

A New Genus of Australian Longneck Turtle (Testudines: Chelidae) and a New Species of *Macrochelodina* from the Kimberley Region of Western Australia (Australia)

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Abstract. Because the holotype of *Chelodina oblonga* Gray, 1841, presently accepted as the longneck of southwestern Western Australia, is actually a member of the *Macrochelodina rugosa* complex of northern Australia, the taxonomic confusion is herein remedied by the designation of a neotype for *C. oblonga*. Because it is so distinctive and represents a monophyletic lineage separate from other *Chelodina* and *Macrochelodina*, we allocate this species to *Macrodiremys* **gen. nov.** with *Macrodiremys (Chelodina) oblonga* (Gray, 1841) designated herein as the type species. After many years of calling the longneck turtle of the Kimberley Region of northern Western Australia the “Kimberley *rugosa*,” data were gathered to compare the Kimberley and all other described *Macrochelodina* species in the *M. rugosa* complex, leading to the description here of a morphologically distinct species, *Macrochelodina walloyarrina* **sp. nov.**

Key Words: Turtle, Pleurodira, chelid, neotype, *Macrodiremys* **gen. nov.**, *Macrochelodina walloyarrina* **sp. nov.**, Western Australia, Australia.



Extant species of side-necked turtles (Pleurodira Cope, 1864) are assigned to one of three families: Chelidae Gray, 1825; Podocnemididae Cope, 1868; and Pelomedusidae Cope, 1868.

Within the family Chelidae there are 18 genera (see BOUR and ZAHER, 2005, for differing opinion). Ten chelid genera are from South America: *Acanthochelys* Gray, 1873; *Batrachemys* Stejneger, 1909; *Bufocephala* McCord et al., 2001; *Chelus* Duméril, 1806; *Hydromedusa* Wagler, 1830; *Mesoclemmys* Gray, 1873; *Phrynops* Wagler, 1830; *Platemys* Wagler, 1830; *Ranacephala* McCord et al., 2001; and *Rhinemys* Wagler, 1830. Eight chelid genera are from Australia, New Guinea, Rote (Indonesia), and East Timor: *Chelodina* Fitzinger, 1826; *Emydura* Bonaparte, 1836; *Euseya* Gray, 1867; *Elusor* Cann and Legler, 1994; *Macrochelodina* Wells and Wellington, 1985; *Pseudemydura* Siebenrock, 1901; *Rheodytes* Legler and Cann, 1980; and *Wollumbinia* Wells, 2007.

Australasian chelids are generally divided into two morphological groups: the short- or sidenecks, and the long- or snakenecks (GEORGES et al., 1998). All are shortnecks except *Chelodina* sensu stricto and *Macrochelodina* in Australia.

Historically (GOODE, 1967; BURBIDGE et al., 1974) and recently (GEORGES et al., 2002) *Chelodina* sensu lato has been designated as comprising first two, then three subgeneric groups (clades): A (= *Chelodina* sensu stricto), B (= *Macrochelodina* Wells and Wellington, 1985), and C (unnamed, containing only “*Chelodina oblonga* Gray, 1841” = *Chelodina colliei* Gray, 1856).

In 1985 WELLS and WELLINGTON elevated subgeneric group B to full genus status, and designated the

name *Macrochelodina* for the new genus, with “*Chelodina oblonga*” as the type species (generotype). However, the holotype of *Chelodina oblonga* was later shown by THOMSON (2000) to be a representative of the form presently assigned to *Macrochelodina (Chelodina) rugosa* (Ogilby, 1890). Therefore, following the original intent of WELLS and WELLINGTON (1985) to describe the “broad-headed” clade of *Chelodina* sensu lato under *Macrochelodina*, IVERSON et al. (2001) fixed *Macrochelodina (Chelodina) rugosa* as the type species of *Macrochelodina*, thereby removing the taxonomic inconsistency.

The currently valid 1999 ICZN code gives great importance to preserving stability and universality, and avoiding the disruption of prevailing name usage whenever possible (Article 82). Article 75.6 provides an example and sets a precedent for dealing with a misidentified holotype. In that case, the Commission set aside the original name-bearing type specimen, and designated a neotype in accord with prevailing usage. We therefore hereby set aside Gray’s 1841 *C. oblonga* holotype (BMNH 1947.3.5.89) and designate Gray’s 1856 *C. colliei* lectotype (THOMSON, 2000; BMNH 1947.3.5.91) as the neotype of *C. oblonga*. This maintains prevailing usage of both *C. oblonga* and *M. rugosa*, maintains taxonomic stability, and makes *C. oblonga* and *C. colliei* objective (same type) synonyms, with *C. oblonga* having priority.

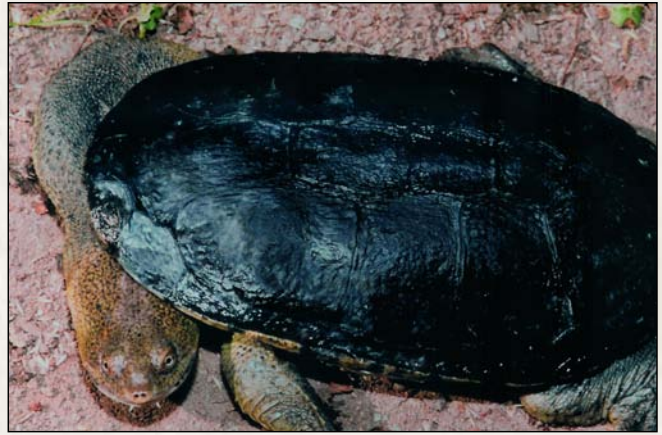
Chelodina sensu stricto (= historical subgeneric group A, = the “*Chelodina longicollis* group,” including the *Chelodina novaeguineae* complex*; see MCCORD et al., 2007a) is differentiated by having a generally narrower, more rounded head, a longer intergular scute, vestigial barbels, a shorter and thinner neck with prominent tubercles,

and a broader plastron, and includes the following taxa: **C. canni* McCord and Thomson, 2002; **C. gunaleni* McCord and Joseph-Ouni, 2007a; *C. longicollis* Shaw, 1794; **C. mccordi* Rhodin, 1994b; **C. novaeguineae* Boulenger, 1888; *C. pritchardi* Rhodin, 1994a; **C. reimanni* Philippen and Grossman, 1990; *C. steindachneri* Siebenrock, 1914; and **C. timorensis* McCord et al., 2007b.

Macrochelodina (= historical subgeneric group B, = the “*Macrochelodina expansa* group,” including the *Macrochelodina rugosa* complex*) is differentiated by having a generally broader head, a longer thicker neck with less obvious tubercles, and a narrower plastron, and includes the following taxa: **M. burrungandjii* Thomson et al., 2000; *M. expansa* Gray, 1857; **M. kuchlingi* Cann, 1997; *M. parkeri* Rhodin and Mittermeier, 1976; and **M. rugosa* Ogilby, 1890. We will designate **M. siebenrocki* Werner, 1901, as a subspecies of *M. rugosa* based on DNA sequence data (in prep.).

The *Macrochelodina* of the Kimberley Region of Western Australia, is morphologically most similar to historical subgeneric group B, and thus herein designated a member. More specifically, *Macrochelodina* of the Kimberley Region is similar to species of the *Macrochelodina rugosa* complex (defined herein) within historical subgeneric group B, sharing the following characters that differentiate them from *M. expansa* and *M. parkeri*: a much narrower parietal roof relative to head width (9%), than that found in *M. expansa* (17%) and *M. parkeri* (11%); a high (20) head robusticity factor (HW x HD/HL) meaning the head is wide and/or deep and/or relatively short compared to the narrower and/or shallower and/or relatively longer heads in *M. expansa* and *M. parkeri*, with lower robusticity factors (16 and 14 respectively); a high HW to HL ratio (0.71) indicating a relatively wide and/or short head, compared to a relatively narrower and/or longer head in *M. expansa* (0.62) and *M. parkeri* (0.65); a greater (0.13–0.14) interorbital width relative to head width than in *M. expansa* (0.12) and *M. parkeri* (0.12); prominent barbels versus vestigial or small barbels in *M. expansa* and *M. parkeri*; a moderately to highly rugose carapace, compared to a much smoother carapace in *M. expansa* and *M. parkeri*; a plastral midline formula with either the intergular scute length or interpectoral seam length (as found in *M. parkeri*) in the second position rather than the interabdominal seam as in *M. expansa*; and an intergular scute often reaching the anterior plastral margin in all but *M. rugosa* sensu stricto, whereas the IG scute never reaches the anterior plastral margin in *M. expansa* or *M. parkeri*. Within historical subgeneric group B, *M. parkeri* is differentiated from all others in having a vermiculated head pattern, a chocolate brown carapace with black flecking, and no upturning of the lateral marginals. The *Macrochelodina* of the Kimberley Region is thus also herein designated a member of the *Macrochelodina rugosa* complex.

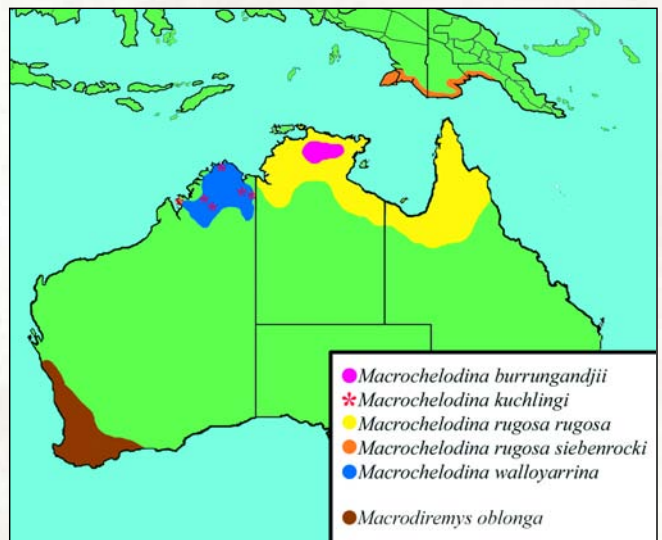
Historical *Chelodina* sensu lato subgeneric group C (BURBIDGE et al., 1974; GEORGES et al., 2002), containing only *C. oblonga* has been yet unnamed. We herein elevate this group to full genus status and designate it with the name *Macrodiremys* gen. nov. (from the Greek *makros* meaning “long”; the Greek *dire* meaning “neck”; and the



Macrodiremys oblonga adult female. Photo: W. P. McCord



Macrodiremys oblonga adult female head. Photo: W. P. McCord



Map of Australia and New Guinea showing the distributions of the *Macrochelodina rugosa* complex and *Macrodiremys oblonga*

Greek *emys* meaning “turtle” = “long necked turtle”). The type species is herein fixed as *Macrodiremys (Chelodina) oblonga* (Gray, 1841) of southwestern Western Australia by present original designation and by monotypy. The genus *Macrodiremys* is described and diagnosed by the following characters: the consistent presence of 5–8 “exposed” (by medially non-contiguous pleurals) contiguous neural bones (THOMSON and GEORGES, 1996), which are either absent, vestigial and/or non-contiguous in *Chelodina* sensu stricto or *Macrochelodina* (except *M. burrungandjii*, see



Male *Macrochelodina walloyarrina*. Note the width of the ventral anterior marginals and length of the barbels. Photo: W. P. McCord



Female *M. walloyarrina* showing robust head. Photo: G. Cosentino



Captive-born juvenile *M. walloyarrina* in the senior author's live collection. Note the characteristic barbels. Photo: G. Cosentino

below); weaker anterior plastral buttresses than in *Chelodina* sensu stricto and *Macrochelodina*; a distinctly narrow oblong shell with a disproportionately long (90% of carapace length) massive neck in relation to shell robusticity, whereas both *Chelodina* sensu stricto and *Macrochelodina* have more rounded or oval and flared shells with shorter (60–70% of carapace length) and less massive necks in proportion to shell robusticity; a gradually tapering narrow plastron with both anterior and posterior lobes distinctly narrowing distally, whereas the plastron is less narrow and tapered, or widens going either anteriorly or posteriorly in *Chelodina* sensu stricto and *Macrochelodina*; and a bluish-gray to light olive-green shell background color in adults, in contrast to a brown or black background color for *Chelodina*

sensu stricto and *Macrochelodina*. Further diagnosis is provided in Gray's 1856 description of *C. colliei* (Swan River, SW Western Australia population), an objective synonym (designated herein) of *C. oblonga*; and by THOMSON (2000) for *C. oblonga*. This is the only species in the new genus *Macrodiremys*.

Chelodina steindachneri belongs to historical subgeneric group A, and hence differs morphologically from the Kimberley longneck of historical subgeneric group B as described above. It is found in Western Australia, but its known range reaches no farther north than the DeGrey River system, suggesting that the two forms are biogeographically separate (allopatric).

Chelodina canni also belongs to historical subgeneric group A, and hence also differs morphologically from the Kimberley longneck of historical subgeneric group B as described above. It is found only as far west as the Roper River system of Northern Territory, and is thus also allopatric to the Kimberley longneck.

Macrochelodina rugosa (including several undescribed forms) belongs to both historical subgeneric group B and the *M. rugosa* complex, as does the Kimberley longneck, making these two taxa morphologically similar. *Macrochelodina rugosa* is presently confirmed as far west as the Victoria River, NT (suspected in the Ord River, WA), which makes *M. rugosa* and the Kimberley longneck allopatric. Detailed differentiation between the two forms is presented herein.

Macrochelodina kuchlingi also belongs to both historical subgeneric group B and the *M. rugosa* complex as does the Kimberley longneck, making them morphologically similar. The entire known range of *M. kuchlingi* is within the known range of the Kimberley longneck, thereby making them likely sympatric wherever *M. kuchlingi* are found — and microsympatric (sharing the same water bodies) in some locations (CANN, pers. comm., 2007). Detailed differentiation between the two forms is presented herein.

Macrochelodina burrungandjii, although biogeographically separated (Arnhem Land Plateau, NT), also belongs to both historical subgeneric group B and the *M. rugosa* complex as does the Kimberley longneck, and is the form most morphologically similar to the Kimberley longneck. Detailed differentiation between the two forms is presented herein.

Chelodina longicollis (of historical subgeneric group A), *Macrochelodina expansa* (of historical subgeneric group B, but not in the *M. rugosa* complex), and *Macrodiremys oblonga* (historical subgeneric group C) are not only biogeographically separate from the Kimberley longneck but also differ from it morphologically as described above.

At this time the only threat to the Kimberley longneck is local consumption, which seems to be at a sustainable level. Inhabiting one of the most remote regions of Australia should help protect these turtles from other anthropogenic threats.

After many years of working with the above species of Australian longnecks (except *M. kuchlingi*), we present here an original description of a species from the Kimberley Region of Western Australia, Australia. This paper is

published to provide a public and permanent scientific record. Date of publication: Reptilia (GB) number 55 (no. 68/ES and no. 17/IT), Castelldefels, Spain, mailed 30 November 2007.

Taxonomy (species level)

KIMBERLEY LONGNECK TURTLE

Macrochelodina walloyarrina sp. nov.

Order Testudines Linnaeus, 1758

Suborder Pleurodira Cope, 1864

Family Chelidae Gray, 1825

Holotype (designated herein). Western Australia Museum (WAM) #R164345, an adult male (224 mm carapace length), preserved in alcohol, collected by Dion Wedd, Glen Erikson, Jack Cover, and John Seyjagat in the Fitzroy River, at Fitzroy River Crossing, Western Australia, Australia, on 20 July 2004.

Paratypes (designated herein). WAM #R164346, adult female (233 mm CL), skeletonized, collected by John Cann and Gerald Kuchling in the Carson River, Western Australia, Australia, in June, 1998; American Museum of Natural History (AMNH) #R159947, a subadult male (195 mm CL), preserved in alcohol, collected by John Cann and Gerald Kuchling in the King Edward River, Western Australia, Australia, in June, 1998; Australian Museum (AM) #R136058, an adult female (263 mm CL), preserved in alcohol, collected by Ross Sadlier in Bell's Creek of the Isdell River, Western Australia, Australia, on 15 September 1990; AM #R136063, an adult male (198 mm CL), preserved in alcohol, same collection data as AM #R136058; AM #R136150, an adult female (263 mm CL), preserved in alcohol, collected by Ross Sadlier in a tributary of the Mitchell River, Mitchell Plateau, Western Australia, Australia, on 21 September 1990.

Type locality. The Fitzroy River at Fitzroy River Crossing, Western Australia, Australia, 18° 10.834' S and 125° 35.849' E.

Distribution. Presently known to be found in the Kimberley Region of Western Australia, Australia, from the Fitzroy River system in the south, to the Mitchell, King Edward, Carson, and Drysdale river systems in the north,

and to the Ord River system in the northeast. Specimens have been collected in the rivers, billabongs, and lagoons.

Etymology. The species name *walloyarrina* is a combination of two Australian aboriginal words — *wallo* meaning “chin,” and *yarrin* meaning “bearded” — in accord with the common name “bearded longneck turtle” often given to the longnecks of the Kimberley (because of their long barbels).

Description

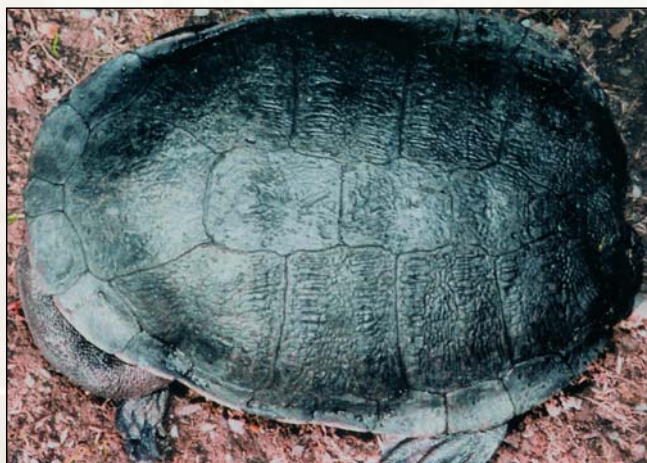
Head. *Macrochelodina walloyarrina* has a high HW to HL ratio (0.74), indicating a very wide and/or short head. The head in both sexes is robust (HW x HD/HL average 21.69), wide, and fairly flat, more so in females. The robusticity is intermediate for the *M. rugosa* complex, ranked third after Cape York and New Guinea *M. rugosa* and *M. burrungandjii*. It has flat irregular uncornified scales on the masseters; a narrow parietal roof (relative to head width) for the *M. rugosa* complex; usually 6 barbels, the medial pair usually long and robust; a blunt and minimally sloped snout; upper rhamphotheca white with fine black striations; and lower rhamphotheca olive green with bold irregular black striations. The iris varies in color from shades of olive or green in northern populations to an orange or rust in southern populations, with an inner ring varying from white to gold surrounding the pupil. Dorsal head color varies from black to an olive green with varying black patches, spots, and vermiculation. The tympana vary from white to olive green with varying degrees of melanism. Ventral head color is white.



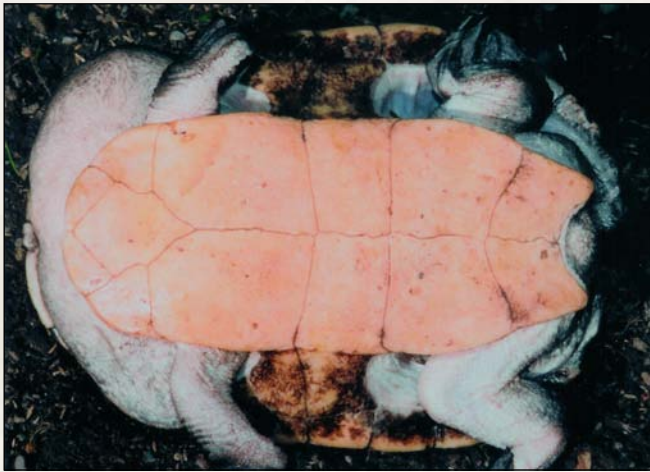
WAM #R164345, holotype of *M. walloyarrina*; carapace. Photo: W. P. McCord



WAM #R164345, holotype of *M. walloyarrina*; plastron. Photo: W. P. McCord



WAM #R164346, first paratype of *M. walloyarrina*; carapace. Photo: W. P. McCord



WAM #R164346, first paratype of *M. walloyarrina*; plastron. Photo: W. P. McCord



AMNH #R159947, second paratype of *M. walloyarrina*; carapace. Photo: W. P. McCord



AMNH #R159947, second paratype of *M. walloyarrina*; plastron. Photo: W. P. McCord

Neck. The neck is 69% as long as the carapace length and bears small rounded tubercles dorsally, laterally, and ventrally. Dorsal neck coloration is gray-black with minimal dark mottling and many white tubercles. Laterally there is a gray-black blotch pattern on a white background. Ventral neck color is basically white with some gray shading.

Carapace. The maximum carapace length is known from studied specimens to reach at least 268 millimeters. It is generally ovate, widest in adults at the seventh marginal scute, and moderately to highly rugose; lacking a median groove, keels, and natural growth rings. There are no exposed neurals in this species. The length of the broad, rectangular nuchal scute is 7.5% of the carapace length; the first marginal is usually smaller (average 91%) in dorsal surface area than the second marginal; the first and second marginals are very wide (from medial to lateral borders); the third and seventh marginals upturn mildly; the fourth, fifth, and sixth marginals upturn moderately; the seventh, eighth and ninth marginals flare; the supracaudals (M12) are not elevated over the tail; and the fifth vertebral is usually longer than wide (95% occurrence) in southern populations, but with more variation (only 55% occurrence) in northern populations. The sulcus between the first vertebral and first costal scutes contacts the second marginal; the sulcus between the first and second costals contacts the anterior or mid fifth marginal; the sulcus between the second and third costals contacts the seventh marginal; the sulcus between the third and fourth costals contacts the ninth marginal; and the sulcus between the fourth and fifth costals contacts the eleventh marginal. The carapace color is solid black.

Plastron. Plastral width relative to plastral length is intermediate (50%) for the *M. rugosa* complex (average 49.6%), ranking third after *M. rugosa* and *M. kuchlingi* (both 52%); plastral width relative to carapace length is low (36%) for the *M. rugosa* complex (average 37.7%), ranking fourth after *M. kuchlingi*, *M. rugosa*, and *M. burrungandjii* in that order. Plastral width at the inguinal notch is on average equal to (100%) the width at the axillary notch; the width at the femoral/anal seam is 77.8% of the width at the humeral/pectoral seam. The anterior plastral lobe does not start narrowing until the anterior pectoral scutes going forward; the posterior plastral lobe does not start narrowing until the posterior femoral scutes going caudally — the plastron has a fairly parallel-sided or rectangular appearance. The anterior edge of the plastron does not reach the caudal border of the ventral marginals when viewed from below; the intergular scute often reaches the anterior plastral border, thus separating the gulars. The distance between the humeral seams of the intergular scute increases going posteriorly (sometimes very little); the gular/intergular seams are longer than the humeral/intergular seams; the gular/humeral seams are shorter than the gular/intergular seams. The plastral seam formula is IG scute length (83% likelihood) > IP > IF > IAN > IAb > IG. The anal notch is shallow for *M. rugosa* complex species. Bridge length relative to carapace length is average

Data Table for *Macrochelodina walloyarrina* sp. nov.

	CL	CW6	CW7	CW8	CD	V1L	V2L	V3L	V4L	V5L	V1W	V2W	V3W	V4W	V5W	M1L
WAM #164345	224.47	156.42	160.19	157.39	70.94	48.70	40.37	-	-	-	55.81	36.13	32.26	-	-	23.03
WAM #164346	233.46	163.75	167.56	160.46	82.47	59.59	48.55	39.55	41.16	29.76	64.87	39.44	37.07	35.02	35.79	27.74
AMNH #159947	195.29	131.56	135.65	135.62	67.90	44.26	32.54	31.79	31.56	37.97	45.66	32.85	29.18	24.50	34.91	21.11

Morphometric Key

CL = straight midline carapace length; CW6,7,8 = straight maximum carapace width at 6th, 7th, and 8th marginals; CD = maximum carapace depth; V1–5L = vertebral number length; V1–5W = vertebral number width; M1–2 L & R = marginal #1–2 length left and right side; PL = midline plastral length; PWA = plastral



Male *M. walloyarrina*. Photo: G. Cosentino



Typical *M. walloyarrina* habitat — a lagoon on the Carson River, northern Western Australia. Photo: J. Cann

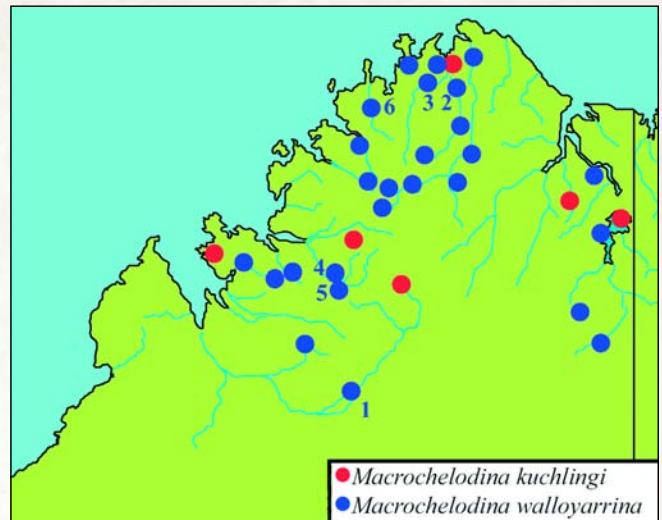
(19%) for the *M. rugosa* complex (average 18.6%). Axillary and inguinal scutes are absent. The ventral seventh marginal aligns with (helps form the border of) the anterior inguinal notch; the pectoral/abdominal seam meets the marginals at the fifth/sixth marginal seam or anterior sixth marginal scute. The plastron is flat in both sexes. The plastral, bridge, and ventral marginal coloration is a basic pale yellow (often stained in the wild) with a minimal degree of dark blotching on the transverse scute seams in some specimens, more so on the ventral marginals and bridge.

Adult males studied reached 85% of the overall size of adult females and had thicker and larger tails. There are five full horizontal scales plus two partial scales, one above and one below the five full scales, on the dorsal surface of each foreleg. Soft parts are gray-black dorsally and white ventrally.

Diagnosis.

The following differentiates *Macrochelodina walloyarrina* **sp. nov.** from its morphologically closest congener *M. burrungandjii* and its biogeographically closest congeners *M. rugosa* (allopatric) and *M. kuchlingi* (sympatric). Of the characters given in the foregoing description, only those that help differentiate *M. walloyarrina* from *M. burrungandjii*, *M. rugosa*, and *M. kuchlingi* are given here.

Head. *Macrochelodina walloyarrina* has a high HW to HL ratio (0.74) for the *M. rugosa* complex (average 0.71); the same ratios are present in eastern (Cape York and New Guinea) *M. rugosa* (0.74); lower ratios (narrower and/or longer head) are present in western (Darwin and Daley River) *M. rugosa* (0.69), and *M. kuchlingi* (0.63); and the highest ratio (widest and/or shortest head) is present in *M. burrungandjii* (0.76). The head robusticity (HW x HD/HL)



Map of the Kimberley Region of Western Australia showing voucher collection sites for *M. kuchlingi* and *M. walloyarrina*. Numbers pertain to the type specimens of *M. walloyarrina*. Created with help from Iverson, 1992, Thomson, 2000, and the WAM.

of *M. walloyarrina* is 5% less than that of *M. burrungandjii*, 9% less than that of (average) *M. rugosa*, and 6% more than that of *M. kuchlingi*. The parietal roof of *M. walloyarrina* is 11% narrower (in relation to head width) than that of *M. burrungandjii* and that of *M. rugosa*, and 20% narrower than that of *M. kuchlingi*. *M. walloyarrina* has three to four pairs of barbels with the most medial one or two pairs being notably long (hence the common name “bearded longneck”), and although *M. burrungandjii* may also have three to four pairs of barbels, usually only the more medial pair will be as much as intermediate in length. *M. rugosa* and *M. kuchlingi* usually have only one pair of small medial barbels,

M1R	M2L	M2R	PL	PWA	PWI	PWHP	PWFA	BL	IG	IGSL	IP	IAb	IF	IAn	HL	HW	HD	IOW	PRW
23.17	27.50	27.26	167.03	79.73	80.79	69.95	57.73	40.66	1.84	43.99	40.86	21.08	31.84	24.77	58.32	39.47	22.91	4.96	3.19
27.68	31.99	29.99	183.44	90.42	90.45	80.06	68.57	43.97	2.79	45.70	43.87	26.57	35.05	26.89	69.55	52.54	30.19	6.23	4.02
20.39	22.46	23.42	146.22	71.14	69.81	62.13	49.24	36.90	1.39	37.90	36.37	23.54	28.49	16.94	52.08	36.62	20.89	5.17	5.74

width at axillary notch; PWI = plastral width at inguinal notch; PWHP = plastral width at humeral/pectoral seam; PWFA = plastral width at femoral/anal seam; BL = bridge length; IGSL = intergular scute length; IG, IP, IAb, IF, IAn = midline plastral inter-scute seam lengths; HL = head length; HW = head width at tympana; HD = maximum head depth; IOW = inter-orbital width; PRW = parietal roof width.

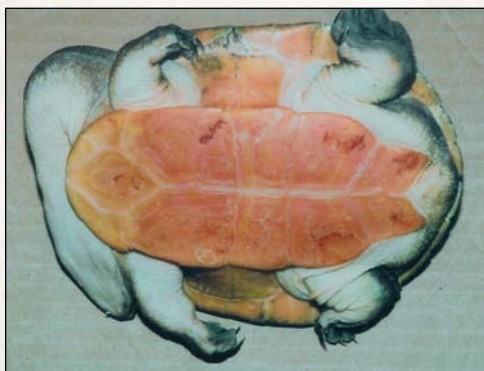
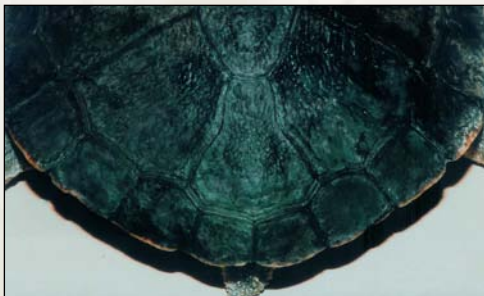


Photo ID key for *Macrochelodina walloyarrina* sp. nov.:

Step 1 – note V5 is longer than wide. Photo: W. P. McCord;

Step 2 – note the long barbels. Photo: W. P. McCord;

Step 3 – note the median length of the intergular scute is longer than the interpectoral midline seam.

Photo: W. P. McCord;

Step 4 – note M1 is nearly equal in dorsal surface area to M2 and both are wide (mediolaterally), resulting in a rectangular nuchal scute. Photo: G. Cosentino

Either step 1 or step 2 (or both) confirms an Escarpment-complex specimen, but due to individual variation, confident identification of *M. walloyarrina* requires at least two of steps 2, 3, and 4.

with one or two pairs of light colored tubercles behind the barbels. The interorbital width relative to head width of *M. walloyarrina* equals that of *M. burrungandjii*, but is 7% less than that of *M. rugosa*, and 13% less than that of *M. kuchlingi*. The iris of *M. walloyarrina* varies in color from olive or green to orange or rust with an inner white to gold ring, whereas the iris of *M. burrungandjii* is chocolate or rust-colored with a light gold inner ring, and the iris of *M. rugosa* (*M. kuchlingi* unknown) is yellow to gold with a black perimeter and a thin white to light-yellow inner ring. Dorsal head color of both *M. walloyarrina* and *M. burrungandjii* varies from olive green to black, whereas that of *M. rugosa* and *M. kuchlingi* is usually black, occasionally brown. The tympana in *M. walloyarrina* and *M. burrungandjii* are usually white with olive green mottling, whereas in *M. rugosa* and *M. kuchlingi* the tympana are white with black mottling.

Neck. In *M. walloyarrina* the neck is 69% of the carapace length, whereas in *M. burrungandjii* and *M. rugosa*, it is 68%, and in *M. kuchlingi*, 64%. Dorsal color of the neck in *M. walloyarrina* is typically gray-black with minimal dark mottling and many white tubercles evident, whereas the dorsal neck color of *M. burrungandjii* typically has a bold dark speckled or blotched pattern, and that of *M. rugosa* and *M. kuchlingi* is black.

Carapace. The maximum carapace length of *M. walloyarrina* is similar to that of *M. burrungandjii* and *M. kuchlingi*; *M. rugosa* reaches 7–10% longer. The carapace of *M. walloyarrina* is generally ovate; in *M. rugosa* and *M. kuchlingi*, ovate to pear-shaped; and in *M. burrungandjii* ovate to oblong. The adult *M. walloyarrina* carapace is widest at the seventh marginal scute, as are the carapaces of *M. kuchlingi* and most *M. rugosa* (with much variation in NT populations), but the carapace of *M. burrungandjii* is widest at the eighth marginal. *M. walloyarrina*, *M. rugosa*, and *M. kuchlingi* lack a median groove,

whereas *M. burrungandjii* has this character in mature specimens. *M. walloyarrina* has no exposed neurals; *M. rugosa* varies from usually none to occasional non-contiguous vestigial exposed neurals; *M. kuchlingi* is expected to have the usual *M. expansa*-group condition of no exposed neurals, but *M. burrungandjii* has three to five contiguous exposed neurals.

The nuchal scute of *M. walloyarrina* is 7.5% of the carapace length; that of *M. rugosa*, 6–7%; that of *M. kuchlingi*, 6%; and that of *M. burrungandjii*, 5.5–6%. Although the first marginal scute is smaller in surface area than the second marginal scute in all species of the *M. rugosa* complex, in *M. walloyarrina* the first marginal is 91% the size of the second marginal (both M1 and M2 being very wide, giving a flared appearance to the anterior carapace); in *M. rugosa*, the first marginal is 83% the size of the second marginal; in *M. kuchlingi*, 85%; and in *M. burrungandjii*, only 68%. In *M. walloyarrina* and *M. burrungandjii* the fifth vertebral scute is longer than it is wide, whereas in most specimens of *M. rugosa* and *M. kuchlingi* it is wider than it is long. In *M. walloyarrina*, *M. rugosa*, and *M. burrungandjii* the sulcus between the first and second costal scutes contacts the fifth marginal, but in the holotype of *M. kuchlingi* the sulcus between the first and second costal scutes contacts the posterior fourth marginal or the fourth/fifth marginal seam.

Plastron. In *M. walloyarrina* the plastral width is 50% the plastral length; in *M. rugosa* and *M. kuchlingi*, 52%; and in *M. burrungandjii*, 48%. The plastral width relative to carapace length is lowest for *M. walloyarrina* at 36%; compared to 39.5% for *M. rugosa*, 40% for *M. kuchlingi*, and 37% for *M. burrungandjii*. The plastral widths at the axillary and inguinal notches are equal for *M. walloyarrina* and do not begin to narrow until the anterior pectorals and the posterior femorals giving a rectangular appearance; in *M. rugosa* and *M. kuchlingi* the plastral width at

the inguinal notch is 98–99% of the width at the axillary notch, and immediately begins to narrow going anteriorly and posteriorly giving an elongate appearance; in *M. burrungandjii* the width at the inguinal notch is 97–99% of the width at the axillary notch, and begins to narrow mid-pectorals and mid-femorals, also giving an elongate appearance to the overall plastral shape. The anterior ventral marginals of *M. rugosa* and *M. kuchlingi* are much narrower than those of *M. walloyarrina* and *M. burrungandjii*. In *M. walloyarrina*, *M. kuchlingi*, and *M. burrungandjii* the anterior intergular scute is known to reach the anterior plastral border; this is rare in *M. rugosa*. In most *M. walloyarrina*, the distance between the humeral seams of the intergular scute increases noticeably going posteriorly; in *M. burrungandjii* the distance increases so slightly (going posteriorly) that the intergular scute appears to have parallel sides; in *M. kuchlingi* the distance increases noticeably going posteriorly; in *M. rugosa* the distance usually decreases going posteriorly. In *M. walloyarrina* the intergular scute width is 35.5% of the plastral width at the axillary notch; in *M. rugosa*, 33%; in *M. kuchlingi*, 30%; and in *M. burrungandjii*, 34%. The plastral midline formula for *M. walloyarrina* is most often IG scute length > IP > IF > IAn > IAb > IG; for *M. rugosa* and *M. kuchlingi* it is IG scute length > IP > IF > IAb > IAn > IG; and for *M. burrungandjii* the formula is IP > IG scute length > IF > IAb > IAn > IG. Although in all members of the *M. rugosa* complex the ventral seventh marginal forms the anterior border of the inguinal fossa, in *M. walloyarrina* the pectoral/abdominal seam contacts the fifth/sixth marginal seam or anterior sixth marginal; in *M. rugosa* and *M. kuchlingi*, the sixth marginal; in *M. burrungandjii*, it can contact either the sixth marginal or the posterior fifth marginal.

Diagnostic Summary

A *Macrochelodina* in the *M. rugosa* complex having the following characters is either *M. walloyarrina* or *M. burrungandjii*: a more rugose, blacker, oval to oblong (not pear-shaped) carapace with flaring of the first, second,



Female *M. burrungandjii*. Note robust head and dorsal surface area of M1 notably smaller than that of M2. Photo: G. Cosentino

and seventh to ninth marginals giving a wider, more squared-off appearance on both ends; a shell robusticity factor (CW x CD/CL) of less than 60, indicating a relatively shallow, narrow shell (in *M. walloyarrina* and *M. burrungandjii*, 54; in *M. rugosa*, 62; and in *M. kuchlingi*, 67); the fifth vertebral scute usually longer than wide (others are wider than long); plastral lobes that do not start to narrow immediately going anteriorly and posteriorly from the base; ventral anterior marginals that are rather wide, not notably narrow; and a wide intergular scute relative to plastral width at the base of the anterior lobe (*M. walloyarrina* and *M. burrungandjii*, 35.5% and 34% respectively; *M. rugosa* and *M. kuchlingi*, 33% and 30%). We herein designate *M. walloyarrina* and *M. burrungandjii* as members of the “Escarpment complex” within the *M. rugosa* complex, defined by the above shared characters.

The following characters most clearly differentiate *M. walloyarrina* from *M. burrungandjii*: the broader, shorter head of *M. burrungandjii* (especially in females); the notably longer barbels of *M. walloyarrina*; the more conspicuously speckled dorsal neck pattern of *M. burrungandjii*; the first marginal having 91% of the surface area of the second marginal (both wide) in *M. walloyarrina* as opposed to

the first marginal having 68% of the surface area of the second marginal (both narrow) in *M. burrungandjii*; lack of a median carapacial groove in *M. walloyarrina*, a groove being present in mature *M. burrungandjii*; a longer, more rectangular (less square) nuchal in *M. walloyarrina*; the widest point of the adult carapace being at the seventh marginal in *M. walloyarrina*, at the eighth marginal in *M. burrungandjii*; the presence of contiguous exposed neurals in *M. burrungandjii*, absent in *M. walloyarrina*; the humeral/intergular seams positioned farther apart going posteriorly in most *M. walloyarrina*, but almost parallel in *M. burrungandjii*; and the intergular scute typically longer (83% likelihood) than the interpectoral seam in *M. walloyarrina*, vice versa in *M. burrungandjii*. ■

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