

APPENDIX II

A long snout enchodontid fish (Aulopiformes: Enchodontidae) from the Early Cretaceous deposits at the El Chango quarry, Chiapas, southeastern Mexico: A multi-approach study

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This appendix presents the modifications made to some characters reported in previous works, it also shows the complete list of the characters used in the phylogenetic analyses, highlighting those that were not considered or included due to be phylogenetically uninformative (autoapomorphic or invariant). Also, it is possible to find the matrices employed in the phylogenetic exercises and the complete phylogenies obtained.

I. Modifications to the discrete morphological matrix

The characters 45 and 91 from Díaz-Cruz et al. (2019b) were reinterpreted because these were recognized as composed characters (see Brazeau, 2011). Originally, character 91, among other characters, was added to the matrix by Holloway et al. (2017). This character in turn, the preopercle shape, was taken from the study made by Silva and Gallo (2011). In that matrix, the preopercle shape is the character number 56, and it has four character states: L-shaped (0); triangular (1); crescent-shaped (2); rod-shaped (3); pipe-shaped (4) (see Silva and Gallo, 2011:83). In our phylogenetic exercise, only two character states, L-shaped (0) and triangular (1) are present in the evaluated taxa.

In addition, character 45, the ventral portion of preopercle, was in a way, implicitly evaluated in character 91, since the states for this character are: anteriorly directed limb (0); small posterior limb (1); broadens anteriorly and posteriorly (2). For example, whether the preopercle broadens anteriorly and posteriorly, it is almost sure that it is going to be coded as triangular for character 91. Although apparently this unconscious overweight in the character has not affected the results, we propose to reinterpret it as following:

Appealing to the reasons above mentioned, we propose to deal with the preopercle splitting it in:

As it was not mentioned for the living species, we assume the codification made by Fielitz (2004) but it is clearly necessary to look for these states in the living forms as well.

Silva and Gallo (2011):

91.-Shape of the preopercle (number 46 in the updated matrix): crescent or curved (0); rod-shape or straight (1).

45.- Shape of preopercle: crescent or curved [0]; rod-shape or straight [1].

46.- Anteriorly directed limb in the ventral portion of preopercle

Absent (0); present (1).

47.- Posteriorly directed limb in the ventral portion of preopercle

Absent (0); present (1).

48.-Size of posterior limb in the ventral portion of the preopercle

[0] Small posterior limb; [1] Large posterior limb (it forms a spine)

49.- Shape of the posterior limb in the ventral portion of the preopercle.

[0] rounded; [1] Acute (tapers to a point); almost straight [2].

50.- Thickness of the posterior limb in the ventral portion of the preopercle.

Laminar posterior limb (0); stout posterior limb (1).

51.- Posterior margin in the vertical limb of preopercle.

[0] Entire or continuous; [1] rugged

Also, with the revision of *Cimolichthys lewesiensis* from the Natural History Museum, London. We realized that the contact between the quadrate and the ectopterygoid, is

laterally overlapped. Consequently, we propose an additional character state to those proposed by Fielitz (2004)

10.- Ectopterygoid. posterior end goes beneath the anterior end of the quadrate, laterally articulating (2)

45.- Ventral portion of preopercle: anteriorly-directed limb (0); small posterior limb (1); broadens anteriorly and posteriorly (2).

46.- Posterior edge of ventral portion of preopercle. Rounded (0); tapers to point (1); tapers to point, with spine (2)

91.-Preopercle shape, Character 91 in our matrix (Character number 56 in Silva and Gallo, 2011).

'L-shaped' (0); triangular (1); 'crescent-shaped' (2); 'rod-shaped' (3); 'pipe-shaped' (4)

Complete list of characters used in the present work. The list includes the new modified characters.

1.- Shape of the rostrodermethmoid: narrow with lateral wings [0]; wide with lateral wings narrow [1]; without lateral wings [2].

2.- Contact of rostrodermethmoid with frontals: ventrally [0]; dorsally [1]; without overlap or underlap [2].

3.- Dermal pattern on frontal bones: absent [0]; present as radiating ridges [1]; present as ridges with tubercles along each ridge [2]; present as tubercles [3].

4.- Parietal bones: meet with each other medially [0]; separated by the supraoccipital [1].

5.- Occipital sensory canal on parietal bones: absent [0]; covered by a heavy ridge of bone [1]; in a trough [2].

6.- Vomerine teeth: present [0]; absent [1].

7.- Facet for articulation with the hyomandibula: posteroventral to the dilatator fossa [0]; ventral to the dilatator fossa [1].

8.- Posttemporal fossa: unroofed [0]; roofed [1].

9.- Parasphenoid: narrow beneath the orbit [0]; wide beneath the orbit [1].

10.- Ectopterygoid: articulates flush with the quadrate's anterior margin [0]; inserts into an anterior incisure of the quadrate [1]; posterior end goes beneath the anterior end of the quadrate or laterally articulating [2].

11.- Endopterygoid teeth: present [0]; absent [1].

12.- Ectopterygoid teeth: absent [0]; numerous (>8) and all of about the same size [1]; between six to eight teeth with the second tooth longest [2].

13.- Dermopalatine teeth: numerous and in several rows [0]; several in a single row [1]; a single tooth [2].

- 14.- Dermopalatine bone:** at least twice as long relative to the longest dermopalatine tooth [0]; shorter than the longest dermopalatine tooth [1].
- 15.- Dermopalatine teeth cross section:** conical [0]; laterally compressed with two cutting edges [1]; two offset cutting edges [2]; elliptical with one anterior cutting edge [3].
- 16.- Lateral view of dermopalatine teeth:** curved [0]; straight [1]; sigmoidal [2].
- 17.- Dermopalatine teeth apical barbs:** absent [0]; present [1].
- 18.- Second epibranchial uncinat process:** absent [0]; present and enlarged [1]; present, not enlarged [2].
- 19.- Cartilaginous condyle on dorsal surface of third pharyngobranchial:** articulates with second epibranchial [0]; absent [1].
- 20.- Gill rakers:** long [0]; present as tooth plates [1].
- 21.- Second pharyngobranchial toothplate:** present [0]; absent [1].
- 22.- Third pharyngobranchial:** does not extend anteriorly beyond tips of epibranchial 1 and pharyngobranchial 2 [0]; extends beyond tips of epibranchial 1 and pharyngobranchial 2 [1].
- 23.- Third pharyngobranchial toothplate:** covers large area of pharyngobranchial 3 [0]; restricted to lateral edge of pharyngobranchial 3 [1].
- 24.- Third pharyngobranchial teeth:** small [0]; large [1].
- 25.- Fifth ceratobranchial teeth:** scattered over anterodorsal surface [0]; mostly restricted to medial edge of anterodorsal surface [1]; all restricted to medial edge of anterodorsal surface [2].
- 26.- Gap between ceratobranchial 5 and basibranchial 4 cartilage:** absent [0]; present [1]; ceratobranchial separated from main body of basibranchial 4 by tail or small nubbins of cartilage extending posteriorly from basibranchial 4 [2].
- 27.- Basibranchial 3:** terminates beneath anterior of basibranchial 4 cartilage [0]; terminates beyond posterior of basibranchial 4 cartilage [1];
- 28.- Third hypobranchial gill rankers or toothplates:** present [0]; absent [1].
- 29.- Number of branquiostegal rays on anterior ceratohyal:** five or more [0]; four or less [1].
- 30.- Maxilla:** excluded from gape of jaw [0]; included in gape and is toothed [1]; maxilla included in gape, but teeth absent [2].
- 31.- Shape of premaxilla:** long and narrow [0]; deep anterior with long ascending process [1]; deep anterior with no ascending process [2]; large wedge-shaped bone [3].
- 32.- Premaxillary teeth:** larger than palatine teeth [0]; of equal size with palatine teeth [1]; smaller than palatine teeth [2].
- 33.- Supramaxilla:** absent [0]; two supramaxillae present [1]; single large supramaxilla [2]; single supramaxilla present but greatly reduced [3].
- 34.- Mandible-Quadrate articulation:** exposed on lateral side [0]; hidden [1].
- 35.- Dentary symphysis:** tapers to a narrow point [0]; remains deep [1].
- 36.- Anteroventral prongs:** absent [1]; present [2].
- 37.- Number of dentary tooth rows:** three or more [0]; two [1]; one [1].

- 38.- Dentary teeth:** most or several of equal size [0]; a single long tooth near the symphysis, at least 33% longer than the others posterior to it [1].
- 39.- Dentary teeth posterior to longest tooth:** equal in size [0]; decreasing in size posteriorly [1].
- 40.- Mandibular sensory canal:** open [0]; partially open [0]; enclosed by bone [2].
- 41.- Mandibular dermal pattern:** absent [0]; present as ridges [1]; as ridges with tubercles along each ridge [2]; as tubercles [3].
- 42.- Vertical bar on posterior portion of articular:** absent [0]; present [1].
- 43.- Supraorbital bone:** present [0]; absent [1].
- 44.- Number of infraorbital bones:** six [0]; eight [1]; five [2]; four [3].
- 45*.- Preopercle shape:** crescent or curved [0]; rod-shape or straight [1].
- 46*.- Anteriorly directed limb in the ventral portion of preopercle:** absent [0]; present [1].
- 47*.- Posteriorly directed limb in the ventral portion of preopercle:** absent [0]; present [1].
- 48*.- Size of posterior limb in the ventral portion of preopercle:** small posterior limb [0]; large posterior limb [1].
- 49*.- Shape of the posterior limb in the ventral portion of preopercle:** rounded [0]; acute (tapers to a point) [1]; almost straight [2].
- 50*.- Thickness of the posterior limb in the ventral portion of the preopercle:** laminar posterior limb [0]; stout posterior limb [1].
- 51*.- Posterior margin in the vertical limb of preopercle:** entire or continuous [0]; rugged [1].
- 52.- Opercular horizontal strengthening ridge or bar:** absent [0]; present [1]; continues past posterior edge to form a spine [2].
- 53.- Interopercle:** present [1]; absent [1].
- 54.- Preopercular dermal pattern:** absent [0]; present as ridges [1]; present as ridges with tubercles along each ridge [2]; present as tubercles [3].
- 55.- Opercular and subopercular dermal pattern:** absent [0]; present as ridges [1]; present as ridges with tubercles along each ridge [2]; present as tubercles [3].
- 56.- Pectoral fin position:** close to the lateral midline of the body [0]; low on body [1].
- 57.- Position of the pelvic fin:** anterior to the dorsal fin [0]; at or posterior to the dorsal fin [1].
- 58.- Ventral limb of posttemporal:** ossified [0]; ligamentous [1].
- 59.- Supracleithrum dermal pattern:** absent [0]; present as ridges [1]; present as tubercles [2].
- 60.- Shape of ventral portion of cleithrum:** narrow and maintaining a uniform width [0]; widening anteriorly [1]; widening anteriorly and posteriorly [2].
- 61.- Cleithrum dermal pattern:** absent [0]; present as ridges [1]; present as tubercles [2].
- 62.- Number of postcleithra:** two [0]; one [1]; none [2]; three [3].
- 63.- Pectoral-fin base oriented:** vertically [0]; horizontally [1].

- 64.- Medial process of pelvic girdle:** not joined medially [0]; joined medially by cartilage [1].
- 65.- Posterior process of pelvic girdle:** present [0]; absent [1].
- 66.- Autogenous pelvic cartilages:** absent [0]; present [1].
- 67.- Shape of anterior-most proximal pterygiophore of the dorsal fin:** narrow blade [0]; triangular [1].
- 68.- Anal-fin pterygiophores:** not fused [0]; fused [1].
- 69.- Number of supraneurals:** three or more [0]; two [1]; one [2]; none [3].
- 70.- Percentage of caudal vertebrae:** <25% [0]; 40-60% [1]; >60% [2].
- 71.- Number of open neural arches:** more than four [0]; first four [1]; none [2].
- 72.- First rib originates on:** third vertebra [0]; fourth vertebra [1]; fifth vertebra [2]; second vertebra [3]; first vertebra [4].
- 73.- Ossification of ribs:** in cartilage [0]; some in membrane bone [1]; all in membrane bone [2].
- 74.- Baudelot's ligament:** originates on first vertebra [0]; originates on more than one vertebra [1].
- 75.- Epipleural bone origin:** third vertebra [0]; second vertebra [1]; first vertebra [2].
- 76.- Position of epipleurals:** all beneath horizontal septum [0]; displaced dorsally into horizontal septum [1].
- 77.- Epipleurals on first and second vertebrae:** autogenous [0]; fused to centra [1].
- 78.- Origin of epineurals:** all on the neural arch [0]; some on centrum or parapophysis [1]; all on the centrum [2].
- 79.- Epineurals:** all attached to the axial skeleton [0]; most unattached [1]; all unattached [2].
- 80.- Epicentrals:** ligamentous [0]; ossified [1]; absent [2].
- 81.- Epicentrals attachment:** all attached to either centrum or parapophyses [0]; anterior ones attached to distal end of epipleurals [1].
- 82.- Body scales:** present [0]; lateral line scales only [1].
- 83.- Dorsal bony scutes:** absent [0]; present but small and without ornamentation [1]; present but large and with ornamentation [2].
- 84.- Margin of anal fin:** not indented [0]; indented [1].
- 85.- Fleishy midlateral keel:** absent [0]; present [1].
- 86.- Eyes:** round and laterally directed [0]; slightly flattened and laterally directed [1]; tubular and dorsally directed [2].
- 87.- Mode of reproduction:** separate sexes [0]; synchronous hermaphrodites [1].
- 88.- Stomach walls:** thick, unpigmented [0]; thin, pigmented [1];
- 89.- Swimbladder:** present [0]; absent [1].
- 90.- Larval eyes:** round [0]; vertically elongated [1].
- 91.- Larval head spines:** absent [0]; present [0].
- 92.- Larval peritoneal pigment:** absent [0]; single or multiple unpaired peritoneal pigment sections [0].

- 93.- Placement of articular facet for the hyomandibula:** posteroventral [0]; ventral [1].
- 94.- Number of articular facets for the hyomandibula:** one facet [0]; two facets [1].
- 95.- Teeth on upper jaw:** only straight [0]; absent [1]; curved + straight [2]; only curved [3].
- 96.- Dimension of the opercle:** deeper than long [0]; longer than deep [1].

Table 1. Deactivated uninformative character list:

Character number	Character	Parsimony non-informative characters	Invariant character
26	Gap between ceratobranchial 5 and basibranchial 4 cartilage	X	
47	Posteriorly directed limb in the ventral portion of preopercle	X	X
89	Swimbladder	X	
93	Placement of articular facet for the hyomandibula	X	
96	Dimension of the opercle	X	X

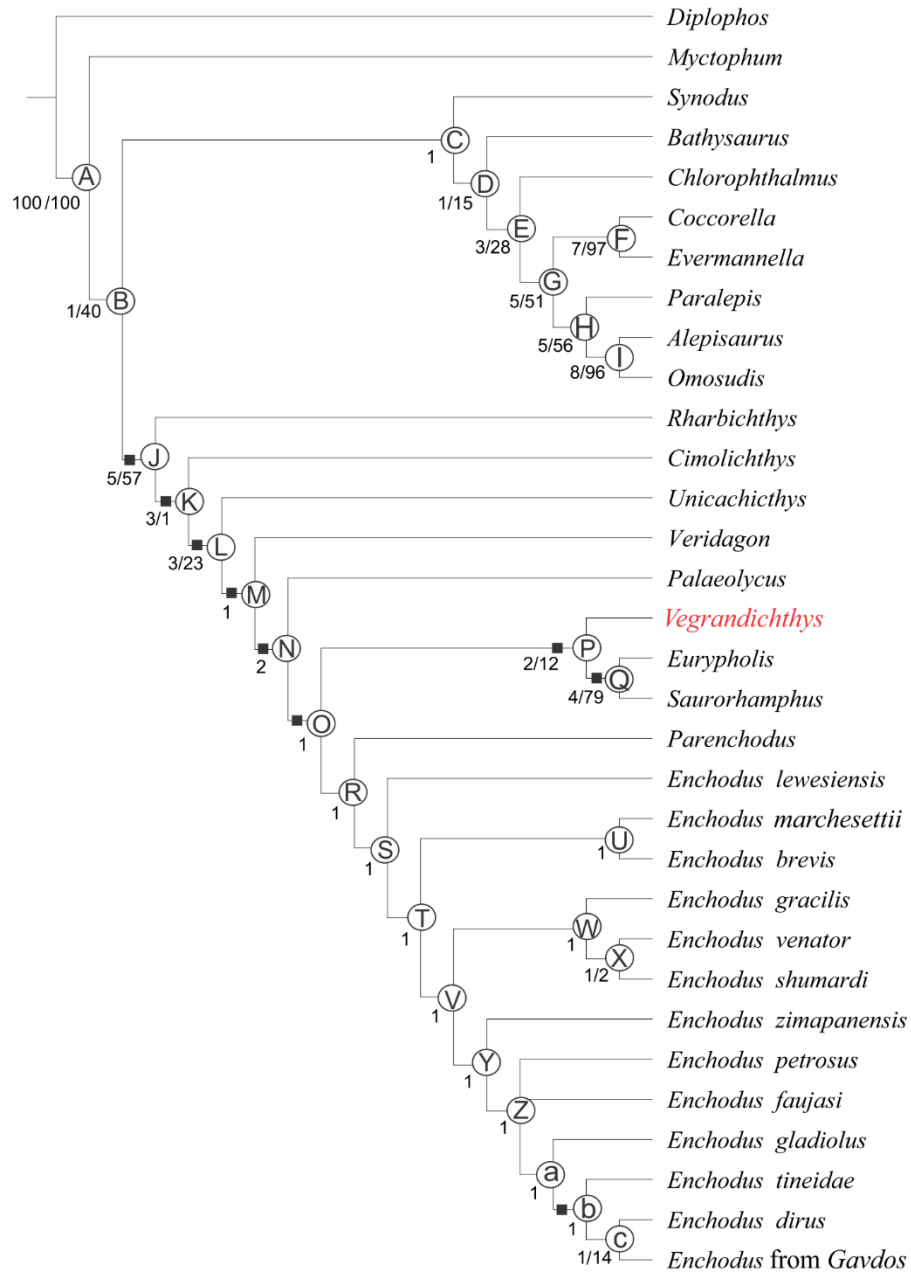


Figure 1. Phylogenetic hypothesis of Enchodontidae obtained with the analysis of discrete characters employing the Maximum Parsimony criterium. Only one tree retained. TL= 316, CI=0.456 and RI=0.693. Black squares indicate presence of synapomorphic characters in the clade. Numbers by nodes show the Bremer/Bootstrap (when present) values.

The full mapping of homoplasies and synapomorphic characters (in bold) by node as following:

Mapping of characters

Node A. No synapomorphies.

Node B. 1: 0→1; 8: 0→1; 11: 0→1; 64: 0→1.

Node C. 17: 0→1; 33: 0→2; 76: 0→1.

Node D. 29: 0→1; 62: 0→3; 65: 0→1; 87: 0→1.

Node E. 1: 1→0; 13: 0→1; 37: 0→2; 69: 0→1; 70: 0→2; 71: 0→1.

Node F. 6: 1→0; 35: 0→1; 58: 0→1; 60: 0→1; 67: 0→1; 78: 0→1; 81: 0→1; 86: 0→2
90: 0→1.

Node G. 2: 0→1; 21: 0→1; 23: 0→1; 25: 0→1; 32: 0→2; 44: 0→1; 56: 0→1; 63: 0→1;
66: 0→1; 84: 0→1.

Node H. 62: 3→0; 70: 2→1; 72: 0→4; 73: 1→2; 74: 0→1; 77: 0→1.

Node I. 15: 0→1; 16: 0→1; 22: 0→1; 27: 0→1; 41: 0→1; 46: 1→0; 54: 0→1; 55: 0→1;
68: 0→1; 85: 0→1; 88: 0→1; 91: 0→1.

Node J. 2: 0→1; 12: 0→1; 32: 0→2; **44: 0→3**; 45: 0→1; 55: 0→1; 69: 0→3.

Node K. 31: 0→3; 33: 0→3; 41: 0→1; 56: 0→1; **83: 0→2**.

Node L (Enchodontidae). **36: 0→1; 43: 0→1; 52: 0→1**; 54: 0→1; **55: 1→2**.

Node M. 38: 0→1; **50: 1→0**; 57: 1→0.

Node N. **12: 1→2**; 15: 0→1.

Node O. 11: 1→0; **41: 1→2; 54: 1→2**.

Node P. 7: 0→1; 55: 2→3; **60: 0→2**.

Node Q. 8: 1→0; **34: 0→1**; 41: 2→3; 48: 0→1; **52: 1→2**; 54: 2→3; 56: 1→0.

Node R. 9: 0→1; 57: 0→1; 70: 1→2.

Node S. 42: 0→1; 83: 2→1.

Node T. 5: 2→1.

Node U. 69: 3→1.

Node V. 15: 1→3.

Node W. 1: 1→0; 11: 0→1.

Node X. 39: 0→1.

Node Y. 61: 2→1; 70: 2→1.

Node Z. 2: 1→0.

Node a. 1: 1→0; **16:** 1→2; 17: 0→1.

Node b. 41: 2→0; 49: 1→0; 54: 2→0; 55: 2→1.

Node c. 37: 1→2,

Diplophos: No autapomorphies:

Myctophum: 26: 0→1; 28: 0→1; 66: 0→1; 71: 0→2; 90: 0→23.

Synodus: 5: 0→1; 9: 0→1; 10: 0→1; 26: 0→2; 72: 0→2.

Alepisaurus: No autapomorphies.

Omosudis: 35: 0→1.

Paralepis: 28: 0→1; 37: 2→1.

Coccorella: 22: 0→1; 25: 1→2; 38: 0→1.

Evermannella: 10: 0→1; 37: 2→1; 39: 0→1; 46: 1→0.

Chlorophthalmus: 20: 1→0.

Bathysaurus: 3: 0→1; 4: 0→1; 28: 0→1; 32: 0→1; 33: 2→1; 72: 0→3; 78: 0→2; 86: 0→1.

Cimolichthys: 1: 1→2; 8: 1→0; 10: 0→2; 93: 1→0; 94: 0→1.

Palaeolycus: 17: 0→1; 35: 0→1; 36: 1→0; 55: 2→1; 83: 2→1.

Rharbichthys: 13: 0→2; 14: 0→1; 15: 0→3; 37: 0→2; 62: 0→3

Eurypholis: 50: 0→1; 94: 0→1

Parenchodus: 2: 1→0; 17: 0→1; 31: 3→2; 35: 0→1; 69: 3→0; 94: 0→1; 95: 0→3.

Unicachichthys multidentata: 10: 0→1; 32: 2→1; 48: 0→1; 51: 0→1; 61: 0→2; 78: 0→2; 79: 0→1; 83: 2→1.

Veridagon: 31: 3→2; 39: 0→1; 60: 0→1; 69: 3→0.

Enchodus lewesiensis: 39: 0→1; 41: 2→1; 49: 1→0.

Enchodus venator: 15: 3→2; 16: 1→0; 31: 3→2; 33: 0→3.

Saurorhamphus: 1: 1→2; 2: 1→2; 12: 2→1; 38: 1→0; 95: 0→3.

Enchodus marchessetti: 11: 0→1; 33: 0→3; 41: 2→3; 54: 2→3; 55: 2→3.

Enchodus petrosus: 10: 0→1; 11: 0→1; 15: 3→2; 37: 1→2; 49: 1→2; 59: 1→0.

Enchodus gladiolus: 10: $0 \rightarrow 1$; 14: $1 \rightarrow 0$.

Enchodus shumardi: 45: $1 \rightarrow 0$.

Enchodus dirus: 49: $0 \rightarrow 2$.

Enchodus brevis: 9: $1 \rightarrow 0$; 31: $3 \rightarrow 2$.

Enchodus faujasi: 3: $2 \rightarrow 1$.

Enchodus gavdos: 41: $0 \rightarrow 1$; 54: $0 \rightarrow 1$.

Enchodus zimapanensis: 8: $1 \rightarrow 0$; 9: $1 \rightarrow 0$; 16: $1 \rightarrow 0$; 36: $1 \rightarrow 0$; 62: $1 \rightarrow 2$; 68: $0 \rightarrow 1$; 83: $1 \rightarrow 0$.

Enchodus tineidae: 40: $0 \rightarrow 2$.

Enchodus gracilis: 7: $0 \rightarrow 1$; 37: $1 \rightarrow 2$.

Vegrandichthys: 10: $0 \rightarrow 1$; 13: $2 \rightarrow 1$; 30: $2 \rightarrow 0$; 31: $3 \rightarrow 0$; 36: $1 \rightarrow 0$; 51: $0 \rightarrow 1$; 67: $1 \rightarrow 0$; 95: $0 \rightarrow 2$.

Table 2. Consistency index per character. Char, Character; ci, consistency index per character; Null, character phylogenetically noninformative.

Char	ci	Char	ci	Char	ci	Char	ci
1	0.286	31	0.429	61	0.5	91	1
2	0.4	32	0.5	62	0.5	92	1
3	0.429	33	0.429	63	0.5	93	Null
4	0.5	34	1	64	1	94	0.333
5	0.667	35	0.2	65	1	95	0.4
6	0.25	36	0.25	66	0.5	96	Null
7	0.5	37	0.2	67	0.25		
8	0.25	38	0.333	68	0.5		
9	0.2	39	0.25	69	0.429		
10	0.286	40	0.286	70	0.333		
11	0.2	41	0.375	71	1		
12	0.667	42	0.333	72	1		
13	0.4	43	1	73	0.667		
14	0.2	44	0.75	74	1		
15	0.5	45	0.2	75	0.5		
16	0.286	46	0.5	76	1		
17	0.25	47	Null	77	1		
18	1	48	0.5	78	0.667		
19	1	49	0.286	79	0.667		
20	0.5	50	0.5	80	0.75		
21	1	51	0.5	81	1		
22	0.5	52	0.667	82	0.5		
23	1	53	0.5	83	0.4		
24	0.5	54	0.429	84	1		
25	1	55	0.429	85	1		
26	Null	56	0.333	86	0.667		
27	1	57	0.25	87	1		
28	0.333	58	1	88	1		
29	1	59	0.333	89	Null		
30	0.5	60	0.5	90	1		

Table 3. Retention index per character. Char, Character; ri, consistency index per character; Null, character phylogenetically noninformative.

Char	ri	Char	ri	Char	ri	Char	ri
1	0.444	31	0.692	61	0.778	91	1
2	0.625	32	0.5	62	0.7	92	1
3	0.636	33	0.6	63	0.8	93	Null
4	0.857	34	1	64	1	94	0
5	0.875	35	0.2	65	1	95	0
6	0.4	36	0.786	66	0.667	96	Null
7	0.667	37	0.385	67	0.667		
8	0.4	38	0.833	68	0.5		
9	0.667	39	0.25	69	0.6		
10	0	40	0.375	70	0.5		
11	0.5	41	0.706	71	1		
12	0.917	42	0.857	72	1		
13	0.75	43	1	73	0.75		
14	0.692	44	0.857	74	1		
15	0.786	45	0.429	75	0.5		
16	0.615	46	0.5	76	1		
17	0.727	47	Null	77	1		
18	1	48	0.5	78	0.5		
19	1	49	0.167	79	0.5		
20	0.5	50	0.5	80	0.667		
21	1	51	0	81	1		
22	0.5	52	0.923	82	0.5		
23	1	53	0.9	83	0.769		
24	0.667	54	0.733	84	1		
25	1	55	0.75	85	1		
26	Null	56	0.714	86	0.5		
27	1	57	0.7	87	1		
28	0	58	1	88	1		
29	1	59	0.556	89	Null		
30	0.8	60	0.8	90	1		

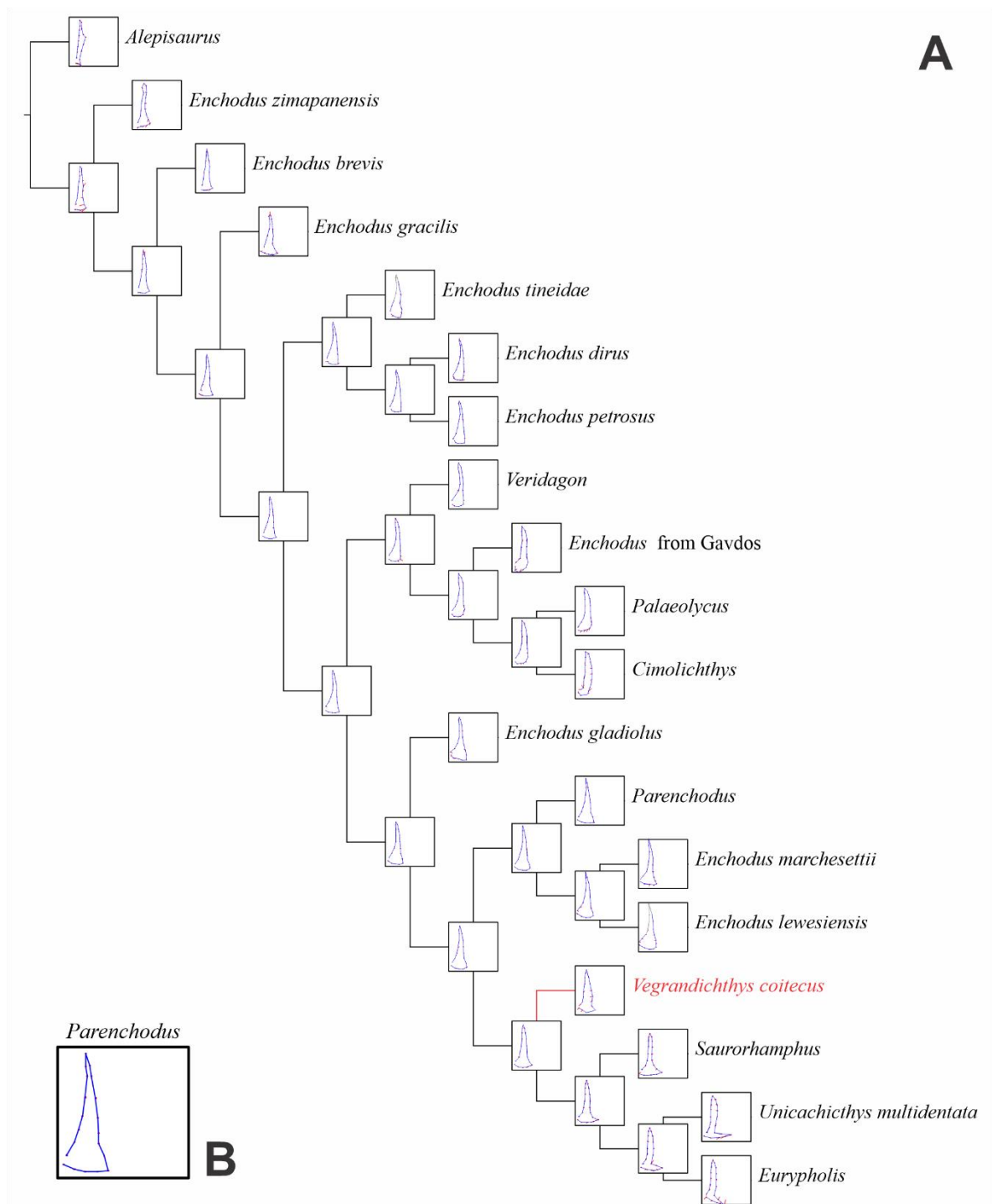


Figure 2. A) Phylogenetic hypothesis of Enchodontidae using Phylogenetics Morphometrics. B) Landmark configuration for the opercle showing in red points the 20-landmark used in the analysis. Best score for the only one retained tree: 0.04079. Branch in red points out the phylogenetic position of *Vegrandichthys coitecus* gen. et sp. nov. This hypothesis shows the configurations for each ancestral and terminal node. In this phylogenetic exercise *Vegrandichthys* is retrieved as a member of the subfamily Eurypholinae. Numbers by nodes show the Bremer/Bootstrap values.

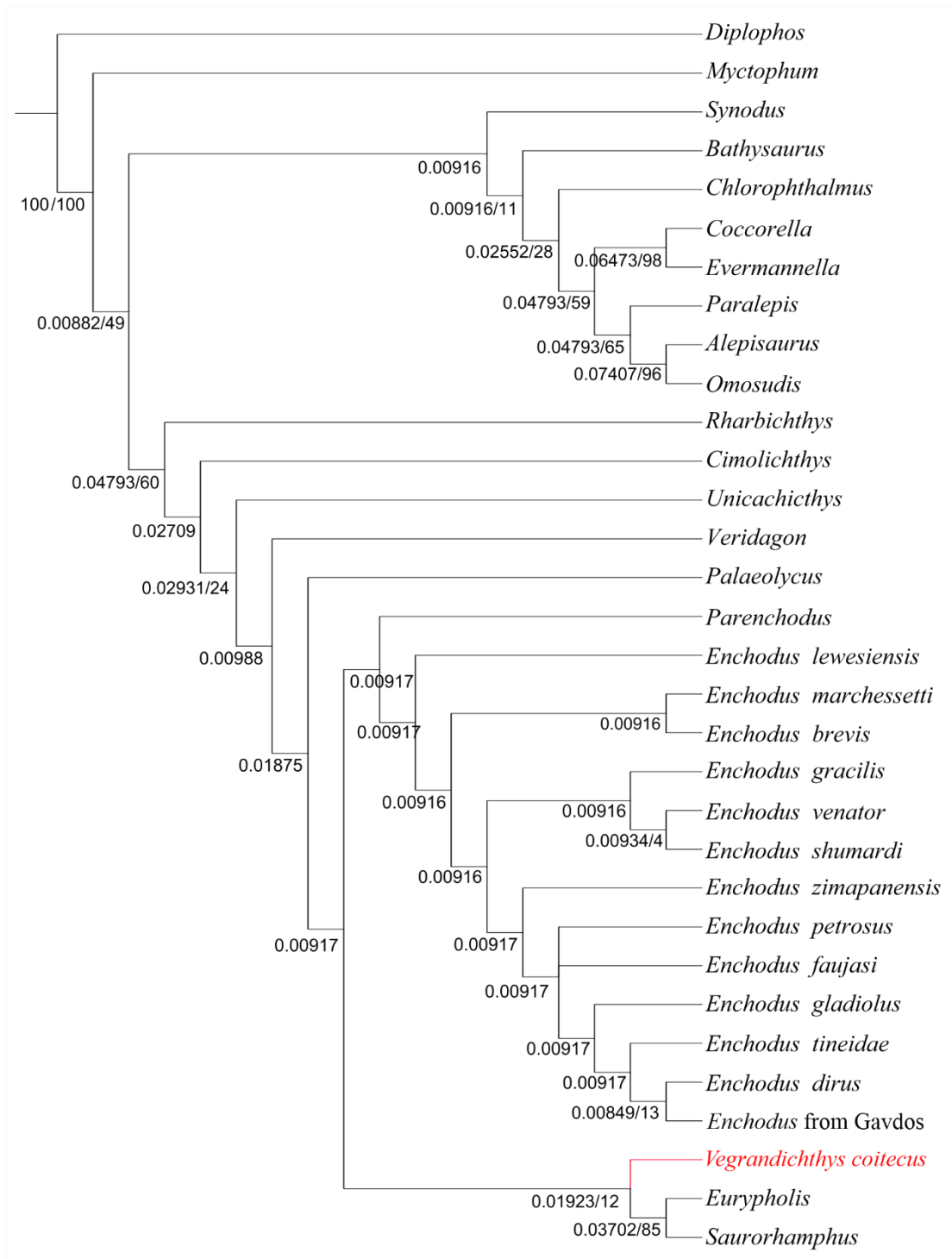


Figure 3. Complete phylogenetic hypothesis of Enchodontidae using Implied Weighed Maximum Parsimony criterium. In this phylogenetic exercise *Vegrandichthys coitecus* gen. and sp. new (in red) is retrieved as a member of the subfamily Eurypholinae. Numbers by nodes show the Bremer/Bootstrap values. The same was found using either K=10 or K=100.

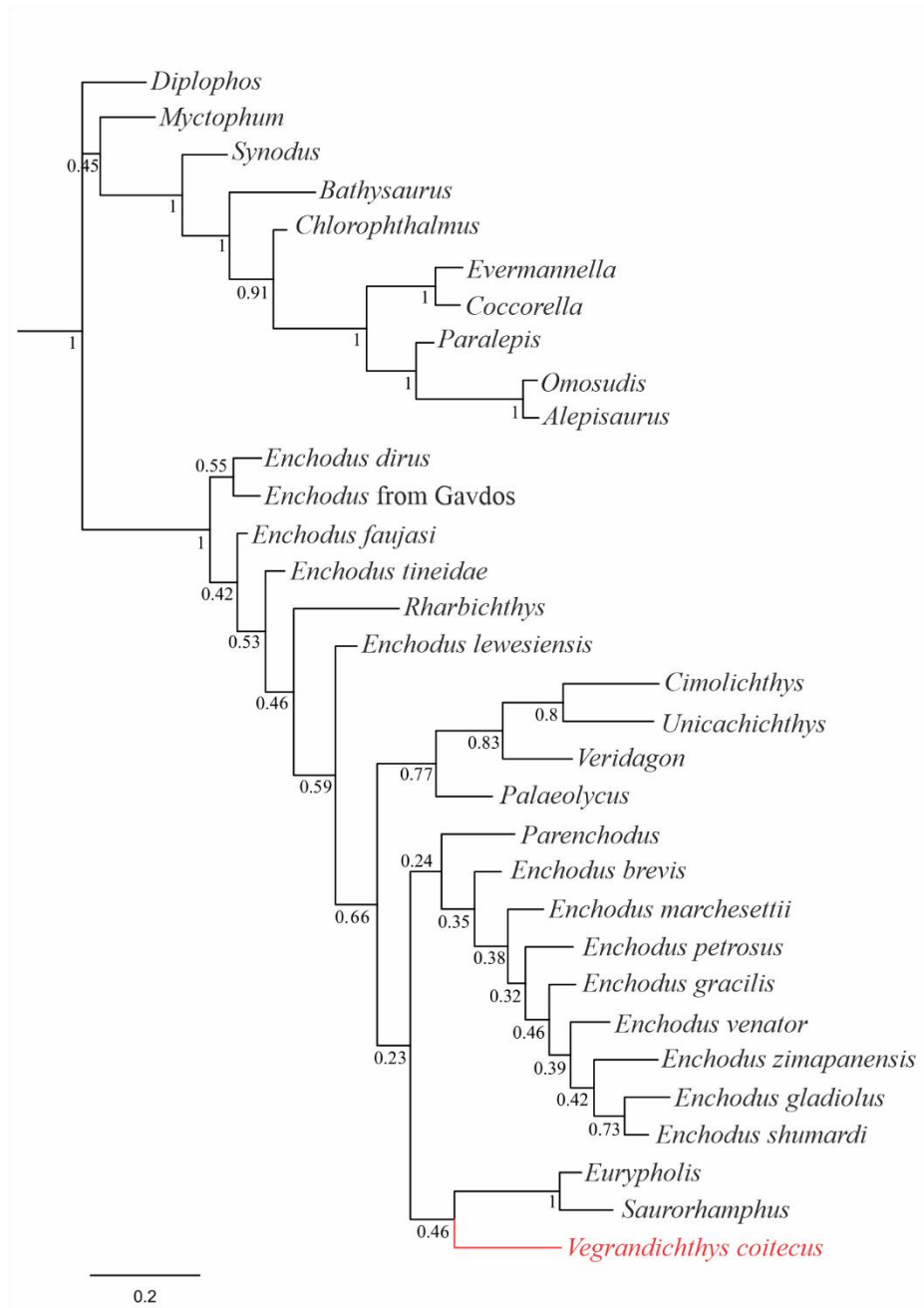


Figure 4. Phylogenetic hypothesis of Enchodontidae obtained with Bayesian Inference. In this phylogenetic exercise, *Vegrandichthys coitecus* gen. and sp. new is retrieved as a member of the subfamily Eurypholinae. Numbers by nodes show the posterior probability.



Figure 5. Phylogenetic hypothesis of Enchodontidae combining the preopercle landmark configuration and the discrete data. This hypothesis shows the configurations for each ancestral and terminal node. Landmarks and configuration in gray correspond to data absent for that taxon. Green lines show the change from the node to its descendant. Red lines show the landmark displacement from ancestor to descendant. Tree length: 316.04924, which 0.04924 is the score (contribution) for the preopercle configuration.