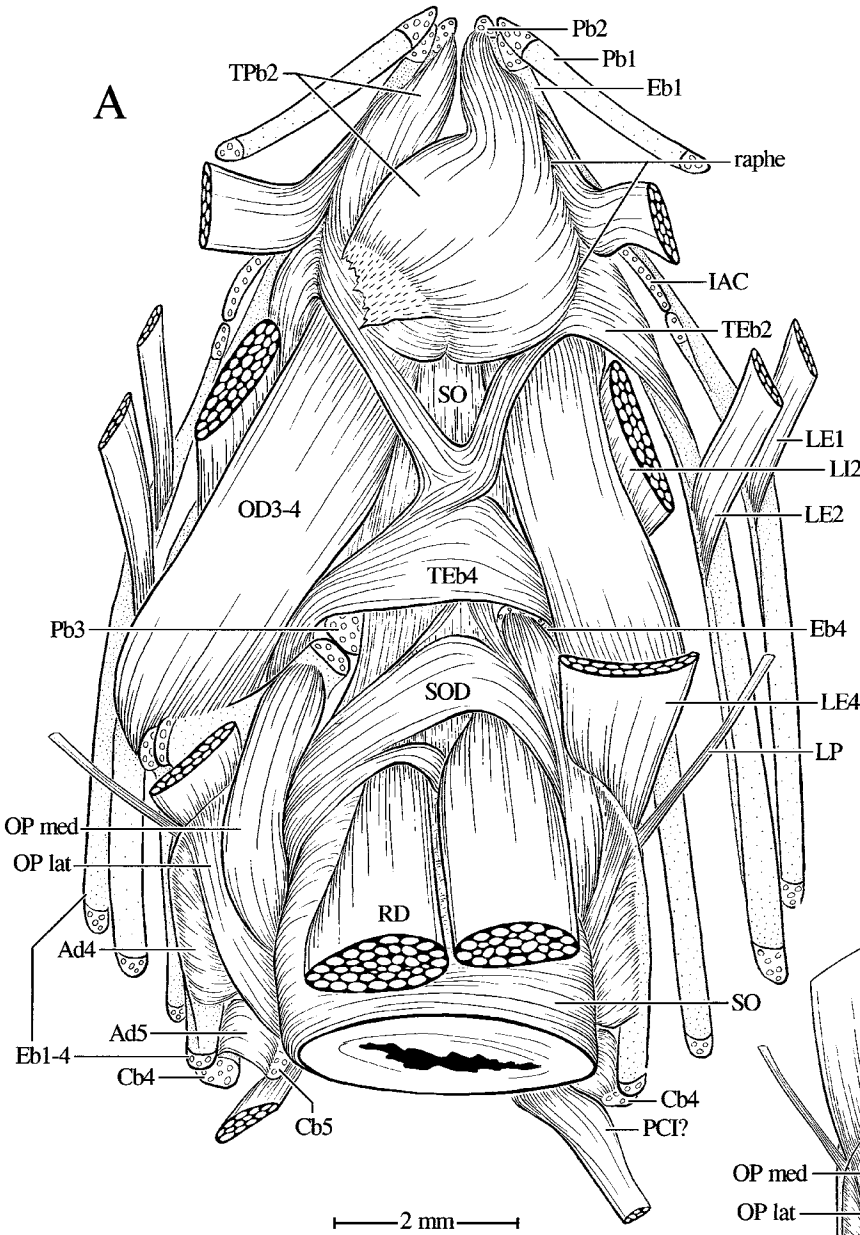


Alepocephalus
(ALEPOCEPHALIDAE)

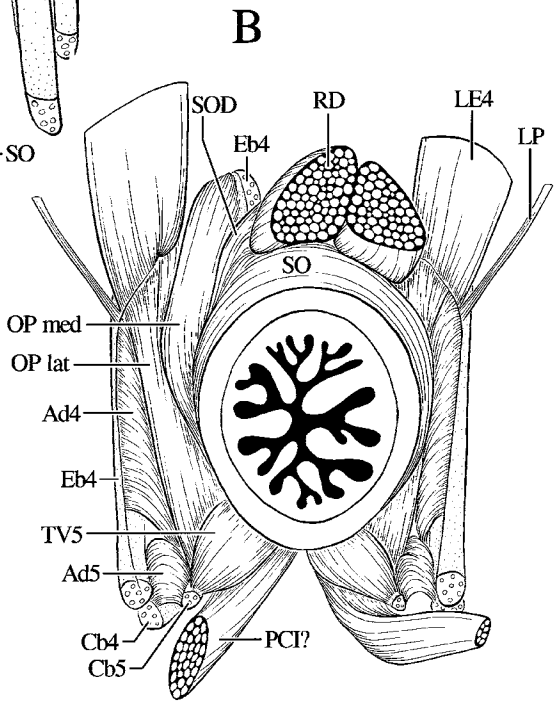
Plate 45. *Alepocephalus tenebrosus*, USNM 215582: A, dorsal view, right-side TPb3p-Pb4 and OD3 cut away to reveal Pb3 and Pb4 and insertions of LI2 and LI3; B, posterior view, left side, Ad5 occludes view of AC, tendon attaches AC to Eb5 ventromedial corner; C, lateral view, left side. Attachments of LE1 and LI1 to SPb1 released.



Plates 52.1, 52.2. *Gonostoma elongatum*, USNM 330309: A, dorsal view; B, posterior view, left side, RDs removed nearly to their insertions and bones spread to clarify muscle attachments; LE4 removed; C, lateral view, right side reversed.



Psettodes
(Psettodidae)



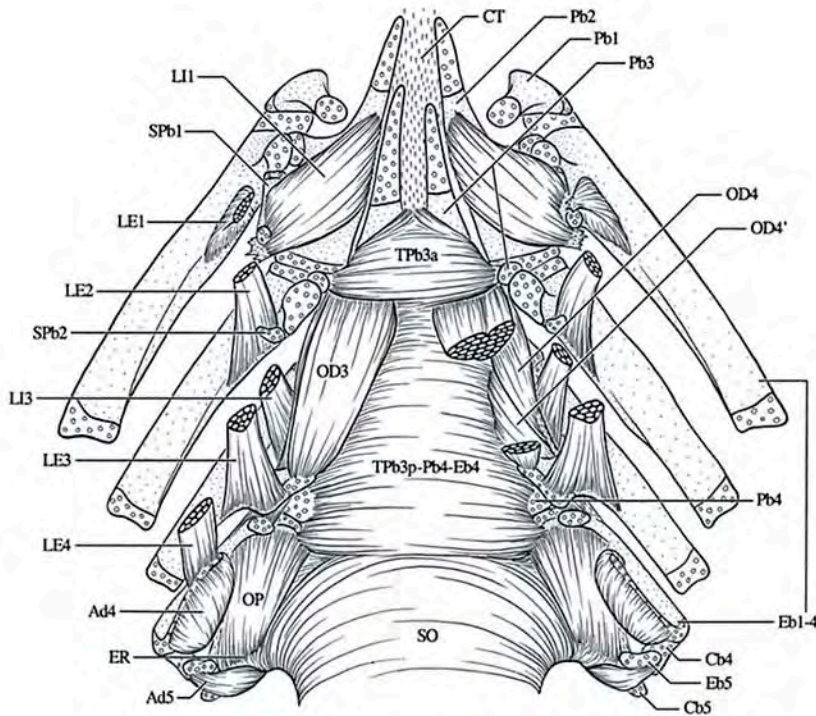
Plates 205.1, 205.2. *Psettodes erumei*, USNM 366443 (eyes on left side): A, dorsal view. B, posterior view. C, lateral view, left side, all right-side (Rt) elements indicated.

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