Supplementary material 2

Tables S1-S4

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Data type: pdf
Explanation notes: Supplementary tables as referred to in the main text.

Table S1. Matrix of character states in support of the phylogeny of Fig. 8. Characters and character states are as defined in Table S2, 1-106.

Table S2. Characters considered of taxonomic value for the Chelidae. Those that could be scored for *Elseya lavarackorum* = *Pelocomastes lavarackorum* (White and Archer, 1994) have an asterisk (*). Notes are for clarification. Comments pertain to this study.

Table S3. Frequency of carapaces with irregular scutes in a population of *Emydura macquarii* nigra on Fraser Island. Only carapaces with irregularities involving insertions or deletions are included. Other variations in scute or sulci shape are not included. N = 670 [from Georges, 1982].

Table S4. Frequency of plastra with irregular scutes in a population of *Emydura macquarii* nigra on Fraser Island. Only plastra with major irregularities involving insertions or deletions are included. Other variations in scute or sulci shape are not included. N = 670 [from Georges, 1982].

Table S1. Matrix of character states in support of the phylogeny of Fig. 8. Characters and character states are as defined in Table S2, 1-106.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
E. albagula	0	1	0	0	0	1	2	0	1	2	0	3	0	0	0	0	0	1	0	0
E. branderhorsti	0	1	0	0	2	1	2	0	1	2	0	3	0	0	0	0	0	1	0	0
E. caelatus	0	1	0	0	0	1	2	0	1	?	1	3	0	0	0	0	0	1	0	0
E. dentata	0	1	0	0	2	1	2	0	1	2	0	3	0	0	0	0	0	1	0	0
E. flaviventralis	0	1	0	0	2	1	2	0	1	2	0	3	0	0	0	0	0	1	0	0
E. irwini	0	1	0	0	0	1	2	0	1	2	0	3	0	1	0	0	0	1	0	0
E. lavarackorum	?	?	?	0	0	1	2	0	1	2	0	3	0	1	0	0	0	1	0	?
E. nadibajagu	?	?	?	0	0	1	2	0	1	2	0	3	0	0	0	?	0	1	0	?
E. novaeguineae	0	1	0	0	0	1	2	0	1	2	1	3	0	0	0	0	0	0	0	0
E. oneiros	0	1	0	0	?	1	2	0	1	2	0	3	0	1	0	0	0	1	0	0
E. orestiad	0	1	0	0	0	1	2	0	1	?	1	3	0	0	0	0	0	0	0	0
E. rhodini	0	1	0	0	0	1	2	0	1	2	1	3	0	0	0	0	0	0	0	0
E. schultzei	0	1	0	0	0	1	2	0	1	2	1	3	0	0	0	0	0	0	0	0
P. uberrima	?	?	?	0	0	1	2	0	1	2	0	?	0	1	0	0	0	1	0	0
Em. macquarii	1	1	3	1	3	1	2	1	1	3	1	3	0	0	0	0	0	0	0	0
Em. victoriae	1	1	3	1	3	1	2	1	1	3	1	3	0	0	0	?	0	0	0	0
M. purvisi	0	0	0	0	1	1	0	2	0	0	1	2	0	0	0	0	0	0	0	0
M. bellii	0	0	0	0	1	1	0	2	1	0	1	3	0	0	0	0	0	0	0	0
M. georgesi	0	0	0	0	1	1	0	2	1	0	1	3	0	0	0	0	0	0	0	0
M. latisternum	0	0	0	0	1	1	0	2	1	0	1	3	0	0	0	0	0	1	0	0
P. sextuberculata	0	2	3	0	0	0	1	0	0	0	2	1	1	1	0	0	0	1	0	1
R. leukops	3	3	3	0	0	1	2	0	1	1	1	3	0	0	0	0	0	0	0	0
QMF30817	?	?	?	?	?	?	?	?	?	2	?	?	?	?	?	?	?	?	?	?
QMF30818	?	?	?	?	?	?	?	?	?	2	?	?	?	?	?	?	?	?	?	?

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
E. albagula	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	1	1
E. branderhorsti	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	?
E. caelatus	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	?
E. dentata	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	?
E. flaviventralis	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	1
E. irwini	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	1	?
E. lavarackorum	?	?	?	?	0	?	?	?	0	0	0	?	?	1	0	0	1	?	1	?
E. nadibajagu	?	?	0	0	0	0	1	0	0	0	0	1	?	?	0	0	1	?	1	?
E. novaeguineae	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	?
E. oneiros	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	1	0	1	?
E. orestiad	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	?
E. rhodini	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	1
E. schultzei	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	?
P. uberrima	?	?	?	?	0	?	?	?	?	0	0	?	?	?	0	0	?	?	?	?
Em. macquarii	0	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	1
Em. victoriae	0	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	1
M. purvisi	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	1
M. bellii	0	1	1	1	0	0	1	1	0	1	0	1	0	0	0	1	0	0	0	1
M. georgesi	0	1	1	1	0	0	1	1	0	1	0	1	0	0	0	1	0	0	0	1
M. latisternum	0	1	1	1	0	0	1	1	0	1	0	1	0	0	0	1	0	1	0	1
P. sextuberculata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R. leukops	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
QMF30817	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	?	?	?
QMF30818	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	?	?	?

	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
E. albagula	0	0	1	0	1	1	0	1	0	1	1	1	1	2	0	1	1	0	0	0
E. branderhorsti	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	0	0
E. caelatus	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	0	0
E. dentata	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	0	0
E. flaviventralis	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	0	0
E. irwini	0	0	1	0	1	1	0	1	0	1	1	1	1	2	0	1	1	0	0	0
E. lavarackorum	?	?	1	?	?	?	?	?	?	1	1	1	1	2	?	1	1	?	?	?
E. nadibajagu	?	?	1	?	?	?	?	?	?	1	1	1	1	2	?	1	1	0	?	?
E. novaeguineae	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	0	0
E. oneiros	0	0	1	0	1	1	0	1	0	1	1	1	1	2	?	1	1	0	0	0
E. orestiad	0	0	0	0	1	1	0	1	0	1	1	1	1	0	?	1	1	0	0	0
E. rhodini	0	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0
E. schultzei	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	0	0
P. uberrima	?	?	1	?	?	?	?	?	?	1	1	1	?	2	?	?	?	?	?	?
Em. macquarii	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	0	0	0	1
Em. victoriae	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	0	0	0	1
M. purvisi	0	0	0	0	0	1	1	1	0	0	0	1	1	0	0	1	0	0	0	1
M. bellii	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1
M. georgesi	0	0	0	?	1	0	0	1	1	1	1	0	1	0	0	1	0	0	0	1
M. latisternum	0	0	0	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0	0	1
P. sextuberculata	0	0	0	0	1	1	0	1	0	0	0	1	1	1	1	0	0	0	0	0
R. leukops	1	1	0	0	1	0	0	1	0	1	1	1	1	0	0	1	0	0	0	1
QMF30817	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1	0	0	?
QMF30818	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1	0	0	?

	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
E. albagula	0	0	1	0	0	1	0	0	0	1	1	1	1	1	0	1	2	0	1	1
E. branderhorsti	0	0	1	1	0	2	0	0	0	1	1	1	1	1	0	1	2	1	1	1
E. caelatus	0	0	1	1	0	1	0	0	0	1	1	1	1	1	0	1	2	1	1	1
E. dentata	0	0	1	1	0	2	0	0	0	1	1	1	1	1	0	1	2	1	1	1
E. flaviventralis	0	0	1	1	0	2	0	0	0	1	1	1	1	1	0	1	2	1	1	1
E. irwini	0	0	1	0	0	1	0	0	0	1	1	1	1	1	0	1	2	0	1	1
E. lavarackorum	0	0	1	0	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?
E. nadibajagu	0	0	1	?	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?
E. novaeguineae	0	0	1	1	0	1	0	0	0	1	1	1	1	1	0	1	2	1	1	1
E. oneiros	0	0	1	0	0	1	0	0	0	1	1	1	1	1	0	1	2	0	1	1
E. orestiad	0	0	1	1	0	1	0	0	0	1	1	1	1	1	0	1	2	1	1	1
E. rhodini	0	0	1	1	0	1	0	0	0	1	1	1	1	1	0	1	2	1	1	1
E. schultzei	0	0	1	1	0	1	0	0	0	1	1	1	1	1	0	1	2	1	1	1
P. uberrima	?	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Em. macquarii	1	0	1	1	0	2	0	0	0	1	1	1	1	1	0	1	2	1	1	1
Em. victoriae	1	0	1	1	0	2	0	0	0	1	1	1	1	1	0	1	2	1	1	1
M. purvisi	1	1	1	0	0	0	1	0	1	1	0	1	1	1	0	1	0	1	1	1
M. bellii	1	0	1	1	1	1	0	0	0	1	0	1	1	1	0	1	0	1	1	1
M. georgesi	1	0	1	1	1	1	0	0	0	1	0	1	1	1	0	1	0	1	1	1
M. latisternum	1	0	1	1	1	1	0	0	0	1	0	1	1	1	0	1	0	1	1	1
P. sextuberculata	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	1	?	0
R. leukops	1	0	1	0	1	1	0	0	0	1	1	1	1	1	0	1	2	1	1	1
QMF30817	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
QMF30818	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
E. albagula	0	0	0	0	1	1	1	1	2	0	1	1	1	1	1	1	1	0	0	2
E. branderhorsti	0	0	0	0	1	1	1	1	2	0	1	1	1	0	?	1	1	0	0	2
E. caelatus	1	0	0	0	1	1	1	1	1	0	0	1	1	0	?	0	1	0	1	1
E. dentata	0	0	0	0	1	1	1	1	2	0	1	1	1	?	?	1	1	0	0	2
E. flaviventralis	0	0	0	0	1	1	1	1	2	0	1	1	1	0	1	1	1	0	0	2
E. irwini	0	0	0	0	1	1	1	1	2	0	1	1	1	?	?	1	1	0	0	2
E. lavarackorum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
E. nadibajagu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
E. novaeguineae	1	0	0	0	1	1	1	1	1	0	0	1	1	?	?	0	1	0	0	1
E. oneiros	0	0	0	0	1	1	1	1	2	0	1	1	1	?	?	1	1	0	0	2
E. orestiad	1	0	0	0	1	1	1	1	1	0	0	1	1	?	?	0	1	0	1	1
E. rhodini	1	0	0	0	1	1	1	1	1	0	0	1	1	0	1	0	1	0	1	1
E. schultzei	1	0	0	0	1	1	1	1	1	0	0	1	1	?	?	0	1	0	0	1
P. uberrima	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Em. macquarii	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	0	1	3
Em. victoriae	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	3
M. purvisi	0	0	0	0	1	1	1	1	0	0	1	1	0	0	1	0	0	0	1	0
M. bellii	0	0	0	0	1	1	1	1	0	0	1	1	0	0	0	0	1	0	0	0
M. georgesi	0	0	0	0	1	1	1	1	0	0	1	1	0	0	0	0	1	0	0	0
M. latisternum	1	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0	1	0	0	0
P. sextuberculata	?	0	?	?	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
R. leukops	1	0	0	0	1	1	1	1	0	0	1	1	0	0	1	0	0	0	0	2
QMF30817	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
QMF30818	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	101	102	103	104	105	106
E. albagula	1	1	0	0	0	0
E. branderhorsti	1	0	0	0	0	0
E. caelatus	1	0	0	0	1	0
E. dentata	1	0	0	0	0	0
E. flaviventralis	1	0	0	0	0	1
E. irwini	1	1	0	0	0	0
E. lavarackorum	?	?	?	?	?	?
E. nadibajagu	?	?	?	?	?	?
E. novaeguineae	1	0	0	0	1	0
E. oneiros	1	1	0	0	0	0
E. orestiad	1	0	0	0	1	0
E. rhodini	1	0	0	0	1	0
E. schultzei	1	0	0	0	1	0
P. uberrima	?	?	?	?	?	?
Em. macquarii	1	0	0	0	2	1
Em. victoriae	1	0	1	0	0	1
M. purvisi	1	0	0	0	2	1
M. bellii	0	1	0	0	2	0
M. georgesi	0	0	0	0	2	1
M. latisternum	0	1	0	1	2	?
P. sextuberculata	0	0	0	0	0	0
R. leukops	0	0	0	0	3	0
QMF30817	?	?	?	?	?	?
QMF30818	?	?	?	?	?	?

Table S2. Characters considered of taxonomic value for the Chelidae. Those that could be scored for *Elseya lavarackorum* = *Pelocomastes lavarackorum* (White and Archer, 1994) have an asterisk (*). Notes are for clarification. Comments pertain to this study.

Carapace

1. Posterior Bridge Strut Suture – Pleural Bone Association
    - 0 Restricted to Pleural Bone 5, rib/gomphosis 5 passes through the strut
    - 1 Overlaps pleural bones 5 & 6, rib/gomphosis 5 anterior to the strut
    - 2 Restricted to Pleural Bone 4
    - 3 Spans the boundary between pleural bones 4 & 5
2. Posterior Bridge Strut Suture – Peripheral Association
    - 0 Contacts Peripheral 7, barely contacts the pleural bones
    - 1 Contacts peripherals 7 & 8, barely contacts pleural bones
    - 2 Contacts peripherals 7 & 8, significantly contacts the pleural bones
    - 3 Contacts Peripheral 6, significantly contacts pleural bones
    - 4 Contacts Peripheral 8, significant contact with pleural bones
3. Posterior Bridge Strut Suture – Shape
    - 0 Triangular in generalised shape, shallow insertion into carapace, small
    - 1 Triangular in generalised shape, deeply inserted into carapace, large
    - 2 Square in generalised shape, deeply inserted into carapace
    - 3 Elongated and elliptical, deeply inserted into carapace
4. *Anterior Bridge Strut Suture -- Relative Length
    - 0 Short, on Pleural Bone 1, length less than or equal to the shortest distance between its terminal end and the vertebrae
    - 1 Long, on Pleural Bone 1, length less than or equal to the shortest distance between its terminal end and the vertebrae
    - 2 Extremely short, barely contacts Pleural Bone 1

    Notes: The anterior bridge strut suture extends inwards from the peripherals, usually Peripheral 3, along the inner surface of Pleural Bone 1.
5. * Anterior Bridge Strut Suture -- Shape (Thomson et al. 1997)
    - 0 Anterior and posterior edges parallel
    - 1 Widest laterally narrowing towards the vertebrae
    - 2 Lateral and vertebral extremities equal in width with a medial constriction
    - 3 Forms a small triangular insertion
6. * Neural Bones – Association of exposed Neural bones with the Nuchal (Pritchard and Trebbau 1984)
    - 0 Contact the Nuchal
    - 1 If present, do not contact the Nuchal
7. *First Rib/Gomphosis Rotation (Thomson et al. 1997)
    - 0 Postero-ventrally rotated , falls posterior to the anterior bridge strut suture
    - 1 Not rotated, included in the anterior bridge strut suture
    - 2 Not rotated, falls posterior to the anterior bridge strut suture
8. * Anterior Bridge Strut Suture -- Leading Edge
    - 0 Contacts posterior 3rd of Peripheral 2 at junction of peripheral 2 and Pleural Bone 1
    - 1 Contacts the middle of Peripheral 3 at junction of peripheral 3 and Pleural Bone 1
    - 2 Contacts the junction of peripherals 2 & where they join Pleural Bone 1
    - 3 Contacts the middle of Peripheral 4 at junction of Peripheral 4 and Pleural Bone 1
9. *Suture of Rib 1 with Rib 2
    - 0 Adjacent to the contact between thoracic vertebrae 1 & 2
    - 1 Completely anterior to the contact between thoracic vertebrae 1 & 2
10. * Anterior Bridge Strut Suture – Angle
    - 0 Approximately 160 degrees or greater
    - 1 Approximately 155 degrees

2 Approximately 140 - 150 degrees
3 Approximately 120 degrees
4 180 degrees (horizontal)
Note: This angle is defined against the line joining the junction of peripherals 3 and 4 and the junction of thoracic vertebrae 1 & 2. It is the obtuse angle. Subject to ontogenetic variation, so similar aged animals need to be compared across taxa.

11. *Width of first Vertebral Scute (Thomson et al. 1997)
    0 Significantly wider than vertebral scutes 2 & 3
    1 Approximately same width as vertebral scutes 2 & 3
    2 Narrower than vertebral scutes 2 & 3
12. * Neural bones (Pritchard 1988; Thomson and Georges 1996)
    0 Neurals 7-8, exposed, contiguous
    1 Six (6) exposed, contiguous neurals
    2 Neural 1 absent, not exposed
    3 Neurals 1-2 absent, not exposed
    4 All neurals absent, not exposed
13. *Carapace -- Vertebral Keel
    0 absent
    1 present
14. *Carapace -- Nuchal Bay (Gaffney et al. 2006)
    0 absent
    1 present
    Comment: Subject to ontogenetic variation in Chelidae. First indications are in the departure of the anterior carapace from the classical ovoid shape; the anterior carapace squares off; in the oldest largest individuals, the most anterior extent of the carapace is on the forward boundary of Marginals M2.
15. *Carapace -- Carinate
    0 absent
    1 present
16. * Plastron -- Hinge
    0 Plastral Hinge absent
    1 Plastral Hinge present
    Comment:
17. * Rib 1 continues along Rib 2
    0 Absent
    1 Present
18. *Cervical Scute
    0 Present
    1 Absent
19. *Nuchal Bone -- Elongation
    0 Maximum width and length approximately equal
    1 Maximum length greatly exceeds maximum width
20. Thoracic Rib 11
    0 Contacts Pleural Bone 8
    1 Contacts Suprapygal
    Note: Thoracic Rib 11 is often referred to as the second caudal rib
21. Width of pleural bones 7 & 8
    0 Pleural Bones 7 & 8 approximately equal
    1 Pleural Bone 8 noticeably wider than Pleural Bone 7
    2 Pleural Bone 7 noticeably wider than Pleural Bone 8
22. Suprapygal -- Contacts (Thomson and Mackness 1999)
    0 Contacts Pygal and Peripheral 11 (close to pygal)
    1 Contacts Pygal and Peripheral 11 close to Peripheral 10
    2 Contacts Pygal and peripherals 10 & 11.

23. Rib/gomphosis of Pleural Bone 6 -- Contacts
    0 Contacts posterior 1/4 of Peripheral 8
    1 Contacts middle of Peripheral 8
24. Pleural Bone 7 – Contact with Peripherals
    0 Contacts posterior edge of Peripheral 9
    1 Contacts middle of Peripheral 9
25. Cervical scute – Association with Peripherals
    0 Not enclosed by peripherals
    1 Enclosed by peripherals
26. Pelvic Ileum Carapace Suture – Shape
    0 Triangular
    1 Square
27. Proximity of Rib heads to Neural Spine
    0 Close with little space
    1 Spread wide but ribs straight
    2 Spread very wide and ribs curved away from pleural bones
    3 Spread wide with ribs 1-4 curved
28. Pygal dorsally inflected over tail
    0 absent
    1 moderately
    2 highly inflected
29. * Costal Scute 1 -- Posterior Sulcus
    0 Contacts middle of Marginal 5
    1 Contacts posterior of Marginal 5
30. * Anterio-Posterior ridge on pleural bones between rib heads
    0 Absent
    1 Present
31. * First rib arches away from thoracic vertebrae
    0 Absent
    1 Present
    Note: First rib forms a convex arch to accommodate an enlarged *longissimus dorsi* muscle
32. Musk ducts
    0 absent
    1 present
33. Plastron -- deeply concave in vicinity of humerals
    0 absent
    1 present
34. * Intergular Scute -- notched anteriorly
    0 absent
    1 present
35. * Pleural concavity forms a shallow trench for the length of the carapace above thoracic arches
    0 absent
    1 present
36. * Marginals -- Relative Size of M1 and M2 (McCord and Thomson 2002)
    0 Marginals 1 and 2 equal in size
    1 Marginal 2 larger than Marginal 1
    2 Marginal 2 smaller than Marginal 1
37. * Carapace -- Topography (Friol et al. 2015)
    0 Convex
    1 Highly convex
    2 Acuminate (tapering to a point)
    3 Bi-carinate (two keel-like projections)
    4 Pyramided

5 Highly pyramided

38. Posterior protuberance of the Vertebral Scutes (Friol et al. 2015)
    0 Absent
    1 Present
39. * Carapace -- Shape (Friol et al. 2015)
    0 Not oval
    1 Oval
40. Lateral widening of Pleural Bone 3
    0 Absent
    1 Present
41. Sulcus between Costal Scute 2 & Costal Scute 3
    0 Contacts Peripheral 7
    1 Contacts Peripheral 6
42. Sulcus between Costal Scute 3 & Costal Scute 4
    0 Contacts Peripheral 9
    1 Contacts Peripheral 8
43. * Carapace -- Most anterior point (Thomson et al. 1997)
    0 Marginal 1
    1 Marginal 2
44. Posterior carapace serrated in adults (Thomson et al. 2006)
    0 Absent
    1 Present
45. Ilium sutural surface with carapace (Thomson and Mackness 1999)
    0 Elongated anterio-posteriorly
    1 Broadly triangular
46. Anterior ventral profile of the Nuchal
    0 Concave
    1 Convex
47. Gomphotic bridge suture at Peripheral 4
    0 Absent
    1 Present
48. Two gomphotic sutures at Peripheral 7
    0 Present
    1 Absent
49. Two gomphotic sutures on posterior edge of Nuchal
    0 Absent
    1 Present
50. * Anterior bridge strut suture -- Ventral blade on posterior edge
    0 Absent
    1 Present
51. * Anterior bridge strut suture -- Ventral blade on anterior edge
    0 Absent
    1 Present
52. * Rib/gomphosis of Pleural Bone 5 rotated and striated
    0 Present
    1 Absent
53. * Sinusoidal leading edge Vertebral 2
    0 Present
    1 Absent
54. * Nuchal Bay -- formation
    0 Absent
    1 Present formed from proximal inclination of 2nd peripheral
    2 Present formed from posterior recession of first peripheral

55. Vomer -- contacts Premaxilla
    0 Absent
    1 Present

Plastron

56. * Plastron -- Mesoplastra (Gaffney et al. 2006)
    0 present
    1 absent
57. * Entoplastron Simple Diamond Shape (Gaffney et al. 2006)
    0 present
    1 absent
58. Longitudinal ridge where the Bridge forms the Plastron
    0 absent
    1 present
59. Plastron -- depressed between the two Ischium sutures
    0 absent
    1 present
60. Plastron -- Femoral region extends laterally (lobes)
    0 absent
    1 present
61. * Intergular Scute -- wider than gular scutes
    0 absent
    1 present
62. * Plastron: Pectoral region extends laterally (lobes)
    0 absent
    1 present
63. * Pectoral Scute -- Midline length less than lateral length
    0 absent
    1 present
64. * Anterior Plastral Lobe (Thomson and Georges 2016)
    0 Square in general shape
    1 Tapered and narrow
65. Dorsal spur on the Entoplastron
    0 Absent
    1 Present

Pelvis

66. Pelvic Ileum -- Suture to Carapace (Thomson and Mackness 1999)
    0 Contacts Suprapygal, pleurals 7 & 8
    1 Contacts Suprapygal, Pleural Bone 8 and close to the suture between pleurals 7 & 8
    2 Contacts Suprapygal, Pleural Bone 8 with broad separation from Pleural Bone 7
    3 Contacts pleurals 7 & 8 only
67. * Ischium -- Suture with Plastron extends to the edge of the Plastron
    0 absent
    1 present
68. Pubis -- elongate and narrow
    0 absent
    1 present
69. Pubis -- almost reaches junction of Hyoplastron and Xyphiplastron
    0 absent
    1 present

70. Ischium -- postero-dorsally rotated (Thomson and Mackness 1999)
    0 absent
    1 present
71. Pelvis -- latero-posteriorly rotated (Thomson and Mackness 1999)
    0 absent
    1 present

Skull

72. Vomer Bone (Friol et al. 2015)
    0 absent
    1 present
73. Nasal Bone (Friol et al. 2015; Gaffney 1977)
    0 absent
    1 present
71. Quadrado-jugal Bone (Friol et al. 2015; Gaffney 1977)
    0 present
    1 absent
75. Jugal Bone -- Lateral extension of the Jugal Bone (Friol et al. 2015)
    0 absent
    1 present
76. Frontal Bone -- Process anterior to Frontal Bone (Friol et al. 2015)
    0 absent
    1 present
77. Skull: Dorso-ventral Flattening of the Skull (Friol et al. 2015)
    0 None
    1 Extreme
    2 Moderate
    3 Curvilinear
    4 Other
78. Lateral Parietal region (Friol et al. 2015)
    0 Wide anterior and reduced posterior region
    1 Rectangular
    2 Moderately concave
    3 Extremely concave
    4 Anterior region reduced
79. Vomer and Palatine are in contact (Thomson et al. 2006)
    0 absent
    1 present
80. Parietal-Squamosal connection visible in dorsal view (Friol et al. 2015)
    0 absent
    1 present
81. Squamosal Crista visible in posterior view (Friol et al. 2015)
    0 horizontal
    1 vertical
82. Convexity of the inner region of the Dentary (Friol et al. 2015)
    0 absent
    1 present
83. Median squamosal region elevated (Friol et al. 2015)
    0 absent
    1 present
84. Shape of the contact between Opisthotic and Squamosal bones in posterior view (Friol et al. 2015)
    0 straight

1 curvilinear

85. Prearticular Fossa (Friol et al. 2015)
    0 Short
    1 Long
86. Inner margin of Mandible lower than outer margin (Friol et al. 2015)
    0 Absent
    1 Present
87. Mandible divided (Gaffney 1977)
    0 Absent
    1 Present
88. Crista Posterior of the Squamosal
    0 Absent
    1 Present
89. Alveolar Ridge in mouth (Thomson et al. 2006)
    0 Absent
    1 Present on Dentary only
    2 Present on Dentary and Rhamphotheca
90. Basioccipital (Friol et al. 2015)
    0 Wide and shortened
    1 Narrow and elongated
91. Pterygoid -- Lateral process open (Friol et al. 2015)
    0 Absent
    1 Present
92. Auditory fossa -- number (Friol et al. 2015)
    0 Three
    1 Two
93. Opisthotic Crista – position in relation to the skull (Friol et al. 2015)
    0 parallel
    1 perpendicular
94. Lingual Ridge in mouth (Thomson et al. 2006)
    0 Absent
    1 Present
95. Parietal Arch
    0 Wide
    1 Narrow
    2 Absent
96. Rhamphotheca of upper jaw (Thomson et al. 2006)
    0 Thin without modification
    1 Thickened, enlarged, to form crushing plate
97. Symphysial Hook on lower jaw (Gaffney 1977)
    0 Present
    1 Reduced or absent
98. Triturating surfaces of upper jaw meet at the midline (Thomson et al. 2006)
    0 Absent
    1 Present
99. Vomer contacts Pterygoids (Thomson et al. 2015)
    0 Absent
    1 Present

Head & Neck

100. Head Shield (Thomson et al. 2015)
    0 Present with lateral extensions to tympanum wrapping around dorsal tympanum

1 Present with lateral extension to tympanum
2 Restricted to dorsal surface of head
3 Absent

101. Neck Tubercles (Thomson and Georges 2009)
0 Large cornified
1 Small or absent

102. Head shield -- deeply fenestrated (Thomson et al. 2006)
0 Absent
1 Present

103. Macrocephaly in adults
0 Absent
1 Present

104. Leading and Trailing eye-spot in iris (Thomson et al. 2006)
0 Absent
1 Present

105. Iris ring color (Thomson et al. 2015)
0 Liquid (Absent)
1 Green
2 Gold
3 White

106. Temporal scales cornified (Thomson and Georges 2016)
0 Present
1 Absent

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Table S3. Frequency of carapaces with irregular scutes in a population of *Emydura macquarii nigra* on Fraser Island. Only carapaces with irregularities involving insertions or deletions are included. Other variations in scute or sulci shape are not included. N = 670 [from Georges, 1982].

Type	Raw Frequency	Percentage Frequency
Cervical divided or partially divided	27	4.0
Cervical fused to adjacent marginal	3	0.4
Cervical deleted	4	0.6
Marginals inserted	15	2.2
Marginals deleted	8	1.2
Costal Scutes inserted	29	4.3
Costal Scutes deleted	1	0.1
Vertebrals inserted	15	2.2
Vertebrals deleted	2	0.3
Total Carapace	**89**	**13.3**

Table S4. Frequency of plastra with irregular scutes in a population of *Emydura macquarii nigra* on Fraser Island. Only plastra with major irregularities involving insertions or deletions are included. Other variations in scute or sulci shape are not included. N = 670 [from Georges, 1982].

Type	Raw Frequency	Percentage Frequency
Insertions confluent with the plastron margin		
Between the intergular and gular	31	4.6
Between the intergular and humeral	15	2.2
Between the humeral and pectoral	1	0.1
Between the pectoral and abdominal	1	0.1
Between the abdominal and femoral	1	0.1
Between the femoral and anal	4	0.6
Other insertions	20	3.0
Deletions	0	0.0
Total plastron	73	10.9