

A Taxonomic Assessment of *Emydura* (Testudines: Chelidae) with Descriptions of New Subspecies from Queensland, Australia.

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Abstract. Taxonomic relationships as currently accepted for turtles of the genus *Emydura* are herein discussed. The results of a genetic study are interpreted. Geographic, phenotypic, and morphological data are given. Two new subspecies, *Emydura macquarii emmotti* ssp. nov. Cann, et al., from Cooper Creek, southwestern Queensland, Australia, and *Emydura macquarii nigra* ssp. nov. McCord, et al., from Fraser Island, Queensland, Australia, are formally described and diagnosed so as to differentiate them from other closely related (conspecific) taxa. Morphometric data for all type specimens given are also presented (Tables 1 and 2).

Key words. Turtle, Pleurodira, chelid, *Emydura*, Australia, Fraser Island, Cooper Creek.

The species boundaries within the genus *Emydura* Bonaparte, 1836, underwent dramatic changes when GEORGES and ADAMS (1996) reported the results of their studies using allozyme electrophoresis. They found *Emydura* to be a relatively young lineage of closely related turtles for which their taxonomic conclusions are interpreted by us as follows. There are only four diagnosable species of *Emydura*: the generotype *E. macquarii* (Gray, 1831), *E. victoriae*

(Gray, 1842), *E. subglobosa* (Kreff, 1876), and a form subsequently described as *E. tanybaraga* Cann, 1997. *Emydura worrelli* Wells and Wellington, 1985, is an allopatric

population of *E. subglobosa*, of which it has since been designated a subspecies (CANN and GEORGES, 2001). *Emydura krefftii* (Gray, 1871), the "Cooper Creek" form, the "Fraser Island" form, and *E. (m.) macquarii*, are four notable allopatric populations (here four subspecies, see CANN and GEORGES, 2001) of the polytypic species *E. macquarii*. All coastal New South Wales and southeastern Queensland (e.g., *E. signata* Ahl, 1932) forms are synonymized with, or considered a single diagnosable taxon with *E. (m.) macquarii*.

More recently, a number of New South Wales and southeastern Queensland *Emydura macquarii* subspecies have been designated, and others have been described on the basis of their unique external morphology and other phenotypic characteristics as found in the

many isolated river drainages of Australia (e.g., *E. m. macquarii*, *E. m. signata*, *E. m. binjing*, *E. m. dharra*, *E. m. gunabarra*, and *E. m. dharuk*. See original descriptions in CANN, 1998). We presently refrain from accepting GEORGES and ADAMS' (1996) synonymy of the coastal New South Wales and southeastern Queensland subspecies as one taxon with *E. (m.) macquarii* (pending future research that may resolve the existing discrepancy between

morphological and molecular evidence). In this taxonomic work we will diagnose only the four notable allopatric populations of *E. macquarii* as credited above to

GEORGES and ADAMS (1996), thus only morphologically placing the coastal New South Wales and southeastern Queensland forms under *E. m. macquarii* for our purposes here.

The name *Emydura australis* (Gray, 1841) is presently synonymized with *Emydura m. macquarii* (COGGER, et al. in CANN, 1998). The names *Emydura windorah* and *Emydura insularis* were proposed for the Cooper Creek and Fraser Island *Emydura* (WELLS and WELLINGTON, 1985) — however, as demonstrated by IVERSON et al. (2001), both names are *nomina nuda* according to the ICZN, and therefore unavailable. Consequently, the Cooper Creek and Fraser Island forms remain undescribed. In the following pages we describe and diagnose these taxa as distinct subspecies of *E. macquarii*.



Head view of male *Emydura m. emmotti*



Head view of male *Emydura m. nigra*

Emmott's short-neck turtle, *Emydura macquarii emmotti* ssp. nov.

Authors: Cann, J., W. P. McCord, and M. Joseph-Ouni

Holotype. Queensland Museum (QM) J51255, an adult female preserved in alcohol, measuring 368 mm carapace length, from Waterloo Station, shearing-shed waterhole, southwestern Queensland, Australia (24°13' S, 143°17' E), donated by Angus Emmott on 15 July 1990.

Paratypes. Queensland Museum (QM) J72280, a subadult female preserved in alcohol, measuring 293 mm carapace length, with the same collection data as the holotype. QM J35338 and QM J35339, subadult male and female preserved in alcohol, measuring 250.5 mm and 295 mm carapace lengths, from Cooper Creek near Windorah, southwestern Queensland, Australia (25°22' S, 142°45' E), donated by the Queensland National Parks and Wildlife Service on 20 March 1979. QM J54514, subadult male preserved in alcohol, measuring 251 mm carapace length, from Tarcombe Reserve, Broadwater hole, southwestern Queensland, Australia (24°06' S, 143°21' E), donated on 28 March 1991 (donor not listed).

Etymology. Named for Angus Emmott, conservationist and naturalist from Cooper Creek, southwestern Queensland, Australia.

Distribution. Confirmed in the Alice, Barcoo, and Thomson river basins, flowing into Cooper Creek (River) and its floodplains in southwestern Queensland; continuing southwestwards into northeastern South Australia in Cooper Creek to the vicinity of Lake Eyre (North and South). This taxon is thought to be found as far northwest in Queensland as the Georgina River.

Description

Carapace. A nuchal scute is present except as a rare aberration. The first and fifth vertebral scutes are always wider than long, whereas the second, third and fourth vertebral scutes are often longer than wide. The color ranges from

olive green in juveniles, to brown in adults. The CW/CL (carapace width to carapace length) ratio is approximately 75%. The CD/CL (carapace depth to carapace length ratio) is approximately 34% in males and 42% females. The maximum length known for males is 251 mm; for females, 368 mm. The marginal scutes display mild serration in juveniles only. The rear marginals are moderately flared in both sexes. The lateral marginals (M4-8) are upturned on mature adults. The carapace texture is smooth in adults.

Plastron. The plastral (seam) formula is IF>IP>IAb>G>IAn>IH. The color of the plastron is pale yellow, and unmarked. The gular scutes are entirely separated by the intergular scute, and the intergular does not contact the pectorals.

Head and limbs. The head lacks a horny casque. The temporal region is smooth. A postorbital stripe is always present in juveniles, but absent in adults. A pale stripe originating from the corner of the mouth passing under the tympanum, is always present in juveniles, but absent in adults. Macrocephaly is mild in males, with a HW/CL (head width to carapace length) ratio of approximately 18%; but significant in females ("boof-headed"), with a HW/CL ratio of approximately 21%. The iris is green with a bright yellow inner ring. No bar is present in the eye. Two small barbels are present. The skin color is variations of gray. There are five claws on the webbed forefeet and four claws on the webbed hind feet. The tail is longer in the male.

Diagnostic comparisons

Emydura macquarii emmotti can be differentiated from *E. m. kreffti* as follows. *E. m. emmotti* has a larger overall shell size (*E. m. kreffti* reaching a known maximum of 290 mm carapace length, with a CW/CL ratio of approximately



Emydura m. emmotti hatchlings

Emydura macquarii emmotti

Table 1

	CL	CW	CD	V1	V1w	V2	V2w	V3	V3w	V4	V4w	V5	V5w	HW	G	IH	IP	IAb	IF	IAn
QM J 51255	368.0	296.0	147.0	70.0	84.5	73.6	63.5	65.4	60.2	65.5	58.3	65.0	93.0	67.0	45.3	25.5	66.5	62.7	70.3	42.4
QM J 72280	293.0	216.5	107.0	52.4	70.1	54.8	54.0	50.7	53.1	53.7	51.5	50.7	70.9	56.7	39.8	12.1	62.8	37.3	50.5	37.0
QM J 35338	250.5	191.0	89.0	43.0	54.8	46.9	51.0	42.9	50.9	45.6	47.8	50.9	74.0	41.0	33.7	15.0	46.0	36.6	47.6	29.9
QM J 35339	295.0	221.0	116.0	52.7	74.1	58.0	57.2	53.6	52.8	53.1	52.0	53.6	74.8	53.5	42.5	14.9	57.1	46.7	52.9	32.1
QM J 54514	251.0	190.0	83.0	40.0	56.5	43.6	54.9	45.2	56.5	59.7	50.8	44.9	70.8	44.5	30.0	14.7	18.3	14.0	50.4	28.5

Key: CL= straight midline carapace length; CW= straight maximum carapace width; CD= maximum carapace depth; V #'= vertebral number length; V #'w= vertebral number width; HW= maximum head width; G= gular scute length; IH, IP, IAb, IF and IAn= length of inter-humeral, pectoral, abdominal, femoral and anal seams of the plastron. Measurements are in millimeters.



Thomson River, *Emydura m. emmotti* habitat in southwestern Qnsld, Australia

73%); a slight upturning of the lateral marginals (M4-8), absent in *E. m. kreffti*; a slight degree of marginal scute serration in the juvenile, whereas *E. m. kreffti* has none; an olive green juvenile carapace and brown adult carapace, whereas the carapace of *E. m. kreffti* is dark brown to almost black in both juveniles and adults; a smooth adult carapace texture, as opposed to a striated carapace texture in adult *E. m. kreffti*; a postorbital stripe in juveniles that does not contact the rear margin of the eye, and no postorbital stripe in adults, whereas a postorbital stripe is present in all *E. m. kreffti*, juveniles and adults, and does contact the rear margin of the eye; no pale stripe from the corner of the mouth passing below the tympanum in adults, whereas this stripe is present in all *E. m. kreffti*; two distinct barbels, compared to the rounded tubercles found in *E. m. kreffti*; a much greater degree of macrocephaly especially in females ("boof-headed"), than is seen in *E. m. kreffti* (which has a HW/CL ratio of approximately 18% in both sexes); and skin color of varying degrees of gray, whereas the skin of *E. m. kreffti* is gray to black.

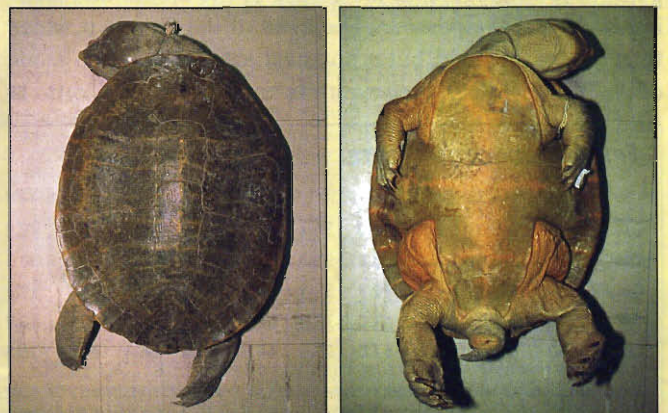
E. m. emmotti can be differentiated from *E. m. macquarii* as follows. *E. m. emmotti* has a larger overall shell size (*E. m. macquarii* has a maximum known carapace length of approximately 340 mm, with a CW/CL ratio of approximately 72%); a much deeper carapace (*E. m. macquarii* has a CD/CL ratio of approximately 32%); no midline carapacial sulcus, whereas a slight groove is present in *E. m. macquarii* in some localities; less rear marginal flaring, especially compared to the male *E. m. macquarii*; a lesser degree of marginal scute serration in juveniles; an olive green juvenile carapace and brown adult carapace, whereas the carapace of *E. m. macquarii* ranges from green to black in juveniles, or some variation of gray in adults; a smooth carapace texture in adults, compared to the striated carapace texture of *E. m. macquarii*; a postorbital stripe in juveniles, whereas *E. m. macquarii* has none; a pale stripe from the corner of the mouth passing below the tympanum in juveniles only, whereas this stripe is present in all ontological stages of *E. m. macquarii*; no pale stripe along the lower jaw, as is present in most *E. m. macquarii*; an indistinct postorbital scale pattern, whereas *E. m. macquarii* (including all coastal New South Wales and southeastern Queensland forms) has a distinctive "daisy petal" pattern (see Fig. 1); definite macrocephaly ("boof-headed"), whereas *E. m. macquarii* (with a

HW/CL ratio of approximately 15%) has none; and skin color of varying shades of gray overall, whereas the skin of *E. m. macquarii* is gray dorsally and pale ventrally.

E. m. emmotti can be differentiated from the Fraser Island *Emydura* as follows. *E. m. emmotti* has a larger overall shell size (Fraser Island *Emydura* reach only 250 mm in carapace length, with a CW/CL ratio of approximately 68%); a deeper shell (the CD/CL ratio of female Fraser Island *Emydura* is approximately 39%); a broader anterior carapace margin; mildly serrated marginal scutes in juveniles, whereas juvenile Fraser Island *Emydura* have none; less rear marginal flaring, especially compared to male Fraser Island *Emydura*; slight upturning of the lateral marginal scutes (M4-8) in adults, not present in Fraser Island *Emydura*; an olive green juvenile carapace and brown adult carapace, whereas all Fraser Island *Emydura* generally have a black carapace; a different plastral (seam) formula (that of Fraser Island *Emydura* being IP>IF>IAB><G><IAN>IH); a postorbital stripe in juveniles that does not contact the rear margin of the eye, whereas when this stripe is present in juvenile Fraser Island *Emydura* it does contact rear margin of the eye; a pale stripe from the corner of the mouth passing below the tympanum present in juveniles only, whereas this stripe is present in all ontological stages of Fraser Island *Emydura*; definite macrocephaly, compared to none in Fraser Island *Emydura* (which has a HW/CL ratio of approximately 16% for both sexes); a distinct bright yellow inner ring on the iris, which is hardly noticeable in Fraser Island *Emydura*; and much lighter, gray skin, whereas the skin of Fraser Island *Emydura* is black.



Subadult *Emydura m. emmotti*



Dorsal and ventral views of the holotype of *Emydura m. emmotti*



Figure 1. Postorbital "daisy-petal" pattern in *Emydura m. macquarii*

Fraser Island short-neck turtle, *Emydura macquarii nigra* ssp. nov.

Authors: McCord, W. P., J. Cann, and M. Joseph-Ouni

Holotype. Queensland Museum (QM) J48008, an adult female preserved in alcohol, measuring 200 mm carapace length, from Lake McKenzie, Fraser Island, Queensland, Australia (25°27' S, 153°04' E), collected by Dr. Arthur Georges on 19 January 1986.

Paratypes. Queensland Museum (QM) J47989, QM J47991, QM J47992, and QM J48000; all preserved in alcohol; measuring 173 mm, 197 mm, 150.3 mm, and 162 mm carapace lengths respectively; and having the same collection data as the holotype.

Etymology. Named for its overall melanistic appearance.

Distribution. Limited to Fraser Island (124 km long, maximum 24 km wide), southeastern Queensland (190 km north of Brisbane), Australia, where it is found in all permanent dune lakes.

Description

Carapace. A cervical scute is present, except as a rare aberration. All vertebral scutes are typically wider than long. Dark brown to black (sometimes mottled) in color. CW/CL (carapace width to carapace length) ratio is approximately 68%. CD/CL (carapace depth to carapace length) ratio is approximately 35% in males and 39% in females. Maximum known carapace length in males is 200 mm; in females, 250 mm. No serrations of marginal scutes are found on juveniles. The rear marginals are flared, more so in males.

Plastron. The plastral (seam) formula is IP>IF>IAb><G><IAn>IH. The color of the plastron is pale yellow and unmarked. The gular scutes are entirely separated by the intergular scute, and the intergular does not contact the pectorals.

Head and limbs. The head lacks a horny casque. The temporal region is smooth. A postorbital stripe is usually absent in adults, but often present in juveniles. There is a pale stripe originating at the corner of the mouth and passing under the tympanum. The head of the female is wider than that of the male, but is not macrocephalic ("boof-headed"). The HW/CL (head width to carapace length) ratio is

approximately 16% in both sexes. No bar is present in the eye. The iris is usually green overall. Two small barbels are present. The skin is generally black. There are five claws on the webbed forefeet and four claws on the webbed hind feet. The tail is longer in the male.

Diagnostic comparisons

Emydura macquarii nigra can be differentiated from *E. m. krefftii* as follows. *E. m. nigra* has a smaller overall shell size (*E. m. krefftii* reaches a carapace length of 290 mm, with a CW/CL ratio of approximately 73%); a less domed and overall shallower shell (*E. m. krefftii* has a CD/CL ratio of approximately 42%); greater flaring of the rear marginals, especially in the male; a darker black carapace (the carapace of *E. m. krefftii* is dark brown to almost black); a less striated carapace texture; a different plastral (seam) formula (that of *E. m. krefftii* is IF>IP>IAb>G>IAn>IH); usually no postor-



Emydura m. nigra hatchling

bital stripe in adults, whereas *E. m. krefftii* has a distinct white, yellow, or green postorbital stripe in juveniles and adults (the only turtle on Australia's eastern seaboard with this characteristic in adults); a more distinct pale stripe from the corner of the mouth passing below the tympanum in adults, whereas this stripe fades in adult *E. m. krefftii*; distinct barbels compared to rounded tubercles in *E. m. krefftii*; no macrocephaly, which tends to be present to some extent in mature female *E. m. krefftii* (with a HW/CL ratio of approximately 18%); no bright yellow inner ring on the iris, which is present in *E. m. krefftii*; and much darker black skin, the skin of *E. m. krefftii* being gray to black. *Emydura m. nigra* matures at a smaller size; lays fewer, smaller eggs; and has lower reproductive potential than *E. m. krefftii* (GEORGES, 1985).

E. m. nigra can be differentiated from *E. m. macquarii* as follows. *E. m. nigra* has a smaller overall shell size (*E. m. macquarii* females reach a carapace length of 340 mm, males reach 300 mm, and both have a CW/CL ratio of approximately 72%); a more domed and overall deeper shell (*E. m.*

Emydura macquarii nigra

Table 2

	CL	CW	CD	V1	V1w	V2	V2w	V3	V3w	V4	V4w	V5	V5w	HW	G	IH	IP	IAb	IF	IAn
QM J 48008	200.0	139.0	79.0	31.4	47.5	41.0	42.2	40.2	42.2	35.3	37.3	33.5	46.5	32.4	27.0	10.6	40.4	32.4	31.8	22.8
QM J 47989	173.0	118.4	60.1	25.4	37.4	31.7	28.1	30.8	30.3	31.3	26.3	30.3	40.1	27.4	21.7	10.6	33.7	23.2	23.2	25.0
QM J 47991	197.0	131.0	72.3	32.3	44.2	34.0	40.8	35.7	42.4	35.1	38.1	33.7	44.3	30.7	24.3	6.5	42.3	24.8	27.6	25.2
QM J 47992	150.3	100.8	41.0	25.6	36.9	30.5	31.6	30.4	30.2	24.6	28.8	24.7	34.0	24.3	20.5	8.7	29.9	22.6	27.2	16.0
QM J 48000	162.0	114.5	57.0	25.6	40.8	30.0	36.4	29.2	36.8	28.1	33.1	27.1	36.7	25.2	18.7	10.2	31.1	22.4	26.8	18.6

Key: CL= straight midline carapace length; CW= straight maximum carapace width; CD= maximum carapace depth; V # = vertebral number length; V #w= vertebral number width; HW= maximum head width; G= gular scute length; IH, IP, IAb, IF and IAn= length of inter-humeral, pectoral, abdominal, femoral and anal seams of the plastron. Measurements are in millimeters.



Emydura m. nigra habitat on Fraser Island, Qnsld., Australia

macquarii has a CD/CL ratio of approximately 32%); no midline carapacial sulcus, whereas a slight groove is present in adult *E. m. macquarii* in some localities; no upturning of the lateral marginal scutes (M4–8), which is present in mature *E. m. macquarii*; no marginal scute serration in juveniles, which is present in *E. m. macquarii* juveniles; a black carapace, whereas the carapace of *E. m. macquarii* ranges from green to black in juveniles, or some variation of gray in adults; a less striated carapace texture; a different plastral (seam) formula (that of *E. m. macquarii* being IF>IP>IAb>G>IAN>IH); a postorbital stripe in most juveniles, which is absent in juvenile *E. m. macquarii*; no pale stripe along the lower jaw, which is present in most *E. m. macquarii*; an indistinct postorbital scale pattern, whereas *E. m. macquarii* (including all coastal New South Wales and southeastern Queensland forms) has a distinctive “daisy petal” pattern (Fig. 1); no bright yellow inner ring on the iris, which is present in *E. m. macquarii*; and dark black skin, whereas the skin of *E. m. macquarii* is gray dorsally and pale ventrally.

E. m. nigra can be differentiated from *E. m. emmotti* as follows. *E. m. nigra* has a smaller overall shell size (*E. m. emmotti* reaches a carapace length of 368 mm, with a CW/CL ratio of approximately 75%); a more tapered anterior carapace; no marginal scute serration in juveniles, which is present to some degree in juvenile *E. m. emmotti*; a higher degree of rear marginal flaring, especially in males; no upturning of the lateral marginal scutes (M4–8), which is present in adult *E. m. emmotti*; a black carapace, whereas

that of *E. m. emmotti* is olive green in juveniles, turning brown in adults; a different plastral (seam) formula (that of *E. m. emmotti* being IF>IP>IAb>G>IAN>IH); often (but not always) a postorbital stripe in juveniles that contacts the rear margin of the eye, whereas the postorbital stripe is always present in *E. m. emmotti* juveniles, but does not contact the rear margin of the eye; a pale stripe from the corner of the mouth passing below the tympanum in both juveniles and adults, whereas this stripe is present only in the juvenile *E. m. emmotti*; no macrocephaly, whereas *E. m. emmotti* presents robust macrocephaly (more in females, with a HW/CL ratio of approximately 21%); no bright yellow inner ring on the iris, which is present in *E. m. emmotti*; and dark black skin, whereas the skin of *E. m. emmotti* is variations of gray.



Dorsal view of *Emydura m. nigra*



Dorsal and ventral views of the holotype of *Emydura m. nigra*

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