

SUPPLEMENTARY DATA 3

**Unriddling an old dolphin: platanistoid *Notocetus vanbenedeni* Moreno, 1892 from the
early Miocene of Patagonia (Argentina)**

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Supplementary Data 3. List of morphological characters and modifications

List of morphological characters used in the phylogenetic analysis. Original matrix from Tanaka & Fordyce (2016), with modifications of Viglino *et al.* (2018b) and Gaetán *et al.* (2019). For each character, references are given for the main past uses as indicated by the original authors, using a hatch (#) to indicate original character number. If there is any modification to the coding or character description, it is marked with an asterisk and there is a note with a short explanation.

Rostrum, Dental, and Mandibular

- (1) Length of rostrum as percent skull length: moderately long, 50–55% (0); long, 55–60% (1); very long, >60% (2); medium, 50–40% (3); very short, 40–35% (4). (Murakami *et al.*, (2012a,b) #1; modified from Arnold & Heinsohn, (1996) #8; Bianucci, (2005) #1; Lambert, (2008) #1; Tanaka & Fordyce, (2014, 2015, 2016) #1; Viglino *et al.*, (2018a,b) #1).
- (2) Premaxillae transverse proportion: transversely inflated almost entire length of rostrum (0); flat almost entire length of the rostrum (1). (Murakami *et al.*, (2012a,b) #2; Tanaka & Fordyce, (2014, 2015, 2016) #2; Viglino *et al.*, (2018a,b) #2).
- (3) Premaxillae mediolateral proportion: not compressed mediolaterally (0); compressed mediolaterally at anterior of rostrum (1). (Murakami *et al.*, (2012a,b) #3; Tanaka & Fordyce, (2014, 2015, 2016) #3; Viglino *et al.*, (2018a,b) #3).
- (4) Premaxillae at apex of rostrum: with lateral margins parallel or diverging (0); narrowing (1). (Murakami *et al.*, (2012a,b) #4; modified from Bianucci, (2005) #2; Tanaka & Fordyce, (2014, 2015, 2016) #4; Viglino *et al.*, (2018a,b) #4).
- (5) Maxilla length as percent rostrum length: short, <85%, tips of maxillae not reaching tip of rostrum, (0); long, >89%, tips of maxillae to within 10% of rostrum tip (1);

same as state 1 except lack of alveoli (2). (Murakami et al., (2012a,b) #5; modified from Lambert, (2005) #1; Tanaka & Fordyce, (2014, 2015, 2016) #5; Viglino et al., (2018a,b) #5).

(6) Mesorostral groove: V-shaped or U-shaped opening (0); partially or completely filled in with vomer, becoming a solid rod of bone (1); absent (2). (Messenger & McGuire, (1998) #1429; Geisler & Sanders, (2003) #5; Geisler et al., (2011, 2012) #5; Murakami et al., (2012a,b) #6; derived from Moore, (1968); Tanaka & Fordyce, (2014, 2015, 2016) #6; Viglino et al., (2018a,b) #6).

(7) Mesorostral groove constricted posteriorly, anterior to the nares and behind the level of the antorbital notch, then rapidly diverging anteriorly: absent (0); present (1). (modified from Murakami et al., (2012b) #279; Tanaka & Fordyce, (2014, 2015, 2016) #7; Viglino et al., (2018a,b) #7).

(8) Lateral margin of rostrum anterior to maxillary flange: concave (0); straight (1); convex (2); absent (3) (Murakami et al., (2012a,b) #7; modified from Bianucci, (2005) #3; Tanaka & Fordyce, (2014, 2015, 2016) #8; Viglino et al., (2018a,b) #8).

(9) Rostral constriction: absent (0); constriction anterior to antorbital notch (1); constriction anterior to maxillary flange (2). (Murakami et al., (2012a, 2012b) #8; modified from Muizon, (1984); Barnes, (1985b); Messenger & McGuire, (1998) #1424; Geisler & Sanders, (2003) #6; Geisler et al., (2011, 2012) #6; Tanaka & Fordyce, (2014, 2015, 2016) #9; Viglino et al., (2018a,b) #9).

(10) Antorbital notch: absent or weakly developed (0); well developed (1). (Messenger & McGuire, (1998) #1426; Fajardo-Mellor et al., (2006) #6; Murakami et al., (2012a,b) #9; Tanaka & Fordyce, (2014, 2015, 2016) #10; Viglino et al., (2018a,b) #10).

(11*) Width of premaxillae at mid-rostrum as percent greatest width of maxillae at level of postorbital processes: wide, >25% (0); medium, 25–15% (1); narrow, <15% (2). (Murakami et al., (2012a,b) #10; modified from Aguirre-Fernandez et al., (2009) #4); Tanaka & Fordyce, (2014, 2015, 2016) #11; Viglino et al., (2018a,b) #11)

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* 2 to 1

(12) Width of rostrum at mid-length as percent greatest width of maxillae at level of postorbital processes: wide, >35% (0); medium, 35–30% (1); narrow, <30% (2). (Murakami et al., (2012a,b) #11; modified from Aguirre-Fernandez et al., (2009) #6; Tanaka & Fordyce, (2014, 2015, 2016) #12; Viglino et al., (2018a,b) #12).

(13*) Width of rostrum at antorbital notch as percent greatest width of maxillae at level of postorbital processes: wide, >68% (0); medium, 68–45% (1); narrow, <45% (2). (Murakami et al., (2012a,b) #12; modified from Geisler & Sanders, (2003) #7; Geisler et al., (2011, 2012) #7; Tanaka & Fordyce, (2014, 2015, 2016) #13; Viglino et al., (2018a,b) #13).

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* 1 to 0

(14) Premaxillae in dorsal view: contacting along midline for less than half length of rostrum (0); widely separated by mesorostral groove in rostrum (1); narrowly separated by mesorostral groove in rostrum (2); contacting along midline for approximately half the entire length or more than of rostrum but not fused (3); contacting along midline for approximately half the entire length or more than of rostrum and partially fused (4); converging (either contacting and separating) in mid-rostrum (5). (modified from Murakami et al., (2012a,b) #13; modified from Muizon, (1988); Fordyce, (1994) #52; Messenger & McGuire, (1998) #1405; Geisler & Sanders, (2003) #9; Geisler et al., (2011, 2012) #9; Tanaka & Fordyce,

(2014, 2015, 2016) #14; Viglino et al., (2018a,b) #14).

- (15*) Suture between maxilla and premaxilla on rostrum: unfused except distal tip of rostrum (0); fused partly or along most of rostrum (1); unfused along rostrum (2). (Murakami et al., (2012a,b) #14; modified from Fordyce, (1994) #36; Messenger & McGuire #1418, (1998); Geisler & Sanders, (2003) #10; Lambert, (2005) #2; Geisler et al., (2011, 2012) #10; Tanaka & Fordyce, (2014, 2015, 2016) #15; Viglino et al., (2018a,b) #15).

NOTE: The codings of the following taxa were modified: *Dilophodelphis forycei* 0 to 1.

Also, a new state has been added for *Phoberodon*, with the condition of the maxilla-premaxilla suture unfused along the rostrum.

- (16*) Posterior wall of antorbital notch: maxilla (0); lacrimal and jugal, or maxilla appeared in small area posterior to antorbital notch parallel with lacrimal and jugal (1); no notch but horizontal groove inferred to be for the facial nerve in the maxilla laterally on the face well above the margin of the rostrum (2). (Murakami et al., (2012a,b) #15; modified from Geisler & Sanders, (2003) #15; Geisler et al., (2011, 2012) #15; Tanaka & Fordyce, (2014, 2015, 2016) #16; Viglino et al., (2018a,b) #16).

NOTE: The codings of the following taxa were changed: *Notocetus vanbenedeni* 0 to 1.

- (17) Anterior sinus fossa: absent (0); between anterior extremity of pterygoid sinus and posterior extremity of upper tooth row (1); between posterior extremity of upper tooth row and midpoint of rostrum (2); beyond midpoint of rostrum (3). (Murakami et al., (2012a,b) #17; modified from Muizon, (1988); Barnes, (1990); Bianucci, (2005) #13; Arnold & Heinsohn, (1996) #21; Geisler & Sanders, (2003) #157; Aguirre-Fernandez et al., (2009) #18; Geisler et al., (2011, 2012) #157; derived from Fraser & Purves, (1960); Tanaka & Fordyce, (2014, 2015) #18

(2016) #17; Viglino et al., (2018a,b) #17).

Teeth

(18) Number of double-rooted teeth in maxilla: 6–8 (0); 0 (1). (modified from Geisler & Sanders, (2003) #23; Geisler et al., (2011, 2012) #23; Murakami et al., (2012a,b) #18; Tanaka & Fordyce, (2014, 2015) #19 (2016) #18; Viglino et al., (2018a,b) #18).

(19) Tooth enamel: reticulating striae (0); smooth (1); nodular (2); absent (3). (Murakami et al., (2012a,b) #20; modified from Messenger & McGuire, (1998) #1469; Geisler & Sanders, (2003) #26; Geisler et al., (2011, 2012) #26; derived from Zhou, (1982); Tanaka & Fordyce, (2014, 2015) #20 (2016) #19; Viglino et al., (2018a,b) #19).

(20) Teeth: heterodont and some teeth with denticle (0); conical, with or without accessory cusp (1); spatulate (2); laterally compressed (3). (Murakami et al., (2012a,b) #21; modified from Heyning, (1989) #40, (1997) #72; Arnold & Heinsohn, (1996) #25; Messenger & McGuire, (1998) #1470; Geisler & Sanders, (2003) #27; Lambert, (2008) #16; Geisler et al., (2011, 2012) #27; derived from Barnes, (1984a); Tanaka & Fordyce, (2014, 2015) #21 (2016) #20; Viglino et al., (2018a,b) #20).

(21) Large incisor tusk: absent (0); present (1). (Tanaka & Fordyce, (2014, 2015) #287 287 (2016) #21; Viglino et al., (2018a,b) #21)

(22) Incisors relatively delicate and procumbent: no (0); yes (1). (Fordyce (1994) #42; Tanaka & Fordyce, (2014, 2015) #285 (2016) #22; Viglino et al., (2018a,b) #22)

(23) Crown of heterodont teeth: long (>10 mm) (0); short (<10mm) (1). (Fordyce (1994) #58; Tanaka & Fordyce, (2014, 2015) #286 (2016) #23; Viglino et al., (2018a,b) #23)

(24) Upper anterior "teeth": about same size as upper posterior teeth (0); greatly enlarged (1); clearly smaller than upper posterior teeth or absent (2). (modified from Murakami et al., (2012a,b) #22; Tanaka & Fordyce, (2014, 2015) #22 (2016) #24; Viglino et al., (2018a,b) #24).

(25) Cheek teeth ectocingulum: present (0); absent (1). (Murakami et al., (2012a, 2012b) #23; modified from Geisler & Sanders, (2003) #31; Geisler et al., (2011, 2012) #31; Tanaka & Fordyce, (2014, 2015) #23 (2016) #25; Viglino et al., (2018a,b) #25).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

(26) Cheek teeth entocingulum: present (0); absent (1). (Geisler & Sanders, (2003) #32; Geisler et al., (2011, 2012) #32; Murakami et al., (2012a,b) #24; Tanaka & Fordyce, (2014, 2015) #24 (2016) #26; Viglino et al., (2018a,b) #26).

(27*) Greatest diameter of largest functional tooth as percent of greatest width of maxillae at the level of the postorbital processes: large, >5% (0); medium, 5–3% (1); small, <3% (2). (Murakami et al., (2012a,b) #25; modified from Aguirre-Fernández et al., (2009) #15; Tanaka & Fordyce, (2014, 2015) #25 (2016) #27; Viglino et al., (2018a,b) #27).

NOTE: We modified the codings of the following taxa: *Dilophodelphis fordycei* 2 to ?

Mandible

(28*) Anterior mandibular teeth: deeply rooted, root >50% of tooth (0); not deeply rooted, root <50% of tooth (1). (Messenger & McGuire, (1998) #1471; Geisler & Sanders, (2003) #28; Geisler et al., (2011, 2012) #28; Murakami et al., (2012a,b) #26; derived from Flower, (1872); Moore, (1968); Tanaka & Fordyce, (2014, 2015) #26 (2016) #28; Viglino et al., (2018a,b) #28).

NOTE: We modified the codings of the following taxa: *Macrosqualodelphis ukupachai*

0 to ?. Since the mandible has not been preserved in this species, and it is the only character of this bone coded on the original matrix, we have modified it accordingly.

(29*) Anterior-most mandibular "tooth": about same size as posterior teeth (0); smaller than posterior teeth (1); greatly enlarged (2); forming a tusk (3). (Murakami et al., (2012a,b) #27; modified from Muizon, (1991); Geisler & Sanders, (2003) #36; Messenger & McGuire, (1998) #1477; Geisler et al., (2011, 2012) #36; derived from Flower, (1872); Tanaka & Fordyce, (2014, 2015) #27 (2016) #29; Viglino et al., (2018a,b) #29).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 0.

(30*) Number of teeth in mandible: 16–11 (0); 9–8 (1); 2 (2); 1 (3); 17–23 (4); 24–27 (5); 28–39 (6); >40 (7). (Murakami et al., (2012a) #28; modified from Messenger & McGuire, (1998) #1468; Geisler & Sanders, (2003) #37; Geisler et al., (2011, 2012) #37; Tanaka & Fordyce, (2014, 2015) #28 (2016) #30; Viglino et al., (2018a,b) #30).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 4.

(31) Length of mandibular symphysis as percent of mandible length: long, >20% (0); short, <20% (1). (Murakami et al., (2012a,b) #29; modified from Messenger & McGuire, (1998) #1465; Arnold & Heinsohn, (1996) #7; Bianucci, (2005) #26; Tanaka & Fordyce, (2014, 2015) #29 (2016) #31; Viglino et al., (2018a,b) #31).

(32) Mandibular symphysis: sutured but unfused (0); fused (1). (Fordyce, (1994) #5; Messenger & McGuire, (1998) #1466; Geisler & Sanders, (2003) #40; Geisler et al., (2011, 2012) #40; Murakami et al., (2012a,b) #30; derived from Flower, (1885); Tanaka & Fordyce, (2014, 2015) #30 (2016) #32; Viglino et al., (2018a,b) #32).

(33*) Longitudinal groove on underside of mandibles: absent (0); present (1). (Geisler & Sanders, (2003) #41; Geisler et al., (2011, 2012) #41; Murakami et al., (2012a,b) #31; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #31 (2016) #33; Viglino et al., (2018a,b) #33).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

(34) Mandible: bowed medially (0); straight (1); slightly bowed laterally (2). (Sanders & Barnes, 2002; Geisler & Sanders, (2003) #42; Geisler et al., (2011, 2012) #42; Murakami et al., (2012a,b) #32; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #32 (2016) #34; Viglino et al., (2018a,b) #34).

(35) Elevation of coronoid process: very high (0); moderate (1); low (2). (Murakami et al., (2012a,b) #33; modified from Geisler & Sanders, (2003) #44; Bianucci, (2005) #27; Geisler et al., (2011, 2012) #44; Tanaka & Fordyce, (2014, 2015) #33 (2016) #35; Viglino et al., (2018a,b) #35).

Orbit

(36) Antorbital process of maxilla in dorsal view: triangular (0); robust and globose or rectilinear (1); absent (2). (Bianucci, (2005) #4; Murakami et al., (2012a,b) #34; Tanaka & Fordyce, (2014, 2015) #34 (2016) #36; Viglino et al., (2018a,b) #36).

(37) Angle of anterior edge of supraorbital process and the median line: oriented slightly anterolaterally, at an angle $<30^{\circ}$ (\pm) with sagittal plane (0) oriented anteromedially (1). (Murakami et al., (2012a,b) #35; modified from Geisler & Sanders, (2003) #49; Geisler et al., (2011) (2012) #49; Tanaka & Fordyce, (2014, 2015) #35 (2016) #37; Viglino et al., (2018a,b) #37).

(38) Ratio of length of antorbital process of lacrimal to length of the orbit: <0.6 (0); ≥ 0.6 (1). (Murakami et al., (2012a,b) #36; Tanaka & Fordyce, (2014, 2015) #36 (2016) #38; Viglino et al., (2018a,b) #38).

- (39) Lacrimal: wrapping around anterior edge of supraorbital process of frontal and slightly overlying its anterior end (0); appearing dorsally and forming most of antorbital process (1); appearing dorsally but not prominently in antorbital process (2); restricted to below the supraorbital process of maxilla (3). (Murakami et al., (2012a,b) #37; modified from Geisler & Sanders, (2003) #51; Geisler et al., (2011, 2012) #51; derived from Kellogg, (1923); Miller, (1923); Tanaka & Fordyce, (2014, 2015) #37 (2016) #39; Viglino et al., (2018a,b) #39).
- (40) Lacrimal foramen or groove: present (0); absent (1). (Geisler & Sanders, (2003) #52; Geisler et al., (2012; 2011) #52; Murakami et al., (2012a,b) #38; Tanaka & Fordyce, (2014, 2015) #38 (2016) #40; Viglino et al., (2018a,b) #40).
- (41) Lacrimal and jugal fusion: separated (0); fused (1). (Heyning, (1989) #7, (1997) #39; Geisler & Sanders, (2003) #53; Geisler et al., (2011, 2012) #53; Murakami et al., (2012a,b) #39; derived from Flower, (1868); Schulte, (1917); Miller, (1923); Tanaka & Fordyce, (2014, 2015) #39 (2016) #41; Viglino et al., (2018a,b) #41).
- (42*) Lacrimal and jugal contact: contacting each other externally (0); lacrimal excluded from edge of skull, jugal directly contacting anterior edge of frontal (1). (Geisler & Sanders, (2003) #54; Geisler et al., (2011, 2012) #54; Murakami et al., (2012a,b) #40; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #40 (2016) #42; Viglino et al., (2018a,b) #42).

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* - to ?.

- (43) Jugal: thick and sturdy (0); thin, splint, or absent (1). (Geisler & Sanders, (2003) #56; Lambert, (2005) #21; Geisler et al., (2011, 2012) #56; Murakami et al., (2012a,b) #41; derived from Miller, (1923); Barnes, (1990); Tanaka & Fordyce, (2014, 2015) #41 (2016) #43; Viglino et al., (2018a,b) #43).
- (44*) Combined anteroposterior length of the lacrimal and jugal exposure that is posterior

to antorbital notch: with skull in ventral view, exposure is small and combined length forms <50% of anteroposterior distance from antorbital notch to postorbital ridge (0); intermediate, forms between 50 and 62% of that distance (1); large, forms between 62 and 69% that distance (2); very large, forms >69% of that distance (3). (Murakami et al., in (2012a,b) #42; modified from Geisler & Sanders, (2003) #55; Geisler et al., (2011, 2012) #55; Tanaka & Fordyce, (2014, 2015) #42 (2016) #44; Viglino et al., (2018a,b) #44).

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* 1 to 0.

(45) Dorsolateral edge of internal opening of infraorbital foramen: formed by maxilla (0); formed by maxilla and lacrimal and/or jugal (1); formed by lacrimal and/or jugal (2); formed by frontal (3). (Geisler & Sanders, (2003) #57; Geisler et al., (2011, 2012) #57; Murakami et al., (2012a,b) #43; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #43 (2016) #45; Viglino et al., (2018a,b) #45).

(46) Ventromedial edge of internal opening of infraorbital foramen: formed by maxilla (0); formed by maxilla and palatine and/or pterygoid (1); formed by palatine and/or pterygoid (2). (Geisler & Sanders, (2003) #58; Geisler et al., (2011, 2012) #58; Murakami et al., (2012ab) #44; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #44 (2016) #46; Viglino et al., (2018a,b) #46).

(47*) Infraorbital plate of maxilla: present (0); absent (1). (Geisler & Sanders, (2003) #59; Geisler et al., (2011, 2012) #59; modified from Murakami et al., (2012a) #45; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #45 (2016) #47; Viglino et al., (2018a,b) #47).

NOTE: We have modified the name of the character, as according to Mead & Fordyce (2009) this structure is called infraorbital plate of the maxilla *sensu* Miller (1923). For cetaceans, this structure only occurs in mysticetes.

- (48) Direction of apex of postorbital process of frontal: projected posterolaterally and slightly ventrally (0); directed ventrally (1); not clear because of extremely reduced process (2). (modified from Murakami et al., (2012a,b) #46; Geisler & Sanders, (2003) #61; Geisler et al., (2011, 2012) #61; Tanaka & Fordyce, (2014, 2015) #46 (2016) #48; Viglino et al., (2018a,b) #48).
- (49) Shape of postorbital process of frontal: robust, blunt descending posteriorly (0); pointed, attenuated, or acute triangular (1); triangular, trapezoidal, or an anteroposteriorly widened falciform (2); dorsoventrally long falciform (3). (modified from Murakami et al., (2012a,b) #47; Tanaka & Fordyce, (2014, 2015) #47 (2016) #49; Viglino et al., (2018a,b) #49).
- (50) Frontal-maxilla suture angled posterodorsally at an angle of 50–70° (\pm) from axis of rostrum, with lateral exposure of frontal thickening posteriorly: absent (0); present (1). (Geisler & Sanders, (2003) #48; Geisler et al., (2011, 2012) #48; Murakami et al., (2012a,b) #48; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #48 (2016) #50; Viglino et al., (2018a,b) #50).

Facial Region

- (51) Anterior dorsal infraorbital foramina: one (0); two (1); three or more (2). (Murakami et al., (2012a,b) #49; modified from Barnes, (1984b); Geisler & Sanders, (2003) #64; Geisler et al., (2011, 2012) #64; Tanaka & Fordyce, (2014, 2015) #49 (2016) #51; Viglino et al., (2018a,b) #51).
- (52*) Circumnarial basin: absent or poorly defined (0); present, situated medial to antorbital notch and anterior to supraorbital process of frontal (1). (Geisler & Sanders, (2003) #65; Geisler et al., (2011, 2012) #65; Murakami et al., (2012a,b) #50; Tanaka & Fordyce, (2014, 2015) #50 (2016) #52; Viglino et al., (2018a,b) #52).

NOTE: We have modified the name of the character to match the name of the structure as defined by Mead & Fordyce (2009). The correct name is circumnarial or supracranial basin, present in odontocetes with a raised lateral margin of maxilla and/or frontal (supraorbital ridge). We also modified the following codings: *Physeter catodon* 0 to 1, *Kogia breviceps* 0 to 1, *Berardius bairdii* 1 to 0, *Ziphius cavirostris* 0 to 1, *Lipotes vexillifer* 0 to 1, *Pomatodelphis inaequalis* 0 to 1, *Platanista gangetica* 0 to 1, *Notocetus vanbenedeni* 0 to 1, *Zarhachis flagellator* 0 to 1.

(53*) Width of premaxillae at antorbital notches as percent width of rostrum at antorbital notch: narrow, <49% (0); moderate, 50–64% (1); wide, >65% (2); antorbital notch absent (3). (Geisler & Sanders, (2003) #66; Geisler et al., (2011, 2012) #66; modified from Murakami et al., (2012a,b) #51; Tanaka & Fordyce, (2014, 2015) #51 (2016) #53; Viglino et al., (2018a,b) #53).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 2 to 0&1

(54) Size of premaxillary foramen: right and left subequal (0); right much larger than left (1); premaxillary foramen absent (2). (Messenger & McGuire, (1998) #1415; Murakami et al., (2012a,b) #53; modified from Geisler & Sanders, (2003) #70; Geisler et al., (2011, 2012) #70; Tanaka & Fordyce, (2014, 2015) #53 (2016) #54; Viglino et al., (2018a,b) #54).

(55*) Position of premaxillary foramen: anterior of antorbital notch and anterior edge of supraorbital process (0); approximately medial to or posterior to antorbital notch region (1); premaxillary foramen absent (2). (Geisler & Sanders, (2003) #71; Geisler et al., (2011, 2012) #71; Murakami et al., (2012a,b) #54; Tanaka & Fordyce, (2014, 2015) #54 (2016) #55; Viglino et al., (2018a,b) #55).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

- (56) Premaxillary foramen locating: medial (0); midpoint to lateral (1) absent (2).
(modified from Murakami et al., (2012b) #280; Tanaka & Fordyce, (2014, 2015) #55 (2016) #56; Viglino et al., (2018a,b) #56).
- (57) Lateral margin of the right premaxilla posterior to premaxillary foramen: widen posteriorly (0); straight (1). (Murakami et al., (2012b) #281; Tanaka & Fordyce, (2014, 2015) #56 (2016) #57; Viglino et al., (2018a,b) #57).
- (58) Posterolateral sulcus: deep (0); shallow or absent (1); presence of additional posterolateral sulcus (longitudinal striation) (2). (Murakami et al., (2012a,b) #55; modified from Muizon, (1984, 1988); Lambert, (2008) #6; Geisler & Sanders, (2003) #72; Geisler et al., (2011, 2012) #72; Tanaka & Fordyce, (2014, 2015) #57 (2016) #58; Viglino et al., (2018a,b) #58).
- (59) Posterior projections of premaxillae: both premaxillae extending posterior to anterior tip of nasals (0); both premaxillae extending posterior to nasals (1); only right premaxillae extended posterior to nasal (2); neither premaxillae extending posterior to external nares, and narrow posterior end of premaxillae adjacent to external nares (3); neither premaxillae extending beyond external nares, and premaxillae displaced laterally by medial projection of maxilla (4); only right premaxilla extending beyond or in line with anterior-most portion of nasals (5).
(Murakami et al., (2012a,b) #76; modified from Muizon (1984); Barnes, (1985a); Heyning, (1989) #39, 42, (1997) #63, 71, 74; Arnold & Heinsohn, (1996) #35; Messenger & McGuire, (1998) #1407, 1408; Fajardo-Mellor et al., (2006) #3; Lambert, (2008) #5; Fordyce, (1994) #27; Tanaka & Fordyce, (2014, 2015) #58 (2016) #59; Viglino et al., (2018a,b) #59).
- (60) A posterior dorsal infraorbital foramen placed posteromedially, near posterior extremity of premaxilla: absent (0); present (1). (Fordyce, (1994) #62; Lambert,

- (2005) #13; Murakami et al., (2012a,b) #58; Tanaka & Fordyce, (2014, 2015, 2016) #60; Viglino et al., (2018a,b) #60).
- (61) Premaxillary sac fossae: absent (0); present (1). (Messenger & McGuire, (1998) #1411; Lambert, (2005) #4; Murakami et al., (2012a,b) #59; Tanaka & Fordyce, (2014, 2015, 2016) #61; Viglino et al., (2018a,b) #61).
- (62) Maxilla on dorsal surface of skull: does not contact supraoccipital posteriorly, maxilla separated by frontal and/or parietal (0); contact present (1). (Geisler & Sanders, (2003) #129; Geisler et al., (2011, 2012) #129, modified from Muizon, (1991, 1994); Murakami et al., (2012a,b) #60; Tanaka & Fordyce, (2014, 2015, 2016) #62; Viglino et al., (2018a,b) #62).
- (63) Maxillae at anterior edge of supraorbital processes: abutting anterior edge of supraorbital processes of frontals (0); covering partially or almost completely surface of supraorbital processes (1). (Murakami et al., (2012a,b) #61; modified from Fordyce, (1994) #3; Messenger & McGuire, (1998) #1419; Geisler & Sanders, (2003) #76; Geisler et al., (2011, 2012) #76; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015, 2016) #63; Viglino et al., (2018a,b) #63).
- (64) Anterolateral corner of maxilla overlying supraorbital process of frontal: thin and equal in thickness to parts posteromedial (0); thickened with thinner maxilla in posteromedial direction (1). (Geisler & Sanders, (2003) #78; Geisler et al., (2011, 2012) #78; Murakami et al., (2012a,b) #62; Tanaka & Fordyce, (2014, 2015, 2016) #64; Viglino et al., (2018a,b) #64).
- (65) Pneumatic maxillary crest overhanging medially: absent (0); present (1). (Zhou, (1982); Heyning, (1989) #26, (1997) #58; Fordyce, (1994) #66; Arnold & Heinsohn, (1996) #14; Messenger & McGuire, (1998) #1421; Murakami et al., (2012a,b) #63; Tanaka & Fordyce, (2014, 2015, 2016) #65; Viglino et al.,

(2018a,b) #65).

(66) Maxillary crest on supraorbital process of maxilla: longitudinal ridges absent except at lateral edge of antorbital process (0); presence of longitudinal ridge except at lateral edge of antorbital process (1); longitudinal ridge present and joined with maxillary flange (2); presence of transversely compressed high crest, except at lateral edge of antorbital process (3); absent (4). (Murakami et al., (2012a,b) #64; modified from Muizon, (1984, 1987); Barnes, (1985b); Messenger & McGuire, (1998) #1420; Geisler & Sanders, (2003) #79; Geisler et al., (2011, 2012) #79; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015, 2016) #66; Viglino et al., (2018a,b) #66).

(67) Anterior edge of nasals: anterior to, or in line with, anterior edges of supraorbital processes of frontals (0); posterior to anterior edges of supraorbital processes of frontals (1). (Murakami et al., (2012a,b) #65; modified from Geisler & Sanders, (2003) #80; Geisler et al., (2011, 2012) #80; Tanaka & Fordyce, (2014, 2015, 2016) #67; Viglino et al., (2018a,b) #67).

(68) Premaxillae in dorsal view: separated anterior to bony nares, exposing mesethmoid (0); joined premaxillae (or maxillae) closing at least posterior part of mesorostral groove (1). (Lambert, (2005) #3; Murakami et al., (2012a,b) #66; Tanaka & Fordyce, (2014, 2015, 2016) #68; Viglino et al., (2018a,b) #68).

(69) Anterior edge of bony nares: inverted V-shaped, premaxillae gradually converging anteriorly to midline (0); inverted U-shaped, premaxillae abruptly converging anteriorly to midline (1). (Muizon, (1988); Geisler & Sanders, (2003) #81; Geisler et al., (2011, 2012) #81; Murakami et al., (2012a,b) #67; Tanaka & Fordyce, (2014, 2015, 2016) #69; Viglino et al., (2018a,b) #69).

(70) Fossa for inferior vestibule on maxilla lateral to external nares or lateral to

premaxilla: absent (0); present (1). (Muizon, (1988); Murakami et al., (2012a,b) #68; derived from Curry, (1992); Tanaka & Fordyce, (2014, 2015, 2016) #70; Viglino et al., (2018a,b) #70).

(71) Maxillary intrusion, anterior to external nares and encroaching the posteromedial or medial face of each premaxilla: absent (0); maxilla visible within opened mesorostral canal as small exposure medially (1); exposure of maxilla reaches dorsally to level of premaxilla and forms a square, rectangular to triangular plate (2); exposure of maxilla reaches dorsally and forms a small subcircular to polygonal ossicle (3). (Muizon, (1984, 1988); Arnold & Heinsohn, (1996) #24; Messenger & McGuire, (1998) #1422; Murakami et al., (2012a,b) #69; Tanaka & Fordyce, (2014, 2015, 2016) #71; Viglino et al., (2018a,b) #71).

(72*) Medial facial crest (*sensu* Fordyce 1994): absent (0); present (1). (transverse premaxillary crest *sensu* Lambert, (2005) #6; Murakami et al., (2012a,b) #70; Tanaka & Fordyce, (2014, 2015, 2016) #72; Viglino et al., (2018a,b) #72).

NOTE: Murakami et al., (2012) definition of posterior maxillary crest would be homologous to the medial facial crest defined by Fordyce (1994). According to Mead & Fordyce (2009), the premaxillary crest definition also involves the maxilla, therefore it would also be homologous to the medial facial crest. In order to maintain terminology consistency, the character name was modified to medial facial crest. Alos, we modified the codings of the following taxa: *Phoberodon arctirostris* 0 to 1.

(73) Premaxilla: not overhanging itself or maxilla laterally (0); overhanging itself or maxilla laterally, from anterior to midpoint of external nares (1). (Murakami et al., (2012a,b) #71; Tanaka & Fordyce, (2014, 2015, 2016) #73; Viglino et al., (2018a,b) #73).

(74) Premaxillary sac fossa: smooth (0); rugose (1). (Messenger & McGuire, (1998) #1551; Murakami et al., (2012a,b) #72; Tanaka & Fordyce, (2014, 2015, 2016) #74; Viglino et al., (2018a,b) #74).

(75) Ratio of width of right premaxilla to width of left premaxilla in line with midpoint of external nares: 0.90–1.19 (0); 1.20–1.50 (1); 1.50> (2). (Murakami et al., (2012a,b) #73; Tanaka & Fordyce, (2014, 2015, 2016) #75; Viglino et al., (2018a,b) #75).

(76*) Ratio of greatest width of premaxillae to greatest width of maxillae at level of postorbital processes: ≥ 0.50 (0); 0.49–0.38 (1); < 0.38 (2). (Murakami et al., (2012a,b) #74; Tanaka & Fordyce, (2014, 2015, 2016) #76; Viglino et al., (2018a,b) #76

NOTE: we changed the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

(77) Premaxillary eminence: absent (0); present but low (1); present and high (2). (Lambert, (2008) #4; Murakami et al., (2012a,b) #75; modified from Muizon, (1984); Barnes, (1985a); Heyning, (1989) #36, (1997) #68; Arnold & Heinsohn, (1996) #12; Messenger & McGuire, (1998) #1410; Geisler & Sanders, (2003); #68; Fajardo-Mellor et al., (2006) #2; Geisler et al., (2011, 2012) #69; derived from Flower, (1867); Noble & Fraser, (1971); Tanaka & Fordyce, (2014, 2015, 2016) #77; Viglino et al., (2018a,b) #77).

(78) Intra-premaxillary foramen on posterior dorsal surface of skull, which is bounded by premaxilla and maxilla: absent (0); present (1) (Tanaka & Fordyce, (2014, 2015) #279 (2016) #78; Viglino et al., (2018a,b) #78)

(79*) Right premaxilla: portion anterior to nasal opening wider than portion posterior to opening, with nasal septum angled anteriorly and to left (0); portion posterior to nasal opening wider than portion anterior to opening, with nasal septum angled

anteriorly and to right (1). (modified from Geisler & Sanders, (2003) #86; Geisler et al., (2011, 2012) #86; Murakami et al., (2012a,b) #77; Tanaka & Fordyce, (2014, 2015) #78 (2016) #79; Viglino et al., (2018a,b) #79).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* - to 0.

(80) Left bony naris: same size or slightly larger than right bony naris (0); at least twice the size of right bony naris (1). (Barnes, (1990); Geisler & Sanders, (2003) #87; Geisler et al., (2011, 2012) #87; Murakami et al., (2012a,b) #78; Tanaka & Fordyce, (2014, 2015) #79 (2016) #80; Viglino et al., (2018a,b) #80).

(81) Supracranial basin: absent (0); present (1). (Heyning, (1989) #8, (1997) #40; Fordyce, (1994) #18; Messenger & McGuire, (1998) #1400; Geisler & Sanders, (2003) #88; Lambert, (2005) #10; Geisler et al., (2011, 2012) #88; Murakami et al., (2012a,b) #79; Tanaka & Fordyce, (2014, 2015) #80 (2016) #81; Viglino et al., (2018a,b) #81).

(82) Proximal ethmoid region: not visible in dorsal view, roofed over by nasals (0); exposed dorsally (1). (Messenger & McGuire, (1998) #1455; Geisler & Sanders, (2003) #92; Geisler et al., (2011, 2012) #92; Murakami et al., (2012a,b) #80; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #81 (2016) #82; Viglino et al., (2018a,b) #82).

(83) Mesethmoid: not expanded posterodorsally (0); extended posterodorsally but narrow (1); expanded posterodorsally and visible in lateral view (2). (Murakami et al., (2012a,b) #81; modified from Muizon, (1984, 1988); Messenger & McGuire, (1998) #1454; Bianucci, (2005) #9; Tanaka & Fordyce, (2014, 2015) #82 (2016) #83; Viglino et al., (2018a,b) #83).

Vertex and Area Adjacent to the Nares

- (84) Inflections of ascending processes of premaxillae: gradual (0); vertical (1). (Geisler & Sanders, (2003) #107; Geisler et al., (2011, 2012) #107; modified from Murakami et al., (2012a,b) #82; derived from Fordyce, (1994); Tanaka & Fordyce, (2014, 2015) #83 (2016) #84; Viglino et al., (2018a,b) #84).
- (85) Inflections of premaxillae just anterior to, or in line with, anterior edge of supraorbital processes of frontals: absent (0); present (1) (Murakami et al., (2012a,b) #83; modified from Geisler & Sanders, (2003) #108; Geisler et al., (2011, 2012) #108; Tanaka & Fordyce, (2014, 2015) #84 (2016) #85; Viglino et al., (2018a,b) #85).
- (86*) Premaxillary cleft: absent (0); present, posterior part of ascending processes of premaxillae bearing a distinct cleft, originating at posterior edge of premaxillae and continuing anteriorly, dividing each premaxilla into two (1); present, with shallow cleft (2). (Geisler & Sanders, (2003) #109; Geisler et al., (2011, 2012) #109; Murakami et al., (2012a,b) #84; Tanaka & Fordyce, (2014, 2015) #85 (2016) #86; Viglino et al., (2018a,b) #86).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 2.

- (87) Nasal bones: two (0); one or zero (1). (Heyning, (1989) #9, (1997) #41; Murakami et al., (2012a,b) #85; modified from Messenger & McGuire, (1998) #1431; Geisler & Sanders, (2003) #113; Geisler et al., (2011, 2012) #113; derived from Kuzmin, (1976); Tanaka & Fordyce, (2014, 2015) #86 (2016) #87; Viglino et al., (2018a,b) #87).
- (88) Nasals: lower than frontals (0); nearly same height as frontals (1); clearly higher than frontals (2). (Muizon, (1988); Messenger & McGuire, (1998) #1434; Geisler & Sanders, (2003); #124; Geisler et al., (2011, 2012) #124; Murakami et al., (2012a) #86; Tanaka & Fordyce, (2014, 2015) #87 (2016) #88; Viglino et al., (2018a,b)

#88).

(89) Nasal protuberance: absent (0); present (1). (Muizon, (1988); Messenger & McGuire, (1998) #1433; Fajardo-Mellor et al., (2006) #7; Lambert, (2008) #8; Murakami et al., (2012a,b) #87; Tanaka & Fordyce, (2014, 2015) #88 (2016) #89; Viglino et al., (2018a,b) #89).

(90*) Both nasals: straight anterior edges in one transverse plane (0); with point on midline and gap on each side between premaxilla and nasal (1); concave posteriorly on midline and gap on each side between premaxilla and nasal (2); concave posteriorly on midline (3). (Murakami et al., (2012a,b) #88; modified from Geisler & Sanders, (2003) #116; Geisler et al., (2011, 2012) #116; derived from Moore, (1968); Tanaka & Fordyce, (2014, 2015) #89 (2016) #90; Viglino et al., (2018a,b) #90).

NOTE: The following codings were modified: *Arktocara yakataga* 0 to ?

(91) Nasals: fossae on nasals absent (0); smooth-surfaced fossa on anterior to anterolateral surface (1); anteromedially depressed (2). (Messenger & McGuire, (1998) #1437; Murakami et al., (2012a,b) #89; Tanaka & Fordyce, (2014, 2015) #90 (2016) #91; Viglino et al., (2018a,b) #91).

(92*) Transverse width of either of nasals as percent maximum length of nasals: very narrow, <20% (0); narrow, 21–69% (1); wide, >70% (2). (Murakami et al., (2012a) #90; modified from Muizon, (1988); Messenger & McGuire, (1998) #1432; Geisler & Sanders, (2003); #119; Geisler et al., (2011, 2012) #119; Tanaka & Fordyce, (2014, 2015) #91 (2016) #92; Viglino et al., (2018a,b) #92).

NOTE: The following codings were modified: *Arktocara yakataga* 2 to ?; *Notocetus vanbenedeni* 1 to 2.

(93*) Nasals: medial portions roughly in same horizontal plane as, or higher than, lateral

portions (0); medial portions depressed, forming a median trough immediately posterior to nasal openings (1). (Muizon, (1988, 1991); Geisler & Sanders, (2003); #118; Geisler et al., (2011, 2012) #118; Murakami et al., (2012a,b) #91; Tanaka & Fordyce, (2014, 2015) #92 (2016) #93; Viglino et al., (2018a,b) #93).

NOTE: The following codings were modified: *Notocetus vanbenedeni* ? to 0.

(94*) Lateral edges of nasals: not overhanging or covering maxillae or premaxillae (0); overhanging or partly covering maxillae or premaxillae (1). (Murakami et al., (2012a,b) #92; Tanaka & Fordyce, (2014, 2015) #93 (2016) #94; Viglino et al., (2018a,b) #94).

NOTE: The following codings were modified: *Notocetus vanbenedeni* ? to 0.

(95*) Nasal-frontal suture: approximately straight transversely (0); anterior wedge (narial process) between posterior ends of nasals (1); W or reversed U suture line (2). (Murakami et al., (2012a, 2012b) #93; modified from Muizon, (1988); Geisler & Sanders, (2003) #121; Geisler et al., (2011, 2012) #121; Tanaka & Fordyce, (2014, 2015) #94 (2016) #95; Viglino et al., (2018a,b) #95).

NOTE: We have rephrased state 2 of this character to make it clearer. Also, we modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 2.

(96) Frontals posterior to nasals and between maxillae: wider than maximum transverse width across nasals (0); same as transverse width of nasals (1); narrower than transverse width of nasals, maxillae expanded medially posterior to nasals (2). (Geisler & Sanders, (2003) #125; Geisler et al., (2011, 2012) #125; Murakami et al., (2012a,b) #94; modified from Messenger & McGuire, (1998) #1457; Tanaka & Fordyce, (2014, 2015) #95 (2016) #96; Viglino et al., (2018a,b) #96).

(97) Frontal boss on vertex: absent (0); present (1). (Muizon, (1984, 1988); Messenger & McGuire, (1998) #1461; Fajardo-Mellor et al., (2006) #12; Murakami et al.,

- (2012a,b) #95; modified from Lambert, (2008) #9; Tanaka & Fordyce, (2014, 2015) #96 (2016) #97; Viglino et al., (2018a,b) #97).
- (98) Vertex: absent (0); present (1); highly developed (2). (Murakami et al., (2012a) #96; Muizon, (1991); Messenger & McGuire, (1998) #1404; Lambert, (2005) #7; Tanaka & Fordyce, (2014, 2015) #97 (2016) #98; Viglino et al., (2018a,b) #98).
- (99) Cranial vertex skewed asymmetrically to left side: absent (0); present (1). (Barnes, (1990); Bianucci, (2005) #7; Aguirre-Fernandez et al., (2009) #18; Murakami et al., (2012a,b) #97; Tanaka & Fordyce, (2014, 2015) #98 (2016) #99; Viglino et al., (2018a,b) #99).
- (100) Anterodorsal wall of braincase: formed by frontals (0); mostly formed by maxillae (1). (Geisler & Sanders, (2003) #127; Geisler et al., (2011, 2012) #127; Murakami et al., (2012a,b) #98; derived from Schulte, (1917); Miller, (1923); Tanaka & Fordyce, (2014, 2015) #99 (2016) #100; Viglino et al., (2018a,b) #100).
- (101) Nuchal crest: higher than frontals and/or nasals (0); at same level as frontals and/or nasals (1); below frontals and/or nasals (2). (Murakami et al., (2012a,b) #99; modified from Geisler & Sanders, (2003) #128; derived from Moore, (1968); Tanaka & Fordyce, (2014, 2015) #100 (2016) #101; Viglino et al., (2018a,b) #101).

Temporal Fossae, Zygomatic Arch, and Occipitals

- (102) Temporal fossa shape in lateral view: height lower than anteroposterior length (0); higher (1); nearly equilateral square (2); lower and its posterior end is rounded (3). (Tanaka & Fordyce, (2014, 2015) #281 (2016) #102; Viglino et al., (2018a,b) #102)
- (103*) Temporal fossa: not roofed over by lateral expansion of maxillae (0); roofed over by lateral expansion of maxillae (1). (Muizon, (1988); Heyning, (1989) #22,

(1997) #54; Arnold & Heinsohn, (1996) #39; Messenger & McGuire, (1998) #1453; Murakami et al., (2012a,b) #100; Tanaka & Fordyce, (2014, 2015) #101 (2016) #103; Viglino et al., (2018a,b) #103).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 0&1 to 1, *Zarhachis flagellator* 0&1 to 1

(104) Roof of temporal fossa formed by: frontals (0); frontals, but with large opening through maxillae and/or premaxillae exposing margins of window formed by a frontal ring (1). (Geisler & Sanders, (2003) #132; Geisler et al., (2011, 2012) #132; Murakami et al., (2012a,b) #101; Tanaka & Fordyce, (2014, 2015) #102 (2016) #104; Viglino et al., (2018a,b) #104).

(105) Position and orientation of origin for temporal muscle on supraorbital process of frontal: origin laying on posterior face of supraorbital process and directed roughly posteriorly (0); origin lying on posteroventral face of supraorbital process and directed roughly ventrally (1). (Fordyce, (1994) #8; Lambert, (2005) #23; Murakami et al., (2012a,b) #102; Tanaka & Fordyce, (2014, 2015) #103 (2016) #105; Viglino et al., (2018a,b) #105).

(106*) Parietal dorsally: not fused to frontal or supraoccipital (0); completely fused to, and indistinguishable from, frontal or supraoccipital (1). (Murakami et al., (2012a,b) #103; Tanaka & Fordyce, (2014, 2015) #104 (2016) #106; Viglino et al., (2018a,b) #106).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 0 to 1.

(107) Parietals in dorsal view: contacting each other on the midline or separated by interparietal (0); in skull roof but visible only as small triangular areas at edges of intertemporal constriction, with supraoccipital overlapping and obscuring median portions (1); completely absent in skull roof (2); visible only as triangular areas,

dorsolateral to supraoccipital, with non-overlapping supraoccipital separated from and contacting parietals along irregular suture (3). (Geisler & Sanders, (2003) #134; Geisler et al., (2011, 2012) #134; Murakami et al., (2012a,b) #104; derived from Whitmore and Sanders, (1977); Barnes, (1990); modified from Lambert, (2005) #15; Tanaka & Fordyce, (2014, 2015) #105 (2016) #107; Viglino et al., (2018a,b) #107).

(108*) Interparietal: present (0); absent or fused and therefore not distinguishable from parietals and frontals (1). (Geisler & Sanders, (2003) #135; Geisler et al., (2011, 2012) #135; Murakami et al., (2012a) #105; Tanaka & Fordyce, (2014, 2015) #106 (2016) #108; Viglino et al., (2018a,b) #108).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 1.

(109) Sagittal crest for temporal muscle: present (0); absent (1). (Murakami et al., (2012a,b) #106; modified from Geisler & Sanders, (2003) #136; Geisler et al., (2011, 2012) #136; Tanaka & Fordyce, (2014, 2015) #107 (2016) #109; Viglino et al., (2018a,b) #109).

(110) Alisphenoid: broadly exposed laterally in temporal fossa (0); lateral surface broadly overlapped by parietal, with a narrow strip visible or invisible on ventral edge of temporal fossa in lateral view (1). (Geisler & Sanders, (2003) #141; Geisler et al., (2011, 2012) #141; Murakami et al., (2012a) #107; Tanaka & Fordyce, (2014, 2015) #108 (2016) #110; Viglino et al., (2018a,b) #110).

(111) Anterior zygomatic process end of squamosal in lateral view: tapered (0); squared (1). (Tanaka & Fordyce, (2014, 2015) #282 (2016) #111; Viglino et al., (2018a,b) #111)

(112) Zygomatic process of squamosal: directed anterolaterally (0); directed anteriorly (1). (Sanders & Barnes, 2002; Geisler & Sanders, (2003) #142; Geisler et al.,

(2011, 2012) #142; Murakami et al., (2012a,b) #108; Tanaka & Fordyce, (2014, 2015) #109 (2016) #112; Viglino et al., (2018a,b) #112).

(113) Zygomatic process of squamosal in lateral view: part of dorsal face visible (0); entire dorsal surface of squamosal visible (1). (Murakami et al., (2012a,b) #109; Tanaka & Fordyce, (2014, 2015) #110 (2016) #113; Viglino et al., (2018a,b) #113).

(114*) Emargination of posterior edge of zygomatic process by neck muscle fossa, skull in lateral view: absent, posterior edge forming nearly right angle with dorsal edge of zygomatic process of squamosal (0); shallow emargination (1); deep emargination (2). (Geisler & Sanders, (2003) #144; Geisler et al., (2011, 2012) #144; Murakami et al., (2012a,b) #110; Tanaka & Fordyce, (2014, 2015) #111 (2016) #114; Viglino et al., (2018a,b) #114).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 0 to 2.

(115*) Width of squamosal lateral to exoccipital as percent greatest width of exoccipitals, skull in posterior view: exposed portion of squamosal narrow, <15% (0); moderate, 16–35% (1). (modified from Geisler & Sanders, (2003) #145; Geisler et al., (2011, 2012) #145; Murakami et al., (2012a,b) #111; Tanaka & Fordyce, (2014, 2015) #112 (2016) #115; Viglino et al., (2018a,b) #115).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

(116) Ventral edge of zygomatic process of squamosal in lateral view: concave (0); almost straight (1); convex (2). (Geisler & Sanders, (2003); #150; Geisler et al., (2011, 2012) #150; Murakami et al., (2012a,b) #112; Tanaka & Fordyce (2014,2015) #113 (2016) #116; Viglino et al., (2018a,b) #116).

(117) Postglenoid process of squamosal: not reduced (0); greatly reduced (1). (Murakami et al., (2012a,b) #113; Tanaka & Fordyce, (2014, 2015) #114 (2016) #117;

Viglino et al., (2018a,b) #117).

(118*) Postglenoid process in lateral view: tapering ventrally (0); squared off ventrally (1); same as state 1 except very wide anteroposterior diameter of process (2). (Geisler & Sanders, (2003) #151; Lambert, (2005) #24; Geisler et al., (2011, 2012) #151; Murakami et al., (2012a,b) #114; derived from Muizon, (1991) ; Tanaka & Fordyce, (2014, 2015) #115 (2016) #118; Viglino et al., (2018a,b) #118).

NOTE: The following codings were modified: *Arktocara yakataga* - to 0

(119*) Relative ventral projections of postglenoid and post-tympanic processes of squamosal: postglenoid process more ventral or at same level as post-tympanic process (0); apex of postglenoid process dorsally higher than post-tympanic process (1). (Lambert, (2005) #25; Murakami et al., (2012a,b) #115; Tanaka & Fordyce, (2014, 2015) #116 (2016) #119; Viglino et al., (2018a,b) #119).

NOTE: The following codings were modified: *Arktocara yakataga* - to 0, *Notocetus vanebenedeni* 0&1 to 0.

(120) Nuchal crest in dorsoposterior view: semicircular, pointed anteriorly (0); rectangular or weakly convex anteriorly or posteriorly (1); convex posteriorly and/or midpoint convex triangular and pointed anteriorly (2); prominently convex anteriorly (3); strongly convex posteriorly (4). (Murakami et al., (2012a,b) #116; modified from Geisler & Sanders, (2003); #152; Geisler et al., (2011, 2012) #152; derived from Barnes, (1985b); Tanaka & Fordyce, (2014, 2015) #117 (2016) #120; Viglino et al., (2018a,b) #120).

(121) Occipital shield: smoothly convex or concave (0); bearing distinct sagittal crest (1). (Sanders & Barnes, (2002); Geisler & Sanders, (2003) #155; Geisler et al., (2011, 2012) #155; Murakami et al., (2012a,b) #117; Tanaka & Fordyce, (2014, 2015) #118 (2016) #121; Viglino et al., (2018a,b) #121).

(122) Dorsal condyloid fossa: absent (0); present, situated anterodorsal to dorsal edge of condyle (1); present and forming deep pit (2). (Geisler & Sanders, (2003) #156; Geisler et al., (2011, 2012) #156; Murakami et al., (2012a,b) #118; derived from Sanders & Barnes, (2002); Tanaka & Fordyce, (2014, 2015) #119 (2016) #122; Viglino et al., (2018a,b) #122).

Anterior Basicranium

(123) Palatine in nasal passage: thin, forming posterior part of nasal passage (0); thick, forming part of anterior wall of nasal cavities (1); palatine does not join anterior wall of nasal passage (2). (Murakami et al., (2012a,b) #119; modified from Geisler & Sanders, (2003); #158; Geisler et al., (2011, 2012) #158; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #120 (2016) #123; Viglino et al., (2018a,b) #123).

(124*) Palatine exposure: exposed ventrally (0); partially covered by pterygoid, which divides it into medial and lateral exposures (1); ventral surfaces completely covered by pterygoids (2). (Muizon, (1987); Arnold & Heinsohn, (1996) #15; Messenger & McGuire, (1998) #1440; Geisler & Sanders, (2003) #159; Lambert, (2005) #27; Geisler et al., (2011, 2012) #159; Murakami et al., (2012a,b) #120; derived from Miller, (1923); Tanaka & Fordyce, (2014, 2015) #121 (2016) #124; Viglino et al., (2018a,b) #124).

NOTE: The following codings were modified: *Arktocara yakataga* ? to 0; *Kogia breviceps* 1 to 0; *Tasmacetus shepherdi* 1 to 0; *Berardius bairdii* 1 to 0, *Notocetus vanbenedeni* 0 to 2.

(125*) Lateral lamina of palatine: absent (0); present (1). (Muizon, (1984, 1988), (1991); Arnold & Heinsohn, (1996) #16; Messenger & McGuire, (1998) #1443; Murakami et al., (2012a,b) #121; Tanaka & Fordyce, (2014, 2015) #122 (2016)

#125; Viglino et al., (2018a,b) #125).

NOTE: The following codings were modified: *Arktocara yakataga* ? to 0; *Zarhachis flagellator* 1 to 0; *Dilophodelphis fordycei* 1 to ?.

(126*) Lateral lamina of palatine relationship with maxilla: free from or sutured to maxilla (0); fused to maxilla (1). (Muizon, (1988); Messenger & McGuire, (1998) #1439; Geisler & Sanders, (2003) #161; Geisler et al., (2011, 2012) #161; Murakami et al., (2012a,b) #122; Tanaka & Fordyce, (2014, 2015) #123 (2016) #126; Viglino et al., (2018a,b) #126).

NOTE: The following codings were modified: *Patriocetus kazakhstan* ? to -; *Mesoplodon ginkgodens* ? to -; *Zygorhiza kochii* ? to -; *Notocetus vanbenedeni* 0 to -; *Platanista gangetica* ? to -; *Zarhachis flagellator* ? to -.

(127*) Lateral lamina of palatine relationship with orbit: does not form bony bridge “over” (= ventral to) orbit (0); does form bony bridge “over” (= ventral to) orbit (1). (Muizon, (1984); Messenger & McGuire, (1998) #1444; Murakami et al., (2012a,b) #123; Tanaka & Fordyce, (2014, 2015) #124 (2016) #127; Viglino et al., (2018a,b) #127).

NOTE: The following codings were modified: *Patriocetus kazakhstan* ? to -; *Berardius bairdii* ? to -; *Ziphius cavirostris* ? to -; *Mesoplodon ginkgodens* ? to -; *Tasmacetus shepherdi* 1 to -; *Xiphiacetus bossi* ? to -; *Simocetus rayi* ? to -; *Xenorophus sloanii* ? to -; *Squalodon calvertensis* ? to -; *Platanista gangetica* 0 to -; *Zarhachis flagellator* ? to -.

(128) Pterygoids in anteroventral view: separated from each other by posteroventrally elongated palatines and/or vomer (0); contacting entire length of hamular process (1); contacting each other partially (2). (Murakami et al., (2012a,b) #124; modified from Arnold & Heinsohn, (1996) #5; Messenger & McGuire, (1998)

#1445; Fajardo-Mellor et al., (2006) #9; derived from Flower, (1884); Barnes, (1985a); Marsh et al., (1989); Tanaka & Fordyce, (2014, 2015) #125 (2016) #128; Viglino et al., (2018a,b) #128).

(129) Medial pterygoid-palatine suture in ventral view: angled anteromedially (0); nearly transverse (1); angled anterolaterally (2); angled anteroposteriorly (3). (Murakami et al., (2012a,b) #125; modified from Geisler & Sanders, (2003) #162; Geisler et al., (2011, 2012) #162; Tanaka & Fordyce, (2014, 2015) #126 (2016) #129; Viglino et al., (2018a,b) #129).

(130) Lateral lamina of pterygoid: absent (0); present and articulated with alisphenoid (1); partial, restricted to region lateral to hamular process (2). (Murakami et al., (2012a) #126; modified from Arnold & Heinsohn, (1996) #121; Messenger & McGuire, (1998) #1446; Geisler & Sanders, (2003) #164; Lambert, (2005) #32; Geisler et al., (2011, 2012) #164; derived from Miller, (1923); Kellogg, (1936); Fraser & Purves, (1960); Tanaka & Fordyce, (2014, 2015) #127 (2016) #130; Viglino et al., (2018a,b) #130).

(131) Subtemporal crest: present (0); present but reduced, or absent (1). (modified from Geisler & Sanders, (2003) #165; Geisler et al., (2011, 2012) #165; Murakami et al., (2012a,b) #127; Tanaka & Fordyce, (2014, 2015) #128 (2016) #131; Viglino et al., (2018a,b) #131).

(132) Dorsal lamina of pterygoid: absent from sphenoidal region but present in orbital region (0); present and covers most of ventral exposure of alisphenoid (1); partially absent from orbital region (2); completely absent from orbital region (3). (Murakami et al., (2012a,b) #128; modified from Arnold & Heinsohn, (1996) #16; Geisler & Sanders, (2003) #167; Geisler et al., (2011, 2012) #167; derived from Miller (1923); Fraser & Purves, (1960); Tanaka & Fordyce, (2014, 2015) #129

(2016) #132; Viglino et al., (2018a,b) #132).

NOTE: We have updated the name of the lamina, following Mead & Fordyce (2009) terminology.

(133*) Pterygoids excavated anterior to choanae by the pterygoid sinuses, with distinct anterior fossa clearly limited forwards by rounded wall: absent (0); present (1). (Lambert, (2005) #28; Murakami et al., (2012a,b) #129; Tanaka & Fordyce, (2014, 2015) #130 (2016) #133; Viglino et al., (2018a,b) #133).

NOTE: The following codings were modified: *Arktocara yakataga* ? to 1

(134) Depth of pterygoid sinus fossa in basicranium: shallow or partially excavated (0); deep, excavated dorsally to level of cranial foramen oval (1); deep, and extended dorsally into orbit (2). (modified from Fordyce, (1994) #6; Lambert, (2005) #30; Murakami et al., (2012a,b) #130; Tanaka & Fordyce, (2014, 2015) #131 (2016) #134; Viglino et al., (2018a,b) #134).

(135) Anterior level of pterygoid sinus fossa: interrupted posterior to, or the level of, antorbital notch (0); extending beyond the level of the antorbital notch (1). (Lambert, (2005) #29; Murakami et al., (2012a,b) #131; Tanaka & Fordyce, (2014, 2015) #132 (2016) #135; Viglino et al., (2018a,b) #135).

(136) Preorbital and postorbital fossae of pterygoid sinuses: widened apices of preorbital and postorbital fossae of pterygoid sinuses present but fossae not merged or fused (0); widened apices of preorbital and postorbital fossae of pterygoid sinuses merged or fused dorsal to path of optic nerve (1). (Murakami et al., (2012a,b) #132; modified from Muizon, (1988); Arnold & Heinsohn, (1996) #19; Bianucci, (2005) #10; Aguirre-Fernandez et al., (2009) #19; Tanaka & Fordyce, (2014, 2015) #133 (2016) #136; Viglino et al., (2018a,b) #136).

(137) Fossa for preorbital lobe of pterygoid sinus in orbit: absent (0); present (1). (Fraser

& Purves, (1960); Arnold & Heinsohn, (1996) #18; Murakami et al., (2012a,b) #133; Tanaka & Fordyce, (2014, 2015) #134 (2016) #137; Viglino et al., (2018a,b) #137).

(138) Dorsal development of fossa for preorbital lobe of pterygoid sinus toward the frontal-maxilla suture: absent (0); present (1). (Muizon, (1984, 1988); Heyning, (1989) #37, (1997) #69; Messenger & McGuire, (1998) #1460; Arnold & Heinsohn, (1996) #20; Lambert, (2008) #13; Murakami et al., (2012a,b) #134; modified from Fajardo-Mellor et al., (2006) #13; derived from Fraser & Purves, (1960); Tanaka & Fordyce, (2014, 2015) #135 (2016) #138; Viglino et al., (2018a,b) #138).

(139) Postorbital lobe of pterygoid sinus fossa: absent (0); present (1). (Arnold & Heinsohn, (1996) #18; Geisler & Sanders, (2003) #170; Geisler et al., (2011, 2012) #170; Murakami et al., (2012a,b) #135; derived from Fraser & Purves, (1960); Tanaka & Fordyce, (2014, 2015) #136 (2016) #139; Viglino et al., (2018a,b) #139).

(140) Anteroposteriorly elongated pterygoid sinus fossa, at level of orbit, bordered by mediolaterally compressed subtemporal crest of frontal: absent (0); present (1). (Murakami et al., (2012a,b) #136; Tanaka & Fordyce, (2014, 2015) #137 (2016) #140; Viglino et al., (2018a,b) #140).

(141*) Orbitosphenoid: not contacting lacrimal or lacrimojugal (0); contacting lacrimal or lacrimojugal (1). (Murakami et al., (2012a,b) #137; Tanaka & Fordyce, (2014, 2015) #138 (2016) #141; Viglino et al., (2018a,b) #141).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 0.

(142) Ratio of length of hamular process of pterygoid to cranium length: <0.30 (0); 0.30–0.44 (1); 0.45–0.59 (2); >0.60 (3). The length of the hamular process of the

pterygoid is measured from anterior edge of the pterygoid to posterior edge of the hamular process. The cranium length is measured from anterior edge of the antorbital process to posterior edge of occipital condyles. (Murakami et al., (2012a,b) #138; modified from Heyning, (1989) #18, (1997) #50; Muizon, (1991); Messenger & McGuire, (1998) #1447; Lambert, (2005) #31; Tanaka & Fordyce, (2014, 2015) #139 (2016) #142; Viglino et al., (2018a,b) #142).

(143) Keel affecting ventral surfaces of hamular processes: absent (0); present (1). (Muizon, (1988); Messenger & McGuire, (1998) #1449; Bianucci, (2005) #14; Murakami et al., (2012a,b) #139; modified from Fajardo-Mellor et al., (2006) #10; Tanaka & Fordyce, (2014, 2015) #140 (2016) #143; Viglino et al., (2018a,b) #143).

(144) Exposure of medial lamina of pterygoid hamuli in lateral view: complete or broad exposure due to extreme reduction of lateral lamina of pterygoid hamuli (0); no exposure due to a posterior extension of lateral lamina extending posterior to medial lamina (1); medial lamina of pterygoid hamuli exposing lateral lamina through ovoid window in lateral view (2). (Muizon, (1988); Fajardo-Mellor et al., (2006) #11; Murakami et al., (2012a,b) #140; derived from Noble & Fraser, (1971); Tanaka & Fordyce, (2014, 2015) #141 (2016) #144; Viglino et al., (2018a,b) #144).

(145) Shape of restricted area between postorbital ridge of frontal and subtemporal crest from ventral view: anteroposteriorly long elliptical (0); wide fan-shape (1); narrow fan-shape (2), rhombus (3). (Tanaka & Fordyce, (2014, 2015) #280 (2016) #145; Viglino et al., (2018a,b) #145)

Posterior Basicranium

(146*) Falciform process of squamosal: plate-like with anteroposteriorly wide base (0);

rod-like with narrow base (1); poorly developed or absent (2). (Geisler & Sanders, (2003) #176; Geisler et al., (2011, 2012) #176; Murakami et al., (2012a,b) #141; modified from Lambert, (2005) #36; Tanaka & Fordyce, (2014, 2015) #142 (2016) #146; Viglino et al., (2018a,b) #146).

NOTE: We modified the codings fo the following taxa: *Notocetus vanbenedeni* ? to 0.

(147*) Falciform process of squamosal: medial surface not sutured to lateral lamina of pterygoid (0); medial surface sutured to lateral lamina of pterygoid (1). (Murakami et al., (2012a,b) #142; modified from Geisler & Sanders, (2003) #177; Geisler et al., (2011, 2012) #177; Tanaka & Fordyce, (2014, 2015) #143 (2016) #147; Viglino et al., (2018a,b) #147).

NOTE: We modified the codings fo the following taxa: *Notocetus vanbenedeni* ? to 1.

(148) Tympanosquamosal recess: absent, with anterior transverse ridge present (0); anterior transverse ridge absent and middle sinus inferred to be present without a large tympanosquamosal recess (1); present and enlarged, forming triangular fossa medial and anteromedial to postglenoid process (2); very large, forming large fossa bordering entire medial edge of glenoid fossa (3). (Geisler & Sanders, (2003) #178; Geisler et al., (2011, 2012) #178; Murakami et al., (2012a, b) #143; modified from Lambert, (2005) #35; derived from Fraser & Purves, (1960), and Fordyce, (2002); Tanaka & Fordyce, (2014, 2015) #144 (2016) #148; Viglino et al., (2018a,b) #148).

(149*) Bifurcation of tympanosquamosal recess: absent, almost undeveloped, elliptic (0); present, with a clear expansion anteriorly, invasion of mandibular fossa medially, and a depression (expansion) at the postglenoid process posteriorly (1). (Murakami et al., (2012a,b) #144; modified from Muizon, (1988); Bianucci, (2005) #11; Aguirre-Fernandez et al., (2009) #20; Tanaka & Fordyce, (2014,

2015) #145 (2016) #149; Viglino et al., (2018a,b) #149).

NOTE: The codings of the following taxa were modified: *Arktocara yakataga* – to 0.

(150*) Fossa for the basisphenoidal sinus: absent (0); present (1). (Fraser & Purves, (1960); Mead & Fordyce, (2009); Murakami et al., (2012a,b) #145; Tanaka & Fordyce, (2014, 2015) #146 (2016) #150; Viglino et al., (2018a,b) #150).

NOTE: The codings of the following taxa were modified: *Notocetus vanbenedeni* ? to 0.

(151*) Position of more-distal part of alisphenoid-squamosal suture, with skull in ventral view: anterior to external opening of foramen oval or a homologous groove (0); courses along groove for mandibular branch of trigeminal nerve, or just posterior to it (1); just medial to anterior edge of floor of squamosal fossa, foramen ovale, and/or groove situated entirely on alisphenoid (2). (Geisler & Sanders, (2003) #180; Geisler et al., (2011, 2012) #180; Murakami et al., (2012a,b) #146; Tanaka & Fordyce, (2014, 2015) #147 (2016) #151; Viglino et al., (2018a,b) #151).

NOTE: The codings of the following taxa were modified: *Notocetus vanbenedeni* ? to 2.

(152) Groove for mandibular branch of trigeminal nerve: lateral end of groove wrapping laterally around posterior end of pterygoid sinus fossa and opening primarily anteriorly (0); directed laterally and located entirely posterior to pterygoid sinus fossa (1). (Murakami et al., (2012a,b) #147; modified from Geisler & Sanders, (2003) #181; Geisler et al., (2011, 2012) #181; Tanaka & Fordyce, (2014, 2015) #148 (2016) #152; Viglino et al., (2018a,b) #152).

(153*) Subcircular fossa (*sensu* Muizon 1987) of squamosal: absent (0); present but shallow, situated dorsolateral to spiny process of squamosal (1); forming deep dorsolateral excavation into squamosal (2). (Geisler & Sanders, (2003) #185; Geisler et al., (2011, 2012) #185; Murakami et al., (2012a,b) #149; Tanaka and Fordyce, (2014, 2015) #149; modified from Tanaka & Fordyce (2016) #153

(2016) #153; Viglino et al., (2018a,b) #153).

NOTE: The coding of the following taxa were modified: *Arktocara yakataga* 0&1 to 0;

Platanista gangetica ? to 0; *Squalodon calvertensis* 0 to 2; *Pomatodelphis inaequalis* ? to 1; *Zarhachis flagellator* 2 to 1; *Squalodelphis fabianii* ? to 1; *Phoberodon arctirostris* ? to 0.

(154) Foramen spinosum: absent (0); present, located in anteromedial corner of anterior part of periotic fossa near or on squamosal-parietal suture (1). (Muizon, (1994); Geisler & Sanders, (2003) #186; Geisler et al., (2011, 2012) #186; Murakami et al., (2012a,b) #150; Tanaka & Fordyce, (2014, 2015) #150 (2016) #154; Viglino et al., (2018a,b) #154).

(155) Posterior portion of periotic fossa of squamosal: fossa absent (0); fossa present but shallow (1); highly compressed fossa forming narrow slit or small blind foramen (2); posteromedial portion contains large deep fossa (3). (Geisler & Sanders, (2003) #187; Geisler et al., (2011, 2012) #187; Murakami et al., (2012a,b) #149 #151; Tanaka & Fordyce, (2014, 2015) #151 (2016) #155; Viglino et al., (2018a,b) #155).

(156) Length of zygomatic process of squamosal as percent of greatest width of maxilla at postorbital process: >31% (0); ≤30% (1). (Murakami et al., (2012a,b) #152; modified from Heyning, (1989) #33, #35, #65, #67; Geisler & Sanders, (2003) #188; Geisler et al., (2011, 2012) #188; Tanaka & Fordyce, (2014, 2015) #152 (2016) #156; Viglino et al., (2018a,b) #156)

(157) External auditory meatus: wide (0); narrow (1); slit-like (2). (Fordyce, (1994) #10; Geisler & Sanders, (2003) #189; Geisler et al., (2011, 2012) #189; Lambert, (2005) #26; Murakami et al., (2012a,b) #153; modified from Tanaka & Fordyce (2014,2015) #153 (2016) #157; Viglino et al., (2018a,b) #157).

- (158) Vomer: posterior edge terminating on or at anterior edge of basisphenoid (0); terminating on basioccipital, covering basioccipital-basisphenoid suture ventrally (1). (Barnes, (1984b); Geisler & Sanders, (2003) #190; Geisler et al., (2011, 2012) #190; Murakami et al., (2012a,b) #154; Tanaka & Fordyce, (2014, 2015) #153 (2016) #158; Viglino et al., (2018a,b) #158).
- (159) Rectus capitus anticus muscle fossa: absent or poorly developed (0); present with well-defined anterior edge (1). (Geisler & Sanders, (2003) #192; Geisler et al., (2011, 2012) #192; Murakami et al., (2012a,b) #155; Tanaka & Fordyce, (2014, 2015) #155 (2016) #159; Viglino et al., (2018a,b) #159).
- (160) Posteroventral-most point of basioccipital crest: rounded over (0); forming closely appressed separate flange, with narrow crease separating exoccipital dorsally from rest of basioccipital crest (1); projecting distinct flange posteriorly (2); distinct but separated by pronounced notch, interrupting basioccipital crest (3). (Geisler & Sanders, (2003) #193; Geisler et al., (2011, 2012) #193; Murakami et al., (2012a,b) #156; Tanaka & Fordyce, (2014, 2015) #156 (2016) #160; Viglino et al., (2018a,b) #160).
- (161*) Angle formed by basioccipital crests in ventral view: parallel with no angle formed (0); ca. 15–40° (1); ca. 42–68° (2); ca. 70–90° (3); >100° (4). (Murakami et al., (2012a,b) #157; modified from Geisler & Sanders, (2003) #194; Geisler et al., (2011, 2012) #194; Tanaka & Fordyce, (2014, 2015) #157 (2016) #161; Viglino et al., (2018a,b) #161).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 2.

- (162) Basioccipital width compared with maximum width of skull in ventral view: narrow, less than 50% (0), wider larger than 51% (1). (Tanaka & Fordyce, (2014, 2015) #283 (2016) #162; Viglino et al., (2018a,b) #162)

(163*) Hypoglossal foramen: separated from jugular foramen, or jugular notch, by thick bone (0); separated by very thin bone or absent, in latter case hypoglossal foramen becoming confluent with jugular foramen (1). (Geisler & Sanders, (2003) #195; Geisler et al., (2011, 2012) #195; Murakami et al., (2012a,b) #158; Tanaka & Fordyce, (2014, 2015) #158 (2016) #163; Viglino et al., (2018a,b) #163).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

(164*) Jugular notch, gap between paroccipital process and basioccipital crest: open notch, width of opening and depth of notch about equal (0); narrow and almost slit-like, depth much greater than width of opening (1). (Geisler & Sanders, (2003) #196; Geisler et al., (2011, 2012) #196; Murakami et al., (2012a,b) #159; Tanaka & Fordyce, (2014, 2015) #159 (2016) #164; Viglino et al., (2018a,b) #164).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

(165) Paroccipital process, skull in ventral view: posterior edge located well anterior to the posterior edge of condyle (0); posterior edge in transverse line with posterior edge of condyle (1). (Geisler & Sanders, (2003) #197; Geisler et al., (2011, 2012) #197; Murakami et al., (2012a,b) #160; Tanaka & Fordyce, (2014, 2015) #160 (2016) #165; Viglino et al., (2018a,b) #165).

(166) Fossa for posterior sinus in exoccipital: absent or slightly concave (0); moderately concave (1); forming deep sack-like structure (2). (Murakami et al., (2012a,b) #161; modified from Muizon, (1991); Lambert, (2005) #38; Tanaka & Fordyce, (2014, 2015) #161 (2016) #166; Viglino et al., (2018a,b) #166).

(167) Occipital condyles; on pedicle (0); lacking pedicle, unified with occipital (1). (Tanaka & Fordyce, (2014, 2015) #284 (2016) #167; Viglino et al., (2018a,b) #167)

(168) Fossa for the articular rim of periotic in the squamosal, medial or posterodorsal to

the external acoustic meatus: present (0) absent (1) (Muizon, (1987); Viglino et al., (2018a) #287 (2018b) #205).

Malleus

(169) Tuberculum of malleus: unreduced (0); highly reduced, almost indistinguishable from articular head (1). (Muizon, (1985); Messenger & McGuire, (1998) #1499; Geisler & Sanders, (2003) #198; Geisler et al., (2011, 2012) #198; Murakami et al., (2012a,b) #162; modified from Lambert, (2005) #69; derived from Doran, (1878); Tanaka & Fordyce, (2014, 2015) #162 (2016) #168; Viglino et al., (2018a,b) #168).

(170) Processus muscularis of malleus: shorter than manubrium of malleus (0); sub-equal or longer than manubrium (1). (Murakami et al., (2012a,b) #163; modified from Muizon, (1985, 1988); Messenger & McGuire, (1998) #1550; Geisler & Sanders, (2003) #199; Lambert, (2005) #70; Geisler et al., (2011, 2012) #199; Tanaka & Fordyce, (2014, 2015) #163 (2016) #169; Viglino et al., (2018a,b) #169).

Periotic

(171*) Length of anterior process of periotic as percent length of pars cochlearis: short, <59% (0); long, >60% (1). (Murakami et al., (2012a,b) #164; modified from Muizon, (1988); Heyning, (1989) #5; Messenger & McGuire, (1998) #1489; Geisler & Luo, (1996) #1; Luo & Marsh, (1996) #24; Geisler & Sanders, (2003) #203; Lambert, (2005) #39; Geisler et al., (2011, 2012) #203; derived from Kellogg, (1936); Yamada, (1953); Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #164 (2016) #170; Viglino et al., (2018a,b) #170).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0, *Squalodelphis fabianii* ? to 1.

(172*) Apex of anterior process of periotic in dorsal view: pointed (0); dorsal edge of

anterior process showing highly rounded or oblique edge due to its reduction with or without pointed apex (1); thickened by prominent dorsal tubercle giving apex rectangular section in plane of body of periotic (2). (Murakami et al., (2012a,b) #165; modified from Fordyce, (1994) #53; Lambert, (2005) #40; Tanaka & Fordyce, (2014, 2015) #165 (2016) #171; Viglino et al., (2018a,b) #171).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(173*) Lateral groove or depression affecting profile of periotic as viewed dorsally: no obvious vertical groove dorsal to hiatus epitympanicus (0); groove present with overall profile of periotic becoming slightly to markedly sigmoidal in dorsal view (1). (Fordyce, (1994) #35; Murakami et al., (2012a,b) #166; Tanaka & Fordyce, (2014, 2015) #166 (2016) #172; Viglino et al., (2018a,b) #172).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(174*) Profile of anterior process of periotic ventrally deflected in lateral view: no, has crudely rectangular profile (0); smoothly deflected (1); abruptly deflected (2). (Fordyce, (1994) #25; Tanaka & Fordyce, (2014, 2015) #288 (2016) #173; Viglino et al., (2018a,b) #173)

NOTE: We modified the codings of the following taxa: *Phocageneus venustus* ? to 1;

Zarhachis flagellator ? to 2; *Tasmacetus shepherdii* 1 to 0; *Pontoporia blainvillei* ? to 1; *Albireo whistleri* ? to 0; *Piscolithax boreios* ? to 0; *Piscolithax longirostris* ? to 0; *Piscolithax tedfordi* ? to 1; *Phocoena sinus* ? to 0; *Phocoena spinipinnis* ? to 0; *Phocoena dioptrica* ? to 0; *Neophocaena phocaenoides* ? to 1; *Delphinus delphis* ? to 0; *Lagenodelphis hosei* ? to 1.

(175*) Anteroposterior ridge on dorsal side: undeveloped (0); developed on anterior process and body of periotic, associated with development of depression adjacent to groove for tensor tympani (1). (Fordyce, (1994) #55; Murakami et al., (2012a,b)

#167; Tanaka & Fordyce, (2014, 2015) #167 (2016) #174; Viglino et al., (2018a,b) #174).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(176) Articulation of anterior process of periotic to outer lip of tympanic bulla: contact of ventral surface of anterior process of periotic with outer lip of tympanic bulla (0); contact with thickened rim of outer lip of tympanic bulla and additionally with accessory ossicle (1); contact only with accessory ossicle (2). (Luo & Marsh, (1996) #7; Lambert, (2005) #46; Murakami et al., (2012a,b) #168; Tanaka & Fordyce, (2014, 2015) #168 (2016) #175; Viglino et al., (2018a,b) #175).

(177*) Parabullary sulcus: absent (0); strongly curved (1); weakly curved (2). (modified from Fordyce, (1994) #56; Tanaka and Fordyce, (2014, 2015) #169; modified from Tanaka & Fordyce (2016) #176; Viglino et al., (2018a,b) #176).

NOTE: The codings of the following taxa were modified: *Phocageneus venustus* ? to 1.

(178) Parabullary ridge of periotic: absent (0); present (1); present with a fossa between anterior process and parabullary ridge (2). (modified from Murakami et al., (2012a,b) #171; Bianucci, (2005) #15; Tanaka & Fordyce, (2014, 2015) #170 (2016) #177; Viglino et al., (2018a,b) #177).

(179) Articulation of anterior process with squamosal: extensive, most of lateral side contacting squamosal (0); large centrally-oriented ovoid region contacting squamosal, free around edges (1); small area of contact with squamosal (2); contact absent, articulation via ligaments (3). (Geisler & Sanders, (2003) #207; Geisler et al., (2011, 2012) #207; Murakami et al., (2012a,b) #172; modified from Heyning, (1997) #32; Messenger & McGuire, (1998) #1490; derived from Heyning, (1989); Tanaka & Fordyce, (2014, 2015) #171 (2016) #178; Viglino et al., (2018a,b) #178).

(180*) Anterior bullar facet: present (0); absent (1). (Muizon, (1984, 1988, 1991); Messenger & McGuire, (1998) #1496; Lambert, (2005) #42; Murakami et al., (2012a,b) #173; modified from Fordyce, (1994) #4; derived from Kellogg, (1936); Tanaka & Fordyce, (2014, 2015) #172 (2016) #179; Viglino et al., (2018a,b) #179).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(181*) Anterior incisure: deep, pocket-like fossa with anterior groove (0); anterior groove only (1). (Geisler & Luo, (1996) #7; Luo & Marsh, (1996) #15; Geisler & Sanders, (2003) #217; Geisler et al., (2011, 2012) #217; Murakami et al., (2012a,b) #174; Tanaka & Fordyce, (2014, 2015) #173 (2016) #180; Viglino et al., (2018a,b) #180).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(182*) Fenestra rotunda: oval to subrounded (0); shaped like teardrop with fissure directed toward aperture for cochlear aqueduct (1). (Fordyce, (1994) #22; Geisler & Sanders, (2003) #222; Lambert, (2005) #49; Geisler et al., (2011, 2012) #222; Murakami et al., (2012a,b) #175; Tanaka & Fordyce, (2014, 2015) #174 (2016) #181; Viglino et al., (2018a,b) #181).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(183*) Dorsal surface of periotic in lateral view: convex dorsally (0); pyramidal process convex dorsally (1); nearly flat (2). (Murakami et al., (2012a,b) #176; modified from Luo & Marsh, (1996) #18; Tanaka & Fordyce, (2014, 2015) #175 (2016) #182; Viglino et al., (2018a,b) #182).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(184) Relative position of dorsal depth of stapedial muscle fossa and fenestra rotunda: ventral to, or in line with, dorsal edge of fenestra rotunda (0); well dorsal to

fenestra rotunda (1). (Geisler & Sanders, (2003) #223; Geisler et al., (2011, 2012) #223; Murakami et al., (2012a,b) #177; Tanaka & Fordyce, (2014, 2015) #176 (2016) #183; Viglino et al., (2018a,b) #183).

(185*) Posterodorsal edge of stapedial muscle fossa: absent, rounded lip (0); present (1). (Geisler & Luo, (1996) #14; Geisler & Sanders, (2003) #217; Geisler et al., (2011, 2012) #217; Murakami et al., (2012a,b) #178; Tanaka & Fordyce, (2014, 2015) #177 (2016) #184; Viglino et al., (2018a,b) #184).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(186*) Caudal tympanic process of periotic: low, its ventral and posterior edges drawing smooth curve (0); elevated, its ventral and posterior edges forming a right angle in medial view (1). (Geisler & Sanders, (2003) #225; Geisler et al., (2011, 2012) #225; Murakami et al., (2012a,b) #179; Tanaka & Fordyce, (2014, 2015) #178 (2016) #185; Viglino et al., (2018a,b) #185).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(187*) Position of aperture for cochlear aqueduct: dorsomedial (0); medial (1). (Lambert, (2005) #51; Murakami et al., (2012a,b) #180 Tanaka & Fordyce, (2014, 2015) #179 (2016) #186; Viglino et al., (2018a,b) #186).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(188*) Aperture for cochlear aqueduct: smaller than aperture for vestibular aqueduct (0); approximately same size as aperture for vestibular aqueduct (1); much larger than aperture for vestibular aqueduct, with narrow posterior edge (2). (Geisler & Sanders, (2003) #227; Geisler et al., (2011, 2012) #227; Murakami et al., (2012a,b) #181; modified from Muizon, (1987); Fordyce, (1994); Lambert, (2005) #52; Tanaka & Fordyce, (2014, 2015) #180 (2016) #187; Viglino et al., (2018a,b) #187).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 2.

(189*) Excavation of tegmen tympani at base of anterior process: absent (0); present, with fossa on dorsolateral side of tegmen tympani (1). (Geisler & Sanders, (2003) #231; Geisler et al., (2011, 2012) #231; Murakami et al., (2012a, 2012b) #182; Tanaka & Fordyce, (2014, 2015) #181 (2016) #188; Viglino et al., (2018a,b) #188).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(190*) Fundus of internal acoustic meatus: funnel-like, smaller at blind end and wider near rim (0); tubular (1). (Luo & Marsh, (1996) #31; Geisler & Sanders, (2003) #234; Geisler et al., (2011, 2012) #234; Murakami et al., (2012a,b) #183; Tanaka & Fordyce, (2014, 2015) #182 (2016) #189; Viglino et al., (2018a,b) #189).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 0 to 1, *Squalodelphis fabianii* ? to 0.

(191*) Internal acoustic meatus: pyriform (0); circular (1). (Muizon, (1984); Messenger & McGuire, (1998) #1498; Bianucci, (2005) #21; Murakami et al., (2012a,b) #184; Tanaka & Fordyce, (2014, 2015) #183 (2016) #190; Viglino et al., (2018a,b) #190).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(192*) Lateral wall of internal acoustic meatus: high, with wedge-shaped area of elevated bone occurring between dorsal edge of tegmen tympani and internal acoustic meatus, the latter extending ventrally and increasing its depth (0); low, not protruding noticeably from fossa and surrounding bone (1). (Murakami et al., (2012a,b) #185; modified from Geisler & Sanders, (2003) #235; Geisler et al., (2011, 2012) #235; Tanaka & Fordyce, (2014, 2015) #184 (2016) #191; Viglino et al., (2018a,b) #191).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(193*) Cochlear aqueduct on periotic large with a thin edge: no (0); yes (1). (Fordyce (1994) #28; Tanaka & Fordyce, (2014, 2015) #289 (2016) #192; Viglino et al., (2018a,b) #192).

NOTE: We modified the codings of the following taxa: *Zarhachis flagellator* ? to 0; *Squalodelphis fabianii* ? to 1.

(194*) Dorsoventral thickness of pars cochlearis of periotic in medial view: thick (0) thin (1) (Gutstein et al., (2014); Tanaka & Fordyce, (2014, 2015) #290; modified from Tanaka & Fordyce (2016) #193; Viglino et al., (2018a,b) #193).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0; *Zarhachis flagellator* ? to 1; *Squalodelphis fabianii* ? to 0.

(195*) Profile of cochlear on periotic in dorsoventral; rounded (0), sub-rectangular (1), squared (2). (modified from Fordyce (1994) #61 and Bianucci et al., (2013) #2; Tanaka & Fordyce, (2014, 2015) #291 (2016) #194; Viglino et al., (2018a,b) #194).

NOTE: We modified the codings of the following taxa: *Zarhachis flagellator* ? to 0; *Squalodelphis fabianii* ? to 0.

(196*) Aperture for vestibular aqueduct, in dorsal view: at transverse level of spiral cribriform tract (0); more lateral than spiral cribriform tract (1) (Lambert, (2005) #53; Murakami et al., (2012a,b) #186; Tanaka & Fordyce, (2014, 2015) #185 (2016) #195; Viglino et al., (2018a,b) #195).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(197*) Articular rim: absent (0); present but small, forming ridge anterolateral to articulation surface of posterior process of periotic and separated from it by sulcus (1); present, sigmoidal and laterally elongated with hook-like process (2). (Geisler & Sanders, (2003) #239; Geisler et al., (2011, 2012) #239; modified from

Murakami et al., (2012a,b) #187; modified from Muizon (1987); Messenger (1994); Messenger & McGuire (1998) #1494; Fordyce, (1994) #33; Lambert, (2005) #55; Tanaka & Fordyce, (2014, 2015) #186 (2016) #196; Viglino et al., (2018a,b) #196).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 2.

(198) Bony connection between posterior process of periotic and squamosal/occipital bones: present (0); absent (ligamentous) (1). (Muizon, (1984); Arnold & Heinsohn, (1996) #34; Messenger & McGuire, (1998) #1491; Murakami et al., (2012a,b) #188; derived from Fraser & Purves, (1960); Kasuya, (1973); Heyning, (1989); Tanaka & Fordyce, (2014, 2015) #187 (2016) #197; Viglino et al., (2018a,b) #197).

(199*) Posterior process of periotic in lateral view: ventrally bent (0); in same plane as body of periotic (1). (Bianucci, (2005) #19; Murakami et al., (2012a,b) #189; modified from Arnold & Heinsohn, (1996) #28; Lambert, (2005) #54; Tanaka & Fordyce, (2014, 2015) #188 (2016) #198; Viglino et al., (2018a,b) #198).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(200*) Angle between posterior process of periotic and long axis of pars cochlearis from dorsal or ventral views: $>135^{\circ}$ (0); $\leq 135^{\circ}$ (1). (Murakami et al., (2012a,b) #190; modified from Geisler & Sanders, (2003) #246; Lambert, (2005) #54; Geisler et al., (2011, 2012) #246; derived from Kasuya, (1973); Barnes, (1990); Luo & Marsh, (1996); Tanaka & Fordyce, (2014, 2015) #189 (2016) #199; Viglino et al., (2018a,b) #199).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(201*) Facet for bulla on posterior process of periotic, parallel-sided; no (0); yes (1). (modified from Fordyce, (1994) #63; Tanaka & Fordyce, (2014, 2015) #190

(2016) #200; Viglino et al., (2018a,b) #200).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(202*) Ventral surface of posterior process of periotic, along a straight path perpendicular to its long axis: flat (0); concave (1); convex (2). (Murakami et al., (2012a,b) #191; modified from Geisler & Sanders, (2003) #242; Geisler et al., (2011, 2012) #242; Tanaka & Fordyce, (2014, 2015) #191 (2016) #201; Viglino et al., (2018a,b) #201).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(203*) Posterior bullar facet of periotic: with many long deep grooves and low ridges (0); with some shallow grooves and/or low ridges (1); without grooves or ridges (2). (Bianucci, (2005) #20; Murakami et al., (2012a,b) #192; Tanaka & Fordyce, (2014, 2015) #192 (2016) #202; Viglino et al., (2018a,b) #202).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 2.

(204*) Length of posterior process of periotic as percent length of pars cochlearis: long, $\geq 85\%$ (0); short, $\leq 84\%$ (1). (Murakami et al., (2012a,b) #193; modified from Barnes, (1990); Luo & Marsh, (1996) #24; Geisler & Sanders, (2003) #245; Geisler et al., (2011, 2012) #245; Tanaka & Fordyce, (2014, 2015) #193 (2016) #203; Viglino et al., (2018a,b) #203).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0, *Squalodelphis fabianii* ? to 0.

(205*) Mastoid exposure of posterior process of periotic on outside of skull: exposed externally (0); not exposed, enclosed by exoccipital and squamosal (1). (Geisler & Luo, (1996) #28; Luo & Marsh, (1996) #28; Geisler & Sanders, (2003) #249; Geisler et al., (2011, 2012) #249; Murakami et al., (2012a,b) #194; Tanaka & Fordyce, (2014, 2015) #194 (2016) #204; Viglino et al., (2018a,b) #204).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

Tympanic Bulla

- (206) Anterior spine of tympanic bulla: absent (0); present but short (1); present and long (2). (Muizon, (1987); Fordyce, (1994) #45; Geisler & Sanders, (2003) #250; Lambert, (2005) #62; Geisler et al., (2011, 2012) #250; Murakami et al., (2012a,b) #195; modified from Messenger & McGuire, (1998) #1484; derived from Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #195 (2016) #205; Viglino et al., (2018a) #205 (2018b) #206).
- (207) Anterolateral convexity of tympanic bulla with anterolateral notch: absent (0); present (1). (Muizon, (1987); Fordyce, (1994) #46; Lambert, (2005) #63; Murakami et al., (2012a,b) #196; Tanaka & Fordyce, (2014, 2015) #196 (2016) #206; Viglino et al., (2018a) #206 (2018b) #207).
- (208) Articulation of posterior process of tympanic bulla with squamosal: process contacting post-tympanic process of squamosal and posterior process of periotic (0); process contacting periotic only (1). (Muizon, (1984); Fordyce, (1994) #29; Arnold & Heinsohn, (1996) #34; Messenger & McGuire, (1998) #1481; Lambert, (2005) #56; Murakami et al., (2012a,b) #197; derived Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #197 (2016) #207; Viglino et al., (2018a) #207 (2018b) #208).
- (209*) Width of tympanic bulla as percentage of its length along its long axis: wide, $\geq 65\%$ (0); narrow and long, $\leq 64\%$ (1). (Geisler & Sanders, (2003) #251; Bianucci, (2005) #23; Geisler et al., (2011, 2012) #251; Murakami et al., (2012a,b) #198; derived from Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #198 (2016) #208; Viglino et al., (2018a) #208 (2018b) #209).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 1 to 0.

- (210) Accessory ossicle or homologous region on lip of bulla: not fused (0); fused to anterior process of periotic (1). (Barnes, (1990); Fordyce, (1994); Luo & Marsh, (1996); Geisler & Sanders, (2003) #255; Geisler et al., (2011, 2012) #255; Murakami et al., (2012a,b) #199; Tanaka & Fordyce, (2014, 2015) #199 (2016) #209; Viglino et al., (2018a) #209 (2018b) #210).
- (211) Lateral furrow of tympanic bulla: shallow groove (0); absent (1); deep, well-defined groove (2). (Murakami et al., (2012a,b) #200; modified from Muizon, (1984, 1988); Arnold & Heinsohn, (1996) #31; Messenger & McGuire, (1998) #1485; Fajardo-Mellor et al., (2006) #17; Lambert, (2008) #17; derived from Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #200 (2016) #210; Viglino et al., (2018a) #210 (2018b) #211).
- (212) Sigmoid process: directed laterally to posterolaterally (0); directed anteriorly to anterolaterally (1). (Murakami et al., (2012a,b) #201; modified from Messenger & McGuire, (1998) #1486; Lambert, (2005) #67, Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #201 (2016) #211; Viglino et al., (2018a) #211 (2018b) #212).
- (213) Dorsomedial edge of sigmoid process: expanded anteriorly to appose lateral tuberosity of periotic (0); not articulating with squamosal or periotic (1). (Murakami et al., (2012a,b) #202; modified from Geisler & Sanders, (2003) #260; Geisler et al., (2011, 2012) #260; modified from Luo & Marsh, (1996) #10; Tanaka & Fordyce, (2014, 2015) #202 (2016) #212; Viglino et al., (2018a) #212 (2018b) #213).
- (214) Ventral margin of tympanic bulla in lateral view: convex (0); concave (1). (Lambert, (2005) #66; Murakami et al., (2012a,b) #203; Tanaka & Fordyce, (2014, 2015) #203 (2016) #213; Viglino et al., (2018a) #213 (2018b) #214).

(215) Elliptical foramen of tympanic bulla: present (0); absent or close (1). (Geisler & Sanders, (2003) #261; Geisler et al., (2011, 2012) #261; Murakami et al., (2012a,b) #204; derived from Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #204 (2016) #214; Viglino et al., (2018a) #214 (2018b) #215).

(216*) Size of posterior process of tympanic bulla: equal to or greater than total length of tympanic bulla (0); much smaller than total length of tympanic bulla (1). (Muizon, (1984, 1991); Heyning, (1989) #23 #29, (1997) #55 #61; Messenger & McGuire, (1998) #1482; Murakami et al., (2012a,b) #205; modified from Lambert, (2005) #57; derived from Yamada, (1953); Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #205 (2016) #215; Viglino et al., (2018a) #215 (2018b) #216).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(217*) Surface of posterior process of tympanic bulla: spiny or irregular edges (0); cauliflower-like bony growth (1); rounded and pachyostotic (2). (Muizon, (1991); Messenger & McGuire, (1998) #1483; Murakami et al., (2012a,b) #206; derived from Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #206 (2016) #216; Viglino et al., (2018a) #216 (2018b) #217).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(218) Median furrow: short extension on ventral face anterior to interprominental notch (0); anterolateral curvature of median groove to connect to long lateral furrow on outer lip (1); median groove reaching an anterior level beyond lateral furrow, and often slightly curved laterally (2); long and deep rectilinear median groove reaching at least to base of anterior tip of tympanic bulla (3). (Lambert, (2005) #64; Murakami et al., (2012a,b) #207; Tanaka & Fordyce, (2014, 2015) #207 (2016) #217; Viglino et al., (2018a) #217 (2018b) #218).

(219*) Median furrow on posterior side of bulla: divided by a transverse ridge originating

from involucrum (0); transverse ridge absent (1). (Geisler & Sanders, (2003) #267; Geisler et al., (2011, 2012) #267; Murakami et al., (2012a, b) #208; Tanaka & Fordyce, (2014, 2015) #208 (2016) #218; Viglino et al., (2018a) #218 (2018b) #219).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 1.

(220*) Posterior edge of inner prominence of involucrum: approximately in line with posterior edge of outer prominence (0); distinctly anterior to posterior edge of outer prominence (1). (Muizon, (1987); Geisler & Sanders, (2003) #269; Geisler et al., (2011, 2012) #269; Murakami et al., (2012a,b) #209; derived from Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #209 (2016) #219; Viglino et al., (2018a) #219 (2018b) #220).

NOTE: The names of the posterior prominences of the bulla were updated to follow Mead & Fordyce (2009) terminology.

(221*) Dorsal margin of involucrum of tympanic bulla: not excavated (0); excavated just anterior to posterior process (1); excavated at mid-part of involucrum (2). (Muizon, (1988); Messenger & McGuire, (1998) #1487; Murakami et al., (2012a,b) #210 #211; modified from Lambert, (2005) #60; Geisler & Sanders, (2003) #271; Geisler et al., (2011, 2012) #271; Tanaka & Fordyce, (2014, 2015) #210 (2016) #220; Viglino et al., (2018a) #220 (2018b) #221).

NOTE: We modified the codings of the following taxa: *Squalodelphis fabianii* ? to 0.

(222*) Ridge on inside of bulla: present, as transverse ridge extending laterally from involucrum and partially dividing cavum tympani into anterior and posterior portions (0); absent (1). (Geisler & Sanders, (2003) #272; Geisler et al., (2011, 2012) #272; Murakami et al., (2012a,b) #212; Tanaka & Fordyce, (2014, 2015) #211 (2016) #221; Viglino et al., (2018a) #221 (2018b) #222).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 0 to 1.

(223*) Ventromedial keel of tympanic bulla: present along entire length (0); terminating approximately at level of lateral furrow or mid-point of the tympanic bulla (1); poorly defined along entire length (2). (Geisler & Sanders, (2003) #273; Geisler et al., (2011, 2012) #273; Murakami et al., (2012a,b) #213; derived from Kasuya, (1973); Tanaka & Fordyce, (2014, 2015) #212 (2016) #222; Viglino et al., (2018a) #222 (2018b) #223).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 0 to 2.

(224) Posterior end of ventromedial keel: not protruding and directed medially (0); protruding and directed medially (1). (Geisler & Sanders, (2003) #275; Geisler et al., (2011, 2012) #275; Murakami et al., (2012a,b) #214; Tanaka & Fordyce, (2014, 2015) #213 (2016) #223; Viglino et al., (2018a) #223 (2018b) #224).

Hyals

(225) Basihyal and thyrohyal connection: unfused (0); fused (1). (Murakami et al., (2012a,b) #215; modified from Bianucci, (2005) #25; Tanaka & Fordyce, (2014, 2015) #214 (2016) #224; Viglino et al., (2018a) #224 (2018b) #225).

(226) Basihyal and thyrohyal shape: arched (0); angled (1). (Murakami et al., (2012a,b) #216; modified from Bianucci, (2005) #25; Tanaka & Fordyce, (2014, 2015) #215 (2016) #225; Viglino et al., (2018a) #225 (2018b) #226).

Vertebrae

(227) Dorsal transverse process of atlas: developed dorsolaterally (0); fused with ventral transverse process, with height of process greater than width (1); absent or rudimentary obtuse angle (2). (Murakami et al., (2012a,b) #217; modified from Muizon, (1988); Barnes, (1990); Tanaka & Fordyce, (2014, 2015) #216 (2016) #226; Viglino et al., (2018a) #226 (2018b) #227).

- (228) Roof of neural canal of atlas: arched (0); convex (1); straight (2). (Murakami et al., (2012a,b) #218; Tanaka & Fordyce, (2014, 2015) #217 (2016) #227; Viglino et al., (2018a) #227 (2018b) #228).
- (229) Postzygapophysis of axis in anterior view: appearing as crest, elongated dorsolaterally (0); appearing as rudimentary crest (1); not appearing (2). (Murakami et al., (2012a,b) #219; Tanaka & Fordyce, (2014, 2015) #218 (2016) #228; Viglino et al., (2018a) #228 (2018b) #229).
- (230*) Cervical vertebrae: unfused (0); atlas and axis fused (1); C1–C3 or C1–C4 fused (2); C1–C6 or C1–C7 fused (3); C2–C7 fused (4). (Murakami et al., (2012a,b) #220; modified from Arnold & Heinsohn, (1996) #9; Messenger & McGuire, (1998) #1501; Geisler & Sanders, (2003) #278 #279; Fajardo-Mellor et al., (2006) #18; Lambert, (2008) #18; Geisler et al., (2011, 2012) #278 #279; derived from Allen, (1923); Miller, (1923); Fraser & Noble, (1971); De Smet, (1977); Rommel, (1990); Tanaka & Fordyce, (2014, 2015) #219 (2016) #229; Viglino et al., (2018a) #229 (2018b) #230).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 0

- (231) Length of cervicals (C1–C7) as percent of height of vertebral body plus neural canal of atlas: long, >150% (0); short, <150% (1). (Murakami et al., (2012a,b) #221; Tanaka & Fordyce, (2014, 2015) #220 (2016) #230; Viglino et al., (2018a) #230 (2018b) #231).
- (232*) Capitular articulation facets of posterior vertebrae: facets gradually shift downward on sequential vertebrae to fuse with tubercular facets (0); facets abruptly shift from a position on neural arch to a pedestal, originating from centrum on subsequent vertebra (1). (Geisler & Sanders, (2003) #282; Geisler et al., (2011, 2012) #282; Murakami et al., (2012a,b) #223; derived from Flower,

(1868); Miller, (1923); Tanaka & Fordyce, (2014, 2015) #222 (2016) #231; Viglino et al., (2018a) #231 (2018b) #232).

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* ? to 0.

(233*) Transverse processes of lumbar vertebrae: extend parallel to anterior and posterior borders (0); triangular (1). (Muizon, (1984, 1985, 1988); Messenger & McGuire, (1998) #1502; Geisler & Sanders, (2003) #285; Geisler et al., (2011, 2012) #285; Murakami et al., (2012a,b) #224; Tanaka & Fordyce, (2014, 2015) #223 (2016) #232; Viglino et al., (2018a) #232 (2018b) #233).

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* ? to 0.

(234*) Transverse processes of lumbar vertebrae: oriented ventrolaterally (0); oriented laterally and horizontally (1). (Geisler & Sanders, (2003) #284; Geisler et al., (2011, 2012) #284; Murakami et al., (2012a,b) #225; derived from Sanders & Barnes, (2002); Tanaka & Fordyce, (2014, 2015) #224 (2016) 233; Viglino et al., (2018a) #233 (2018b) #234).

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* ? to 1.

(235) Ratio of greatest breadth of transverse process to width of centrum at anterior face in lumbar vertebrae: some or all lumbar vertebrae >2.5 (0); no lumbar vertebrae >2.5 (1). (Murakami et al., (2012a,b) #226; Tanaka & Fordyce, (2014, 2015) #225 (2016) #234; Viglino et al., (2018a) #234 (2018b) #235).

Sternum and Sternal Ribs

(236) Sternum: consists of four or five parts (0); consists of two or three parts (1); consists of single bone (2). (Murakami et al., (2012a,b) #229; modified from Geisler & Sanders, (2003) #290; Geisler et al., (2011) #290; derived from Yablokov, (1964); Van Valen, (1968); Tanaka & Fordyce, (2014, 2015) #228 (2016) #235; Viglino et al., (2018a) #235 (2018b) #236).

(237) Ventrolateral processes on manubrium of sternum: absent (0); present but small, occur ventral to articulation surface of first costal cartilage or rib (1). (Muizon, (1988); Messenger & McGuire, (1998) #1503; Geisler & Sanders, (2003) #289; Geisler et al., (2011, 2012) #289; Murakami et al., (2012a,b) #230; derived from Klima et al., (1980); Tanaka & Fordyce, (2014, 2015) #229 (2016) #236; Viglino et al., (2018a) #236 (2018b) #237).

(238) Sternal ribs: unossified or ossification of fewer than five pairs (0); ossification of five pairs or more (1). (Murakami et al., (2012a,b) #231; derived from Flower, (1867); Tanaka & Fordyce, (2014, 2015) #230 (2016) #237; Viglino et al., (2018a) #237 (2018b) #238).

(239*) Number of two head ribs: ≥ 9 (0); 8 (1); ≤ 7 (2). (Murakami et al., (2012b) #282; Tanaka & Fordyce, (2014, 2015) #231 (2016) #238; Viglino et al., (2018a) #238 (2018b) #239).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 2.

Scapula

(240*) Anterodorsal part of scapula: rounded (0); rounded and anterior edge pointed (1); almost rectilinear (2). (Murakami et al., (2012a,b) #232; Tanaka & Fordyce, (2014, 2015) #232 (2016) #239; Viglino et al., (2018a) #239 (2018b) #240).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 0.

(241*) Ventral projection on anterior border of scapula: absent (0); present (1). (Fajardo-Mellor et al., (2006) #26; Murakami et al., (2012a,b) #233; derived from Noble & Fraser, (1971); Tanaka & Fordyce, (2014, 2015) #233 (2016) #240; Viglino et al., (2018a) #240 (2018b) #241).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 0.

(242*) Anterior slope on scapula between anterior angle and midpoint of glenoid fossa

with anterior and posterior margin of glenoid fossa on a plane: shallow, $<35^\circ$ (0); steeper, $>35^\circ$ (1). (modified from Murakami et al., (2012a,b) #234; modified from Bianucci, (2005) #31; Tanaka & Fordyce, (2014, 2015) #234 (2016) #241; Viglino et al., (2018a) #241 (2018b) #242).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* ? to 1.

(243) Posterior slope on scapula, between scapula and midpoint of glenoid fossa with anterior and posterior margin of glenoid fossa on a plane: shallow, $<25^\circ$ (0); steeper, $>25^\circ$ (1). (modified from Murakami et al., (2012a,b) #235; modified from Bianucci, (2005) #32; Tanaka & Fordyce, (2014, 2015) #235 (2016) #242; Viglino et al., (2018a) #242 (2018b) #243).

(244) Crest between infraspinous fossa and teres fossa: weakly developed (0); strongly developed (1). (Murakami et al., (2012a,b) #236; Tanaka & Fordyce, (2014, 2015) #236 (2016) #243; Viglino et al., (2018a) #243 (2018b) #244).

(245) Coracoid process of scapula: not expanded distally (0); expanded distally (1); notably reduced or absent (2). (Murakami et al., (2012a,b) #237; modified from Muizon, (1987, 1994); Messenger & McGuire, (1998) #1504; Geisler & Sanders, (2003) #292; Lambert, (2005) #73; Bianucci, (2005) #33; Geisler et al., (2011) #292; derived from True, (1904); Tanaka & Fordyce, (2014, 2015) #237 (2016) #244; Viglino et al., (2018a) #244 (2018b) #245).

(246) Coracoid process of scapula, with glenoid fossa: directed horizontally (0); directed nearly anterodorsally (1); directed anteroventrally (2). (modified from Murakami et al., (2012a,b) #238; modified Barnes, (1990); Tanaka & Fordyce, (2014, 2015) #238 (2016) #245; Viglino et al., (2018a) #245 (2018b) #246).

(247*) Acromion of scapula: narrow and not expanded distally (0); expanded distally (1). (Murakami et al., (2012a,b) #239; modified from Bianucci, (2005) #34; Tanaka

& Fordyce, (2014, 2015) #239 (2016) #247; Viglino et al., (2018a) #246 (2018b) #247).

NOTE: We modified the coding of the following taxa: *Notocetus vanbenedeni* 0 to 1.

(248*) Acromion of scapula, when glenoid fossa direct ventrally: directed horizontally (0); directed anterodorsally (1); directed anteroventrally (2). (Murakami et al., (2012a,b) #240; modified from Barnes, (1990); Tanaka & Fordyce, (2014, 2015) #240 (2016) #247; Viglino et al., (2018a) #247 (2018b) #248).

NOTE: We modified the codings of the following taxa: *Notocetus vanbenedeni* 2 to 0.

(249) Supraspinous fossa of scapula: present (0); acromion process of scapula lies on anterior edge, with loss of supraspinous fossa (1). (Muizon, (1987, 1994); Fordyce, (1994) #48; Geisler & Sanders, (2003) #293; Lambert, (2005) #72; Geisler et al., (2011, 2012) #293; Murakami et al., (2012a,b) #241; modified from Tanaka & Fordyce, (2014, 2015) #241, 292 (2016) #248, 249; Viglino et al., (2018a) #248 (2018b) #249).

Forelimb (except scapula)

(250) Ratio of length of humerus to length of radius: long, >1.1 (0); short, <0.8 (1). (Murakami et al., (2012a,b) #242; modified from Sanders & Barnes, (2002); Geisler & Sanders, (2003) #297; Geisler et al., (2011, 2012) #297; Tanaka & Fordyce, (2014, 2015) #242 (2016) #251; Viglino et al., (2018a) #251 (2018b) #250).

(251) Location of apex of deltopectoral tuberosity of humerus: within proximal 65% of humerus (0); within distal 35% of humerus (1). (Murakami et al., (2012a,b) #243; modified from Muizon, (1988); Messenger & McGuire, (1998) #1506; Geisler & Sanders, (2003) #295; Bianucci, (2005) #35; Geisler et al., (2011, 2012) #295; Tanaka & Fordyce, (2014, 2015) #243 (2016) #252; Viglino et al., (2018a) #252

(2018b) #251).

(252) Prominent deltoid crest on anterior edge of humerus: present, forms greatest anteroposterior diameter along shaft (0); forming a knob-like tuberosity (1); tuberosity or crest absent (2). (Geisler & Sanders, (2003) #294; Geisler et al., (2011, 2012) #294; Murakami et al., (2012a,b) #244; derived from Sanders & Barnes, (2002); Tanaka & Fordyce, (2014, 2015) #244 (2016) #253; Viglino et al., (2018a) #253 (2018b) #252).

(253) Radial and ulnar facets of humerus in lateral view: facets forming a semicircular articulation surface (0); facets forming an obtuse angle (1). (Barnes, (1990); Geisler & Sanders, (2003) #296; Geisler et al., (2011, 2012) #296; Murakami et al., (2012a,b) #245; Tanaka & Fordyce, (2014, 2015) #245 (2016) #254; Viglino et al., (2018a) #254 (2018b) #253).

(254) Olecranon process: present as a distinct process (0); present as a slightly raised proximal posterior edge (1); absent (2). (Messenger & McGuire, (1998) #1507; Geisler & Sanders, (2003) #296; Geisler et al., (2011, 2012) #284; Murakami et al., (2012a,b) #246; modified from Muizon, (1984); Barnes, (1990); Arnold & Heinsohn, (1996) #10; Fajardo-Mellor et al., (2006) #28; derived from Howell, (1927); Bianucci (2005) #37; Tanaka & Fordyce, (2014, 2015) #246 (2016) #255; Viglino et al., (2018a) #255 (2018b) #254).

Soft Tissues

(255) Spermaceti organ: absent (0); present (1). (Fordyce, (1994) #17; Messenger & McGuire, (1998) #1511; Geisler & Sanders, (2003) #97; Geisler et al., (2011, 2012) #97; Murakami et al., (2012a,b) #247; derived from Norris and Harvey, (1972); Cranford et al., (1996); Tanaka & Fordyce, (2014, 2015) #247 (2016) #256; Viglino et al., (2018a) #256 (2018b) #255).

- (256) Museau de singe: absent (0); present (1). (Messenger & McGuire, (1998) #1512; Murakami et al., (2012a,b) #248; derived from Norris, (1964); Cranford et al., (1996); Tanaka & Fordyce, (2014, 2015) #248 (2016) #257; Viglino et al., (2018a) #257 (2018b) #256).
- (257) Lateral lips of nasal plug: present (0); absent (1). (Messenger & McGuire, (1998) #1523; Murakami et al., (2012a,b) #249; Tanaka & Fordyce, (2014, 2015) #249 (2016) #258; Viglino et al., (2018a) #258 (2018b) #257).
- (258) Proximal sac: single frontal sac (0); sac complex, with nasofrontal sacs and vestibule (1). (Heyning, (1989) #6 #11 #17, (1997) #33 #43 #49; Fordyce, (1994) #16; Messenger & McGuire, (1998) #1531 #1532; Lambert, (2005) #18; Murakami et al., (2012a,b) #250; Tanaka & Fordyce, (2014, 2015) #250 (2016) #259; Viglino et al., (2018a) #259 (2018b) #258).
- (259) Posterior nasal sacs: absent (0); present (1). (Heyning, (1989) #41, (1997) #73; Arnold & Heinsohn, (1996) #6; Messenger & McGuire, (1998) #1534; Murakami et al., (2012a,b) #251; Tanaka & Fordyce, (2014, 2015) #251 (2016) #260; Viglino et al., (2018a) #260 (2018b) #259).
- (260) Posterior nasal sacs: single (0); divided (1). (Messenger & McGuire, (1998) #1535; Murakami et al., (2012a) #252; Tanaka & Fordyce, (2014, 2015) #252 (2016) #261; Viglino et al., (2018a) #261 (2018b) #260).
- (261) Anterior section of nasofrontal sac: absent (0); present (1). (Messenger & McGuire, (1998) #1536; Murakami et al., (2012a,b) #253; Tanaka & Fordyce, (2014, 2015) #253 (2016) #262; Viglino et al., (2018a) #262 (2018b) #261).
- (262) Anterior part of nasofrontal sac: smooth (0); trabeculate (1). (Messenger & McGuire, (1998) #1537; Fajardo-Mellor et al., (2006) #35; Murakami et al., (2012a,b) #254; derived from Heyning, (1989); Tanaka & Fordyce, (2014, 2015)

- #254 (2016) #263; Viglino et al., (2018a) #263 (2018b) #262).
- (263) Vestibular sac: absent (0); present (1); hypertrophied (2). (Heyning, (1989) #28, (1997) #60; Fordyce, (1994) #31; Arnold & Heinsohn, (1996) #1 #3; Messenger & McGuire, (1998) #1541; Lambert, (2005) #17; Fajardo-Mellor et al., (2006) #39; Murakami et al., (2012a,b) #255; Tanaka & Fordyce, (2014, 2015) #255 (2016) #264; Viglino et al., (2018a) #264 (2018b) #263).
- (264) Floor of vestibular sac (nasal sac): not rigid (0); rigid (1). (Heyning, (1989) #38, (1997) #70; Arnold & Heinsohn, (1996) #2; Messenger & McGuire, (1998) #1543; Fajardo-Mellor et al., (2006) #38; Murakami et al., (2012a,b) #256; Tanaka & Fordyce, (2014, 2015) #256 (2016) #265; Viglino et al., (2018a) #265 (2018b) #264).
- (265) Vestibular sac (nasal sac): undivided (0); bilaterally divided (1). (Messenger & McGuire, (1998) #1544; Fajardo-Mellor et al., (2006) #36; Murakami et al., (2012a,b) #257; derived from Heyning, (1989); Tanaka & Fordyce, (2014, 2015) #257 (2016) #266; Viglino et al., (2018a) #266 (2018b) #265).
- (266) Right and left sides of vestibular sac (nasal sac): same size (0); right side larger than left (1). (Heyning, (1989) #30, (1997) #62; Messenger & McGuire, (1998) #1545; Murakami et al., (2012a,b) #258; Tanaka & Fordyce, (2014, 2015) #258 (2016) #267; Viglino et al., (2018a) #267 (2018b) #266).
- (267) Intrinsic muscle in vestibular sac (nasal sac): absent (0); present (1). (Messenger & McGuire, (1998) #1546; Fajardo-Mellor et al., (2006) #37; Murakami et al., (2012a,b) #259; derived from Mead, (1975); Tanaka & Fordyce, (2014, 2015) #259 (2016) #268; Viglino et al., (2018a) #268 (2018b) #267).
- (268) Floor of vestibular sac (nasal sac): smooth (0); wrinkled (1). (Heyning, (1997) #70; Arnold & Heinsohn, (1996) #2; Messenger & McGuire, (1998) #1543; Murakami

et al., (2012a,b) #260; Tanaka & Fordyce, (2014, 2015) #260 (2016) #269; Viglino et al., (2018a) #269 (2018b) #268).

(269) Diagonal membrane: absent (0); present (1). (Messenger & McGuire, (1998) #1550; Murakami et al., (2012a,b) #261; Heyning, (1989); Tanaka & Fordyce, (2014, 2015) #261 (2016) #270; Viglino et al., (2018a) #270 (2018b) #269).

(270) Spiracular cavity: slit-like (0); rounded (1). (Messenger & McGuire, (1998) #1552; Murakami et al., (2012a,b) #262; Tanaka & Fordyce, (2014, 2015) #262 (2016) #271; Viglino et al., (2018a) #271 (2018b) #270).

(271) Pars posteroexternus muscle: absent (0); present (1). (Messenger & McGuire, (1998) #1553; Murakami et al., (2012a,b) #263; Tanaka & Fordyce, (2014, 2015) #263 (2016) #272; Viglino et al., (2018a) #272 (2018b) #271).

(272) Pars intermedius muscle: absent (0); present (1). (Messenger & McGuire, (1998) #1554; Murakami et al., (2012a,b) #264; Tanaka & Fordyce, (2014, 2015) #264 (2016) #273; Viglino et al., (2018a) #273 (2018b) #272).

(273) Pars posterointerus muscle: absent (0); present (1). (Messenger & McGuire, (1998) #1556; Murakami et al., (2012a,b) #265; Tanaka & Fordyce, (2014, 2015) #265 (2016) #274; Viglino et al., (2018a) #274 (2018b) #273).

(274) Pars anterointerus muscle: one insertion (0); two insertions (1). (Messenger & McGuire, (1998) #1557; Murakami et al., (2012a,b) #266; Tanaka & Fordyce, (2014, 2015) #266 (2016) #275; Viglino et al., (2018a) #275 (2018b) #274).

(275) Blowhole shape: longitudinal slit, may be slightly sigmoidal or angled (0); crescent, with apices pointed anteriorly (1); crescent, with apices pointed posteriorly, may be skewed (2); rectangular (3). (Murakami et al., (2012a,b) #267; modified from Messenger & McGuire, (1998) #1525; Tanaka & Fordyce, (2014, 2015) #267 (2016) #276; Viglino et al., (2018a) #276 (2018b) #275).

- (276) Soft tissues of nasal passages distal to bony external nares: separated for most of their length but confluent just proximal to blowhole (0); confluent (1). (Heyning, (1989); Fordyce, (1994) #20; Messenger & McGuire, (1998) #1529; Geisler & Sanders, (2003) #95; Lambert, (2005) #16; Geisler et al., (2011, 2012) #95; Murakami et al., (2012a,b) #268; Tanaka & Fordyce, (2014, 2015) #268 (2016) #277; Viglino et al., (2018a) #277 (2018b) #276).
- (277) Distal sac: absent (0); present, situated immediately distal to museau de singe (1). (Murakami et al., (2012a,b) #269; modified from Heyning, (1989) #12, (1997) #44; Fordyce, (1994) #14; Messenger & McGuire, (1998) #1533; Geisler & Sanders, (2003) #99; Lambert, (2005) #19; Geisler et al., (2011, 2012) #99; Tanaka & Fordyce, (2014, 2015) #269 (2016) #278; Viglino et al., (2018a) #278 (2018b) #277).
- (278) Blowhole ligament: absent (0); present (1). (Heyning, (1989) #15, (1997) #44; Fordyce, (1994) #13; Messenger & McGuire, (1998) #1527; Geisler & Sanders, (2003) #101; Lambert, (2005) #20; Geisler et al., (2011, 2012) #101; Murakami et al., (2012a, 2012b) #270; Tanaka & Fordyce, (2014, 2015) #270 (2016) #279; Viglino et al., (2018a) #279 (2018b) #278).
- (279) Blowhole ligament: not appressed against skull (0); appressed against skull (1). (Messenger & McGuire, (1998) #1528; Murakami et al., (2012a,b) #271; Tanaka & Fordyce, (2014, 2015) #271 (2016) #280; Viglino et al., (2018a) #280 (2018b) #279).
- (280) Cartilage on blowhole ligament: absent (0); present (1). (Messenger & McGuire, (1998) #1529; Murakami et al., (2012a,b) #272; Tanaka & Fordyce, (2014, 2015) #272 (2016) #281; Viglino et al., (2018a) #281 (2018b) #280).
- (281) Accessory sac: absent (0); present, forms small diverticulum of inferior vestibule

and extends anterolaterally around the attachment of blowhole ligament to the premaxilla (1). (Messenger & McGuire, (1998) #1549; Geisler & Sanders, (2003) #106; Fajardo-Mellor et al., (2006) #40; Geisler et al., (2011, 2012) #106; Murakami et al., (2012a,b) #274; derived from Schenkkan, (1971); Mead, (1975); Heyning, (1989); Tanaka & Fordyce, (2014, 2015) #273 (2016) #282; Viglino et al., (2018a) #282 (2018b) #281).

(282) Esophageal forestomach: present (0); absent (1). (Geisler & Sanders, (2003) #300; Geisler et al., (2011, 2012) #300; Murakami et al., (2012a,b) #275; derived from Mead, (1989); Rice and Wolman, (1990); Tanaka & Fordyce, (2014, 2015) #274 (2016) #283; Viglino et al., (2018a) #283 (2018b) #282).

(283) External throat grooves: absent (0); one pair converged anteriorly (1); irregular in number and shape (2). (Murakami et al., (2012a) #276; modified from Messenger & McGuire, (1998) #1512 #1513; Geisler & Sanders, (2003) #301; Geisler et al., (2011, 2012) #301; Tanaka & Fordyce, (2014, 2015) #276 (2016) #284; Viglino et al., (2018a) #284 (2018b) #283).

(284) Dorsal fin: present (0); dorsal hump (1); absent (2). (Murakami et al., (2012a) #277; modified from Messenger & McGuire, (1998) #1562; Geisler & Sanders, (2003) #304; Geisler et al., (2011, 2012) #304; derived from Leatherwood & Reeves, (1983); Jefferson & Newcomer (1993), Reeves et al., (2002); Tanaka & Fordyce, (2014, 2015) #277 (2016) #285; Viglino et al., (2018a) #285 (2018b) #284).

(285) Shape of flipper: fan shaped (0); rounded at tip (1); sharply pointed at tip (2); entire flipper rounded (3). (Murakami et al., (2012a) #278; modified from Fajardo-Mellor et al., (2006) #31; Lambert, (2008) #25; derived from Leatherwood & Reeves (1983), Brownell et al., (1987); Tanaka & Fordyce, (2014, 2015) #278 (2016) #286; Viglino et al., (2018a) #286 (2018b) #285).

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