

Sagittal landmarks	Description	Landmark Type
1	Intersection of the sagittal line and anterior margin of anterior border	Type 1
2	Intersection of the sagittal line and anterior margin of the glabella	Type 1
3	Intersection of the sagittal line and the occipital furrow (S0)	Type 1
4	Intersection of the sagittal line and posterior margin of occipital ring (L0)	Type 1
Paired landmarks		
5, 6	Junction of anterior facial suture and LA in dorsal view. Coincident with point of lateral-most extent of LA	Type 2
7, 8	Junction of the axial furrow and S3	Type 1
9, 10	Point of medial-most extent of S3	Type 2
11, 12	Junction of the axial furrow and S2	Type 1
13, 14	Point of medial-most extent of S2	Type 2
15, 16	Junction of the axial furrow and S1	Type 1
17, 18	Point of medial-most extent of S1	Type 2
19, 20	Junction of the axial furrow and occipital furrow (S0)	Type 1
21, 22	Point of lateral-most extent of occipital ring (L0)	Type 2
23, 24	Anterior tip of palpebral lobe	Type 2
25, 26	Posterior end of palpebral lobe	Type 2
27, 28	Junction of the axial furrow and palpebral furrow	Type 1
Semilandmark curves		
29-36, 37-44	Anterior margin of anterior border and of anterior facial suture (8 points between landmarks 1 and 5, 1 and 6)	
45-52, 53-60	Anterior margin of glabella (8 points between landmarks 2 and 5, 2 and 6)	
61-63, 64-66	S3 furrow (3 points between landmarks 7 and 9, 8 and 10)	
67-68, 69-70	S2 furrow (2 points between landmarks 11 and 13, 12 and 14)	
71-72, 73-74	S1 furrow (2 points between landmarks 15 and 17, 16 and 18)	
75-76, 77-78	Occipital furrow (S0) (2 points between landmarks 3 and 19, 3 and 20)	
79-82, 83-86	Posterior margin of occipital ring (L0) (4 points between landmarks 4 and 21, 4 and 22)	
87-89, 90-92	Posterolateral margin of LA (3 points between landmarks 5 and 7, 6 and 8)	
93-95, 96-98	Lateral margin of L3 along axial furrow (3 points between landmarks 7 and 11, 8 and 12)	
99-100, 101-102	Lateral margin of L2 along axial furrow (2 points between landmarks 11 and 15, 12 and 16)	
103-104, 105-106	Lateral margin of L1 along axial furrow (2 points between landmarks 15 and 19, 16 and 20)	
107-114, 115-122	Distal margin of palpebral lobe (8 points between landmarks 23 and 25, 24 and 26)	
123-130, 131-138	Palpebral furrow (8 points between landmarks 25 and 27, 26 and 28)	

Table S1. Description of all landmarks and semilandmark curves for *Calyptaulax annulata* shown in Figure 1a.

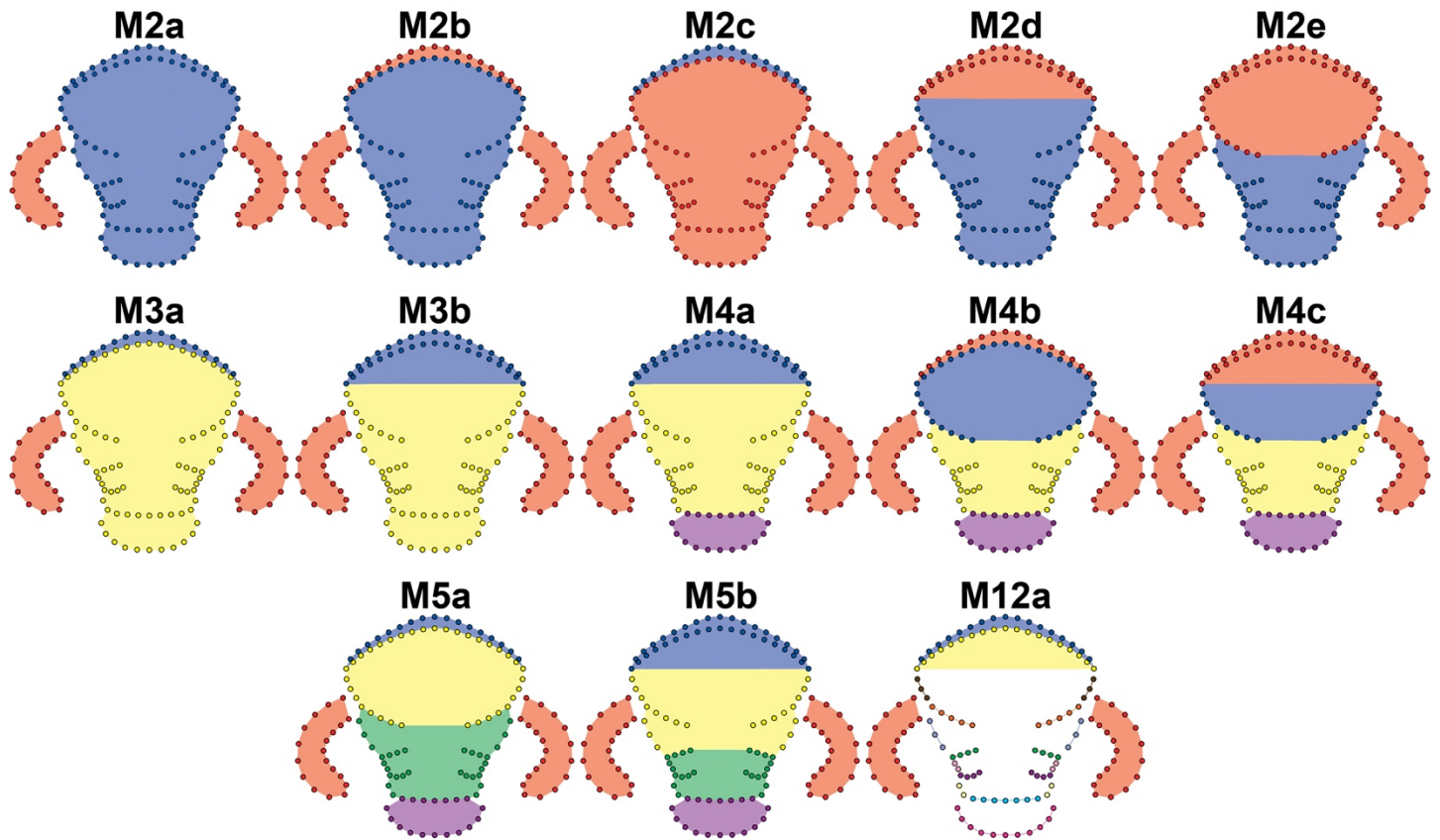


Figure S1. Thirteen alternative modular hypotheses of increasing modular complexity for the cranium of *Calyptaulax annulata*. Hypothesis labels correspond to the number of modules which comprise each model.

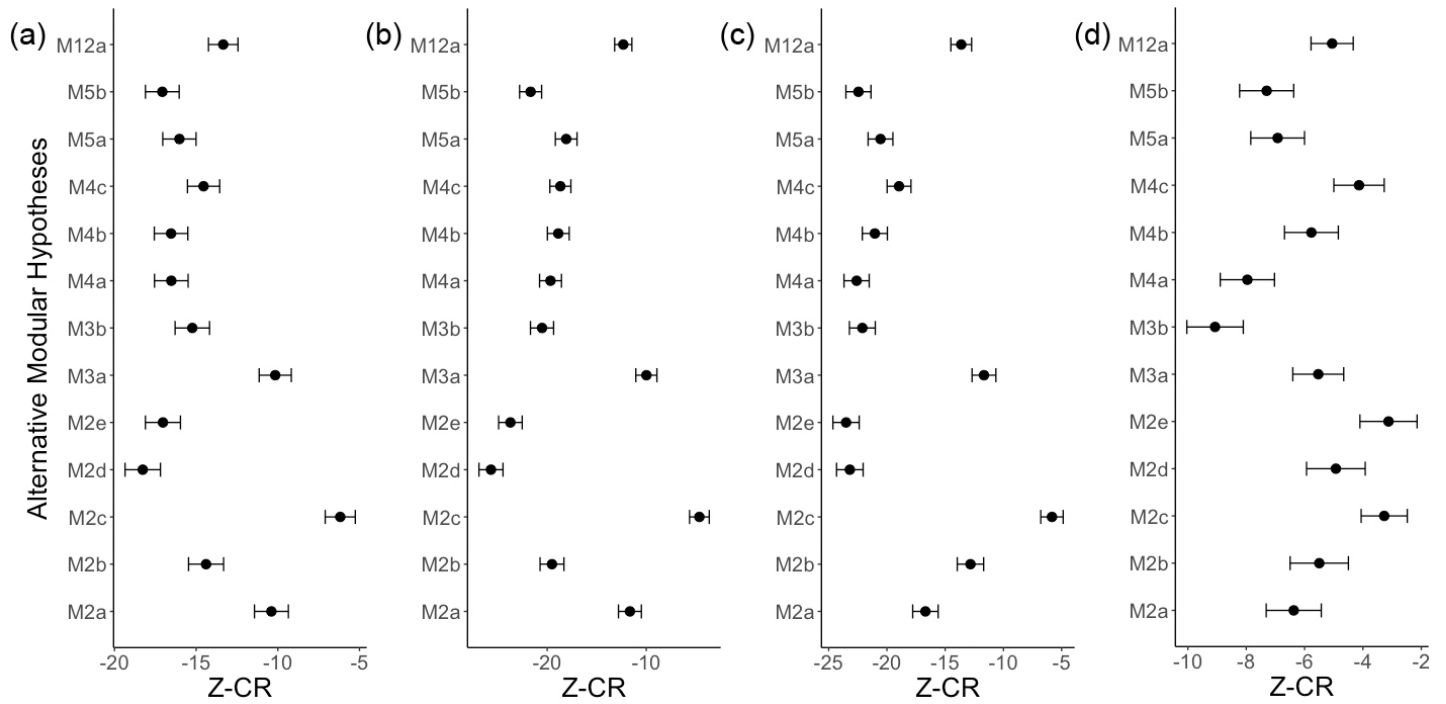


Figure S2. Sensitivity of effect sizes (Z_{CR}) to methodological choices for thirteen alternative modular hypotheses of the cranium of *Calyptaulax annulata*. (a) "Standard" analysis, presented in main text, which used Procrustes distance to slide semilandmarks and where allometry was removed from the sample. (b) Analysis where allometry was not removed (semilandmarks were slid using the Procrustes distance criterion). (c) Analysis where bending energy was used as the criterion to slide semilandmarks (allometry was removed). (d) Analysis which used one half of the (semi)landmark configuration (Procrustes distance was the criterion used to slide semilandmarks and allometry was removed).

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1	Intersection of the sagittal line and anterior margin of anterior border	Type 1
2	Intersection of the sagittal line and anterior margin of the glabella	Type 1
3	Intersection of the sagittal line and the occipital furrow (S0)	Type 1
4	Intersection of the sagittal line and posterior margin of occipital ring (L0)	Type 1
Paired landmarks		
5, 6	Junction of anterior facial suture and palpebral lobe	Type 1
7, 8	Posterior end of palpebral lobe	Type 2
9, 10	Indent along axial furrow adjacent to S3	Type 2
11, 12	Point of lateral-most extent of S3	Type 2
13, 14	Point of medial-most extent of S3	Type 2
15, 16	Point of lateral-most extent of S2	Type 2
17, 18	Point of medial-most extent of S2	Type 2
19, 20	Junction of the axial furrow and S1	Type 1
21, 22	Point of medial-most extent of S1	Type 2
23, 24	Junction of the axial furrow and occipital furrow (S0)	Type 1
Semilandmark curves		
25-31, 32-38	Anterior margin of anterior border and of anterior facial suture (7 points between landmarks 1 and 5, 1 and 6)	
39-43, 44-48	Anterior margin of glabella (5 points between landmarks 2 and 9, 2 and 10)	
49-52, 53-56	Distal margin of palpebral lobe (4 points between landmarks 5 and 7, 6 and 8)	
57-60, 61-64	Palpebral furrow (4 points between landmarks 5 and 7, 6 and 8)	
65-67, 68-70	Lateral margin of L2 and L3 along axial furrow (3 points between landmarks 9 and 19, 10 and 20)	
71-72, 73-74	S3 furrow (2 points between landmarks 11 and 13, 12 and 14)	
75-77, 78-80	S2 furrow (3 points between landmarks 15 and 17, 16 and 18)	
81-84, 85-88	S1 furrow (4 points between landmarks 19 and 21, 20 and 22)	
89-93, 94-98	Occipital furrow (S0) (5 points between landmarks 3 and 19, 3 and 20)	
99-103, 104-108	Posterior margin of occipital ring (L0) (5 points between landmarks 4 and 23, 4 and 24)	

Table S2. Description of all landmarks and semilandmark curves for *Cloacaspis senilis* shown in Figure 1b.

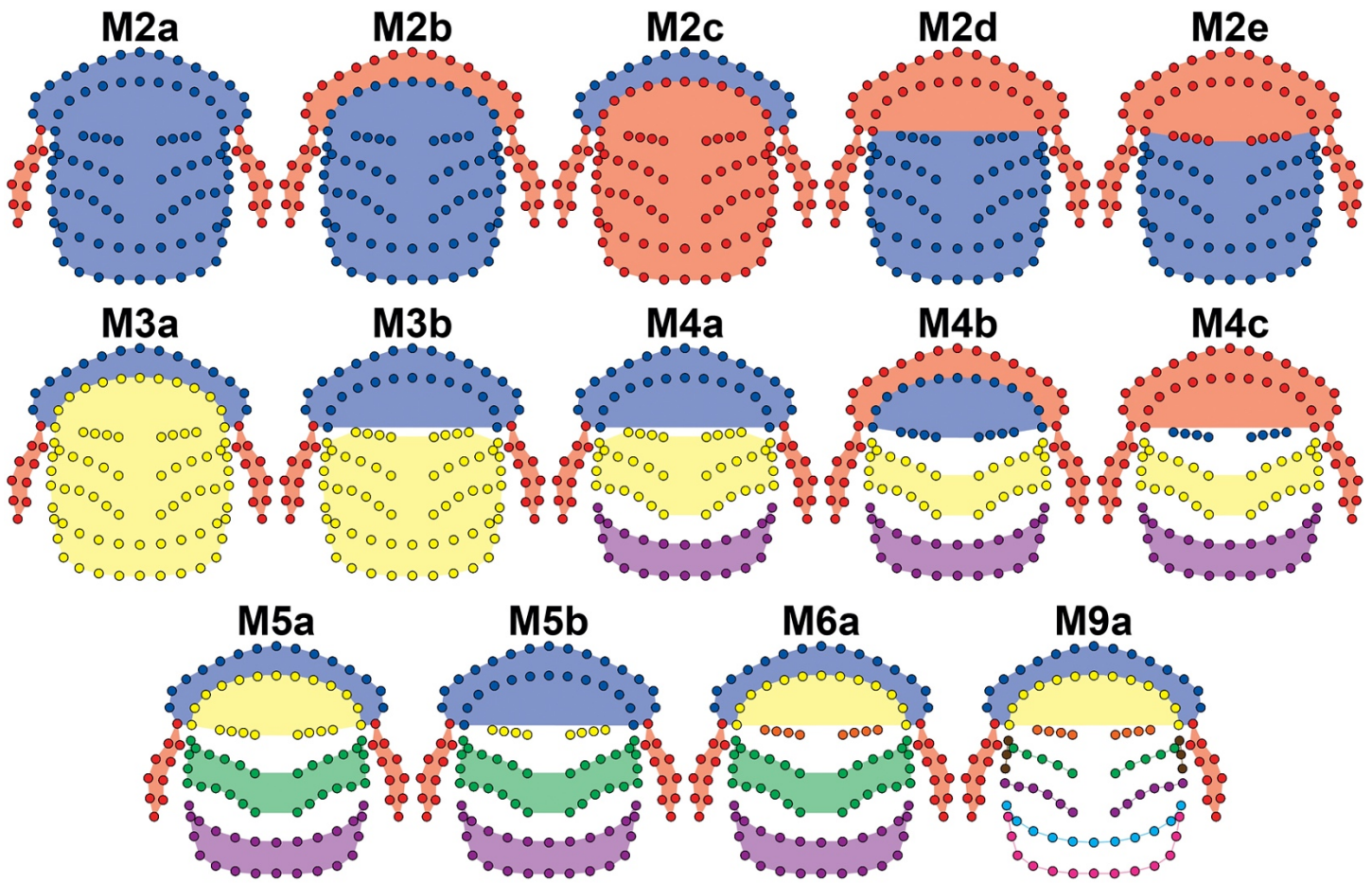


Figure S3. Fourteen alternative modular hypotheses of increasing modular complexity for the cranium of *Cloacaspis senilis*. Hypothesis labels correspond to the number of modules which comprise each model.

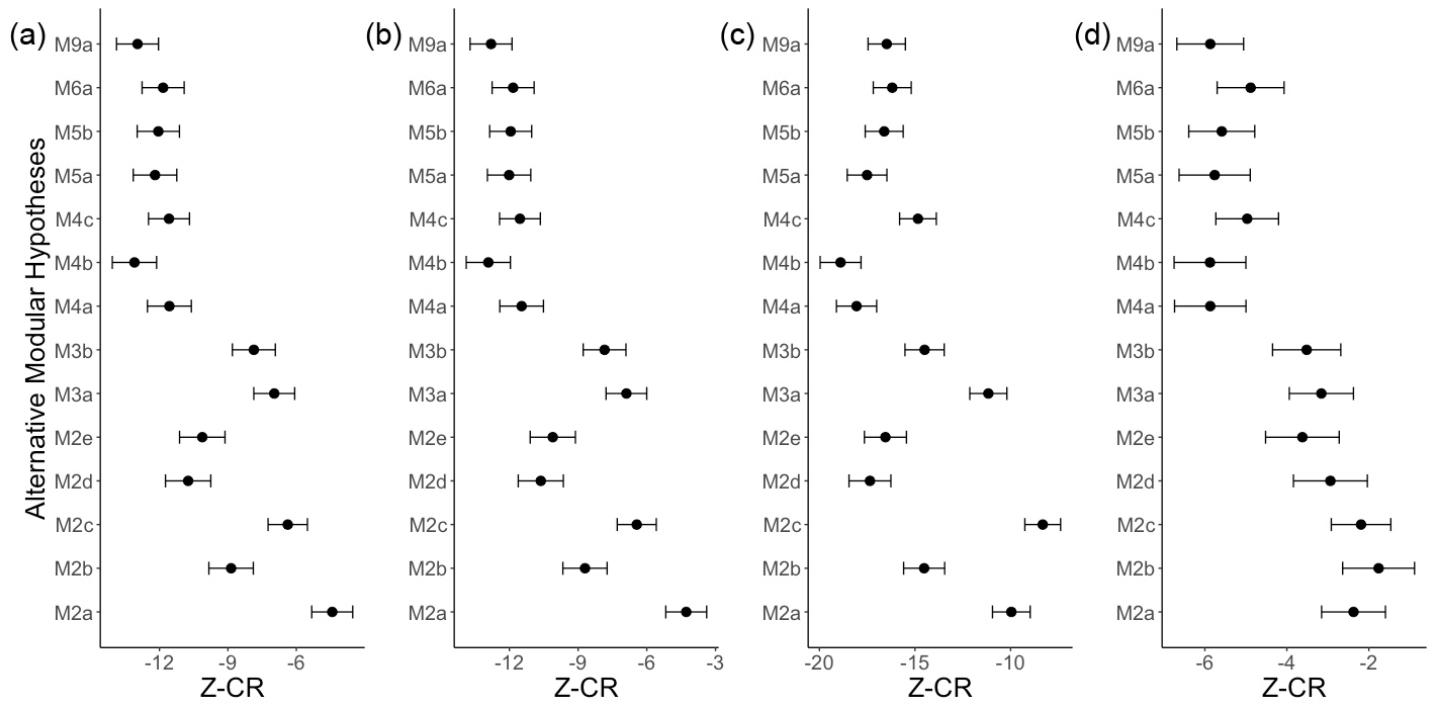


Figure S4. Sensitivity of effect sizes (Z_{CR}) to methodological choices for fourteen alternative modular hypotheses of the cranium of *Cloacaspis senilis*. (a) "Standard" analysis, presented in main text, which used Procrustes distance to slide semilandmarks and where allometry was removed from the sample. (b) Analysis where allometry was not removed (semilandmarks were slid using the Procrustes distance criterion). (c) Analysis where bending energy was used as the criterion to slide semilandmarks (allometry was removed). (d) Analysis which used one half of the (semi)landmark configuration (Procrustes distance was the criterion used to slide semilandmarks and allometry was removed).

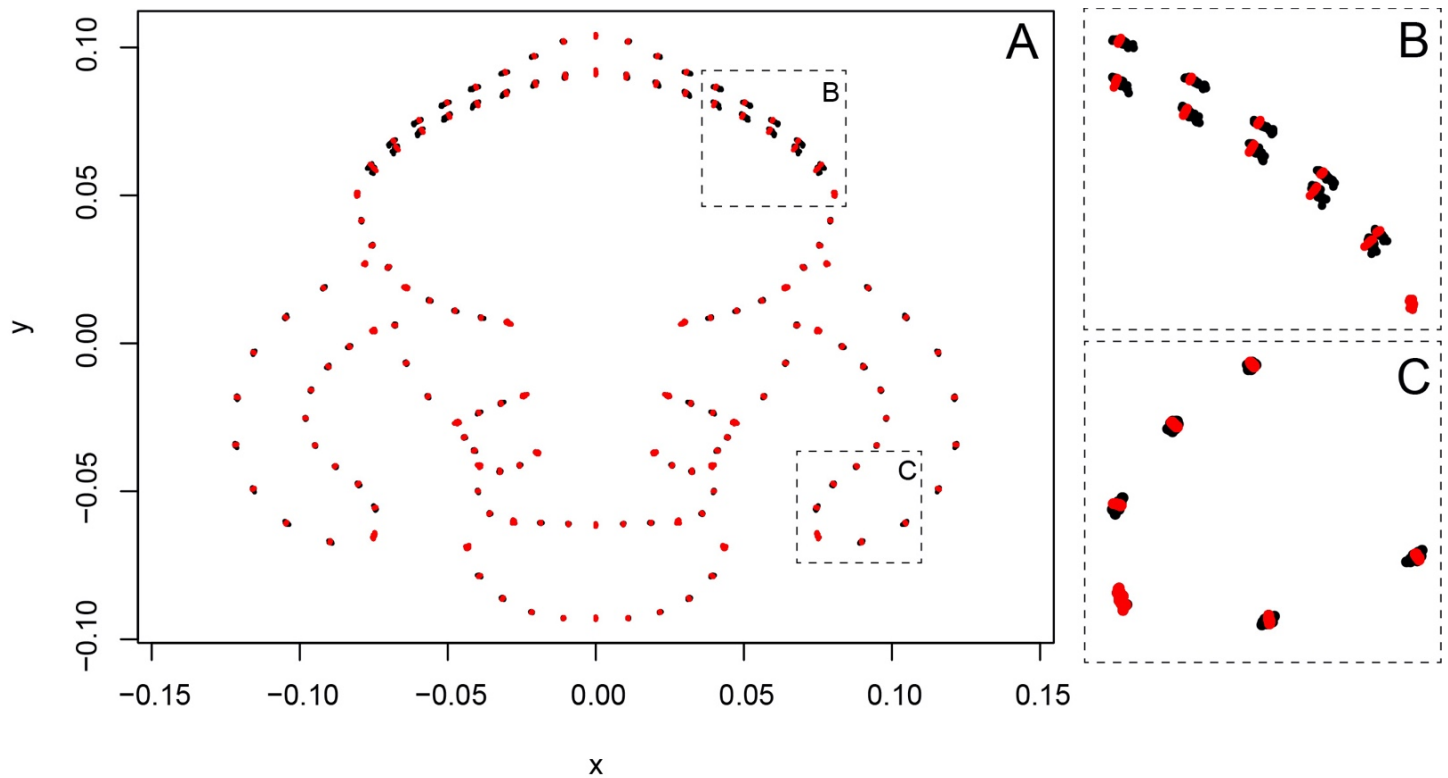


Figure S5. Landmark configurations for the dataset used to assess measurement error. The landmark configurations were superimposed either by minimizing the bending energy (black) or the Procrustes distances (red) to slide the semilandmarks. (A) Landmark configurations plotted in the same coordinate space. (B) Close-up view of selection of landmarks along the curves describing the anterior margin of the cranium and the anterior margin of the glabella. The landmark in the lower right corner is a fixed landmark and the variance at that landmark is not impacted by the method chosen to slide the semilandmarks. (C) Close-up view of selection of landmarks along the curves describing the posterior part of the palpebral lobe. The landmark in the lower left corner is a fixed landmark and the variance at that landmark is not impacted by the method chosen to slide the semi-landmarks. In both (B) and (C) it is visually evident that the bending energy approach results in more variation at each semilandmark than the Procrustes distance approach does.

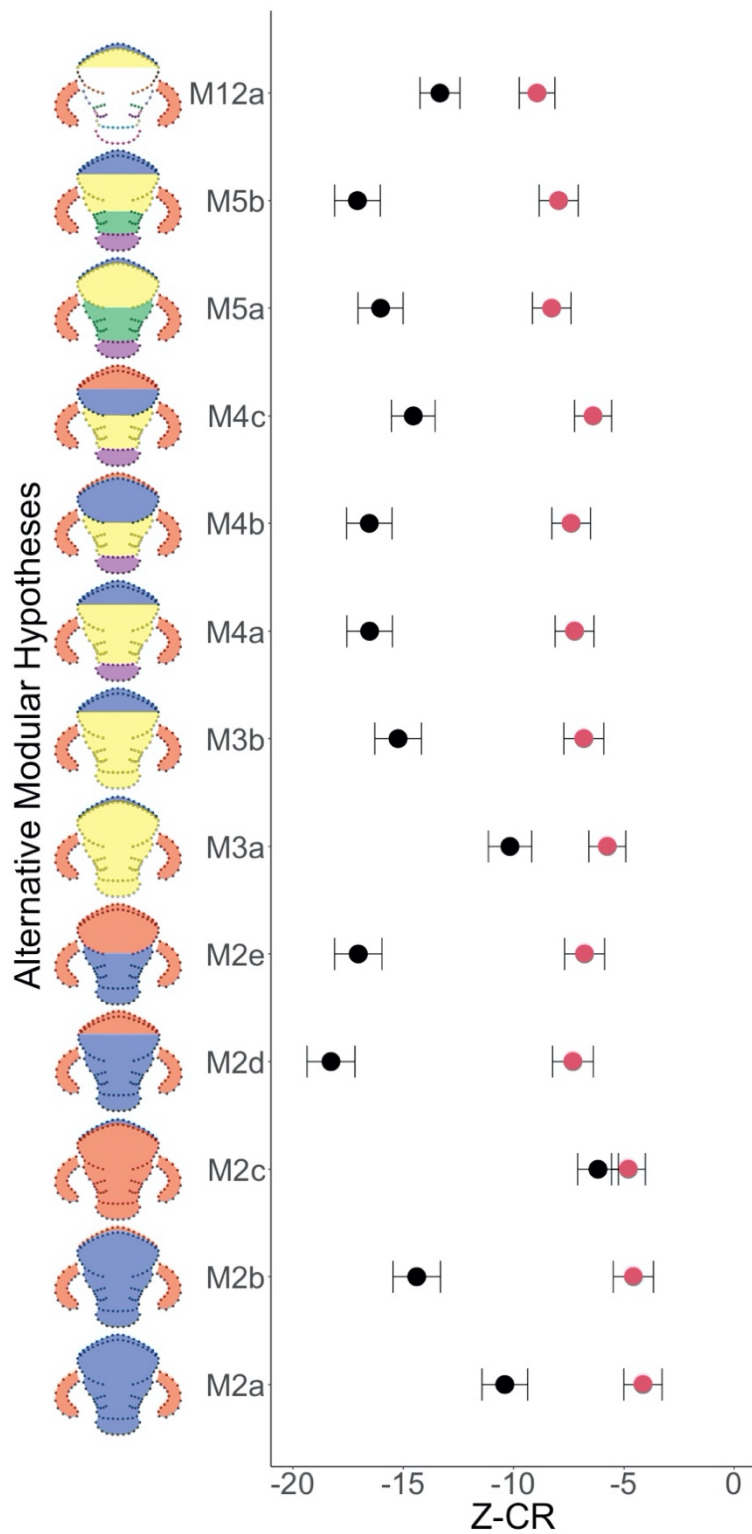


Figure S6. Sensitivity of effect sizes (Z_{CR}) to measurement error for thirteen alternative modular hypotheses of the cranium of *Calyptaulax annulata* using Procrustes distance to slide semilandmarks. Black points represent the “standard” analysis, presented in main text, which used Procrustes distance to slide semilandmarks and where allometry was removed from the sample. Red dots represent the analysis of the symmetrized measurement error sample using Procrustes distance to slide semilandmarks.

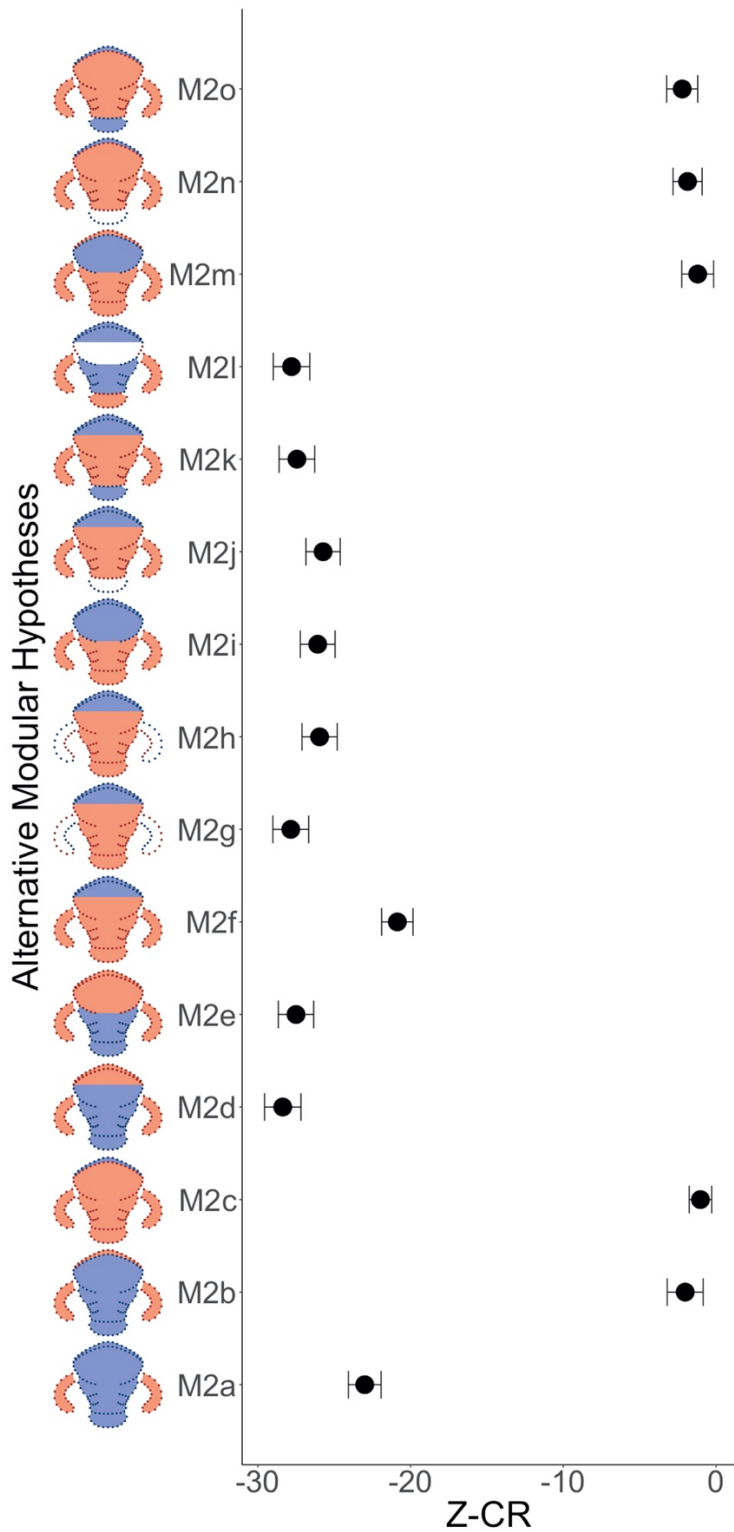


Figure S7. Sensitivity of effect sizes (Z_{CR}) to measurement error for fifteen alternative modular hypotheses of the cranium of *Calyptaulax annulata* using bending energy to slide semilandmarks. Modular hypotheses M2a through M2e are the same as in the main analysis. To explore the impact of the bending energy criterion, we calculated effect sizes for ten additional modular hypotheses (M2f to M2o). All of the tested models had two modules but vary in whether the anterior margins of the cranium and glabella were the same module (M2a, M2d, M2e, M2f, M2g, M2h, M2i, M2j, M2k, M2l) or separate modules (M2b, M2c, M2m, M2n, M2o).