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Myuchelys latisternum (Gray 1867) – Sawshelled Turtle, Saw-Shell Turtle

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Summary. – The Sawshelled Turtle, *Myuchelys latisternum* (Family Chelidae), is a small to medium-sized short-necked turtle (maximum recorded carapace length to 287 mm in females, 224 mm in males) endemic to northern and eastern Australia. Historically known for a long time as *Elseya latisternum*, the species has recently also been occasionally associated with the invalid genus name *Wollumbinia*. The species inhabits deep to shallow pools and lagoons on permanently flowing waterways, particularly in the upper reaches and side channels of larger rivers. *Myuchelys latisternum* is chiefly carnivorous, feeding on a variety of aquatic invertebrates, but will also consume fruit, and other vegetation. Nests are laid in fine sand or alluvial substrate on banks close to the water, with clutch size ranging from 9 to 20 eggs and oviposition recorded from September to March. The species is widespread and no significant current conservation threats have been identified.

Distribution. – Australia. The species has a broad distribution from the Richmond River in northern New South Wales north along the east coast of Queensland to the Jardine River at the tip of Cape York, around the rivers draining into the Gulf of Carpentaria to the headwaters of the Daly River in the Northern Territory. Occupies streams of the Arnhem Land Plateau and associated escarpment plunge pools, including those of the Liverpool, Katherine, South Alligator and Mary Rivers.

Synonymy. – *Elseya latisternum* Gray 1867, *Emydura latisternum*, *Elseya latisternum latisternum*, *Wollumbinia latisternum*, *Myuchelys latisternum*, *Euchelymys spinosa* Gray 1871a, *Elseya latisternon* Gray 1871b (nomen novum), *Wollumbinia dorsii* Wells 2009 (nomen illegitimum).

Subspecies. – None currently known.

Status. – IUCN 2013 Red List: Not Listed (Least Concern, LC, assessed 1996), TFTSG Draft Red List: Least Concern (LC, assessed 2011); CITES: Not Listed; Australia: protected under the Territory Parks and Wildlife Conservation Act 1998, the National Parks and Wildlife Act 1979 in New South Wales, and the Queensland Nature Conservation Act 1992. International trade in this species is limited by strict control of live exports from Australia under the Environment Protection and Biodiversity Conservation Act 1999.

Taxonomy. — This species was originally described as *Elseya latisternum* by Gray in 1867 from a single specimen collected from an unknown location in northern Australia. Four years later, in 1871, Gray also named *Euchelymys spinosa* and *Elseya latisternon*. These three taxa were synonymized by Cogger (1983) under *E. latisternum*.

The genus *Elseya* has a chequered history. Challenges to the taxonomic concept of *Elseya* were first recognized by Legler (1981), who identified two distinct lineages within the genus, one comprising what was then regarded as *Elseya latisternum* and its close relatives, the second comprising *Elseya dentata* and its close relatives. The genus *Elseya* was initially erected for *Elseya dentata* and *Elseya latisternum* (Gray 1867) with *E. dentata* (Gray 1863) later designated as the type species (Lindholm 1929). Boulenger (1889) redefined the genus as having an alveolar ridge, a longitudinal ridge on the maxillary triturating surface, present only in *E. dentata*, and *E. latisternum* and *E. novaeguineae* were placed in the genus *Emydura*. Goode (1967) expressed little faith in the alveolar ridge as a taxonomic feature at the generic level and transferred *E. latisternum* and *E. novaeguineae* back to *Elseya*. Gaffney (1979) treated *Elseya* as a junior synonym of *Emydura*, with support from Frair (1980) and McDowell (1983). Georges and Adams (1992), using molecular approaches, demonstrated that *E. latisternum* and three other species formed a clade paraphyletic with respect to the remaining species of *Elseya*—their common ancestor had *Emydura* among its descendants. Georges and Adams (1992) believed that the paraphyly was best resolved by splitting the genus *Elseya* (foreshadowed by Legler [1981]) rather than adopting the sweeping synonymy recommended by

Figure 1. Adult female *Myuchelys latisternum*, Chillagoe Creek, far northern Queensland. Photo by Alastair Freeman.

McDowell (1983) and Gaffney (1979). Later Thomson and Georges (2009) gave effect to this by describing the new genus *Myuchelys* that includes the former *E. latisternum.* The diagnosis was based on shared primitive characters only, with no morphological synapomorphy identified to unite the four species included in the genus (Thomson and Georges 2009), relying rather on synapomorphies derived from molecular data (Georges and Adams 1992; Georges et al. 1998).

In 2007 Wells redefined the genus *Elseya* and in 2009 erected the genus *Wollumbinia* for *E. latisternum*. However, the method of this description, in a non-peer-reviewed, electronic newsletter, has been considered by many to not constitute an available publication under the International Code of Zoological Nomenclature (Georges and Thomson 2010; TTWG 2010). More recently, the use of the name *Wollumbinia* has been rejected by Kaiser et al. (2013), a recommendation endorsed by the Australian Society of Herpetologists and other leading herpetological societies around the world. The most recent taxonomic review of the Australasian Chelidae (Thomson and Georges 2010) refers to this species as *Myuchelys latisternum* and this name has been subsequently used in a number of publications Thomson and Georges 2010; TTWG 2010, 2012; Fielder et al. 2012; Fielder 2013; Le et al. 2013). However, both authors of this account believe that debate will continue over which generic name is valid.

Because of its widespread distribution and differences in morphology across its range, *M. latisternum* has long been considered to be a species complex (Cann 1998), with the level of genetic distance between some populations similar to that reported for clearly differentiated turtle species

Figure 2. Adult female *Myuchelys latisternum,* Johnstone River, Wet Tropics, far northern Queensland. Photo by Alastair Freeman.

Figure 3. Adult female *Myuchelys latisternum*, Laura River, Cape York Peninsula, Queensland. Photo by John Cann.

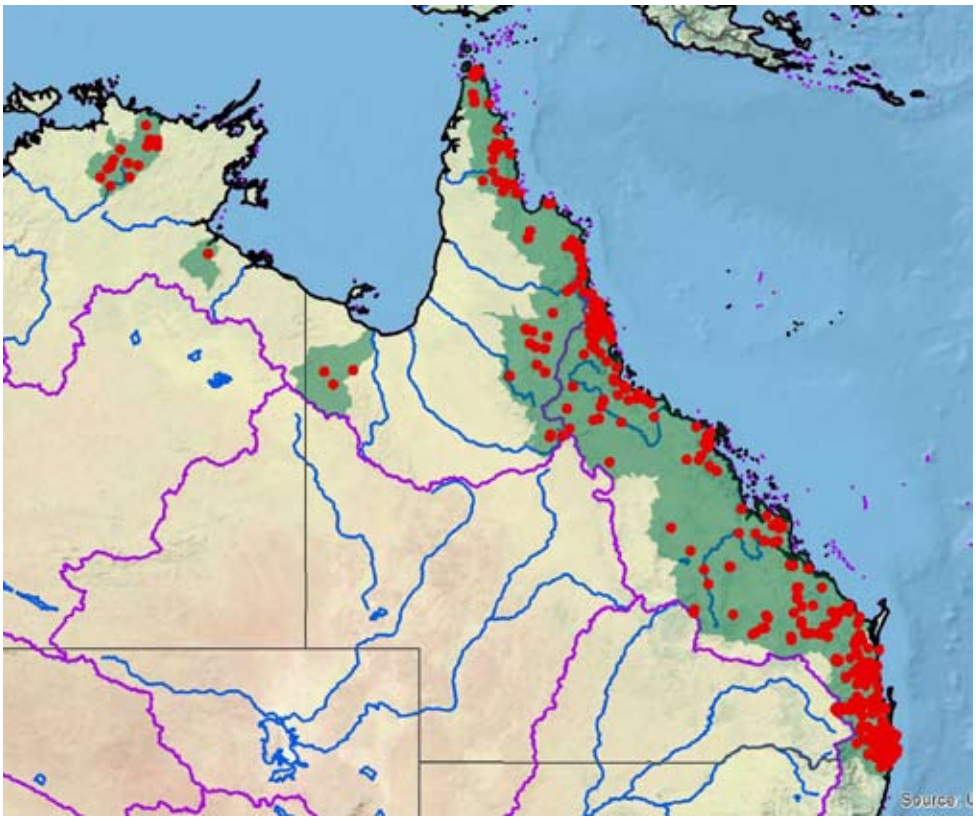

Figure 4. Distribution of *Myuchelys latisternum* in Australia. Purple lines = boundaries delimiting major watersheds (level 3 hydrologic unit compartments – HUCs); red dots = museum and literature occurrence records of native populations based on Iverson (1992), plus more recent and authors' data; green shading = projected native distribution based on GIS-defined HUCs constructed around verified localities and then adding HUCs that connect known point localities in the same watershed or physiographic region, and similar habitats and elevations as verified HUCs (Buhlmann et al. 2009), and adjusted based on authors' and others' subsequent data. Data used in the creation of this map has been collected by a variety of scientists, naturalists and land managers from a range of institutions and government departments. Distribution of *Myuchelys latisternum* for Queensland based on records compiled from the Queensland government's Wildnet database. Distribution of *Myuchelys latisternum* for Northern Territory and New South Wales compiled from the Australian government's Atlas of Living Australia (part of the Global Biodiversity Information Facility). Authors' datasets make up part of these databases; additional data provided by A. Georges of the Australian Ecology Research Group, University of Canberra.

(Seddon et al. 1998). However, more recent taxonomic work suggests that when intermediate populations are analyzed, genetic differences between the northern- and southern-most populations appear to be clinal variation (Georges and Thomson 2010); although the idea that this species may comprise a species complex is not dismissed by Georges and Thomson (2010).

Description. — *Myuchelys latisternum* is a small to medium-sized short-necked turtle that varies in size between populations. It is sexually dimorphic, with females being on average larger than males and attaining a larger maximum size. Mean straight carapace length (SCL) and weight varies between catchments, with northern populations tending to be smaller in size. On the Atherton

Figure 5. Juvenile *Myuchelys latisternum*; **(left)**: Richmond River, northern New South Wales, photo by John Cann; **(center)**: McLeod River, far northern Queensland, photo by Alastair Freeman; **(right)**: Jardine River, northern tip of Cape York Peninsula, Queensland, photo by John Cann.

Figure 6. Habitats for *Myuchelys latisternum*; **(upper left)**: upland habitat (> 700 m ASL) through developed farmland, Barron River, Atherton Tablelands, Queensland; **(upper right)**: monsoonal savannah, Chillagoe Creek, far northern Queensland; **(lower left)**: rainforest, Henrietta Creek, Wet Tropics World Heritage Area, far northern Queensland; **(lower right)**: gorge habitat in northern tropical savannahs, Porcupine Gorge, northern Queensland. Photos by Alastair Freeman.

Tablelands in the Wet Tropics of northern Queensland the maximum SCL recorded was 234.1 mm for females (n = 15) and 157.2 mm for males (n = 29) (Freeman, unpubl. data). In the same region, in the upper Johnstone River, the mean SCL and weight of adult females was 181.5 mm and 840 g (n = 15), while for males it was 127.6 mm and 257 g (n = 29) (Freeman, unpubl. data). In contrast, on the Burnett River in central Queensland, the maximum SCL for females has been recorded as 287.9 mm (n =12) and 221.1 mm (n = 7) for males (Hamann et al. 2008). On the Fitzroy River, also in central Queensland, adult females were recorded with a maximum SCL of 256.8 mm (n = 26) and a mean SCL of 243.9 mm (n = 17), and males with a maximum SCL of 224.0 mm (n = 26) (Limpus et al. 2011) and a mean SCL of 182.5 mm (n = 26 (Limpus et al. 2011).

Juvenile and young adults have a high central keel on the carapace and strongly serrated rear marginals. The carapace shape of adults changes across the geographic range, with specimens from the southern part of the distribution having a more rounded carapace compared to a more elongated form seen in more northern populations in the Wet Tropics and Cape York Peninsula. The carapace serrations along the outer edge of the rear marginals, which give this species its common name, do not occur in all populations and in some are almost non-existent (Cann 2008), although serrations are always present in juveniles.

The iris color varies across its range and will often have a leading and trailing dark spot (Cann 1998; Fielder 2013). The head shield that extends downwards on either side of the head to the tympanum is an important feature that enables identification in the field and is a consistent feature across the entire range of the species. The upper surface of the neck is covered in pointed tubercles. It has been suggested that these tubercles are most frequent in populations west of the Great Dividing Range where water is more often murky then clear (Legler and Winokur 1979); however, there are currently no systematically collected data to confirm if this is true.

The carapace is generally brown to dark brown above while the plastron can be pale brown to almost white, often with darker mottling. The underside is often discolored with a brown patina. In some populations a pale yellow/orange stripe can be prominent along the angle of the jaw; this is especially prominent in juveniles. The underside of recently hatched *M. latisternum* can vary from cream with darker mottling to bright orange with black mottling (Cann 1998; Freeman unpubl. data).

Figure 7. Illegal crab pot found on the Johnstone River. When recovered this pot contained at least four *M. latisternum* in various stages of decomposition as well as two platypus (*Ornithorhynchus anatinus*). Photo by Alastair Freeman.

Distribution. — On the east coast of Australia *M. latisternum* has been recorded in the coastal eastern catchments from the northern tip of Cape York to as far south as the Richmond drainage in northern New South Wales (Cann 1998, 2008; Wilson and Swan 2013; Freeman, unpubl. data). It also occurs in Gulf of Carpentaria catchments on western Cape York, extending as far as the Gregory and Nicholson rivers catchment basin (Cann 1998, 2008; White 1999; Wilson and Swan 2013). Isolated populations occur on the Liverpool, Mann, South and East Alligator rivers of the Arnhem Land Plateau (Cann 2008), and it also occurs in the upper Mary River drainage, where it is the westernmost population in the Northern Territory (Georges and Thomson 2010) and restricted to the sandstone plateau and escarpment country (Georges and Merrin 2008). Its widespread distribution on the east coast across multiple catchments is probably as a result of this species' ability to roam some distance from watercourses, dams, and lakes. For example, *M. latisternum* has been observed crossing ridge lines hundreds of meters from the nearest suitable aquatic habitat in North Queensland (Freeman, unpubl. data).

Habitat and Ecology. — *Myuchelys latisternum* is a species that is most often found in the headwaters or side tributaries of large rivers in creeks, waterholes, lakes, and dams, with numbers and apparent density diminishing nearer the coast or as the waterway increases in size and flow (Legler and Georges 1993; Limpus et al. 2002; Cann 2008; Limpus et al. 2011; Wilson and Swan 2013). On the Atherton Tablelands the species has been recorded at sites higher than 1050 m altitude (Freeman unpubl. data). It is an adaptable species that occurs in a variety of landscape settings from savannah woodland to tropical rainforest and including farmland and semi-urban environments (Cann 1998; White 1999; DeLathouder et. al. 2009; Freeman, pers. obs.). Where it occurs, *M. latisternum* is often sympatric with other short-necked turtles such as *Elseya* and *Emydura* species, although usually at lower densities (White 1999; Hamann et al. 2008; DeLathouder et al. 2009; Freeman, unpubl. data). There is little available information as regards the population density of this species other than for eight urban lakes in Brisbane where population estimates varied from 4.5 to 18 turtles between the different lakes (DeLathouder et al. 2009).

Like a number of Australian freshwater turtles, *M. latisternum* employs cloacal respiration, with initial research seeming to indicate that that this species had the ability to obtain up to 27% of its resting oxygen requirements directly from the water (King and Heatwole 1994). However, this study was actually conducted on *M. georgesi* from the Bellinger River, outside of the current known range of *M. latisternum* (A. Georges, pers. comm.). Subsequent research on hatchling and juvenile *M. latisternum* from the Burnett River has confirmed that they can cloacally respire, with the mean aquatic respiration varying being 29.2% in hatchlings and 13.6% in juveniles tested (Clark et al. 2008). This figure was similar to three other Australian short-neck species (*Emydura signata*, *Elseya albagula*, *Elusor macrurus*), but significantly lower than a fourth species (*Rheodytes leukops*) also tested in the study (Clark et al. 2008).

Along with other Australian short-neck species, *M. latisternum* can sometimes be observed out of the water on logs and rocks in and adjacent to the waterways it inhabits, apparently basking (Webb 1978; Freeman, pers. obs.). Whether this behavior has a thermoregulatory purpose or is for other reasons is currently unknown.

Diet. — *Myuchelys latisternum* is chiefly carnivorous but will feed on vegetative material; it has been described as an opportunistic omnivore (Legler and Georges 1993), an omnivore with carnivorous preferences (Moll and Moll 2004), and a carnivore (Tucker et al. 2012). Food items that have been recorded in its diet includes fruit, leaves, filamentous algae and water weed; as well as aquatic and terrestrial insects, bivalves, snails, crustaceans, fish, tadpoles, frogs, and carrion (Worrell 1963; Cann 1998; Limpus et al. 2011; Tucker et al. 2012; Freeman, pers. obs.). The species is also a successful predator of the toxic cane toad (*Rhinella marinus*), an introduced species in Australia that is lethal to many species of native reptiles, including other species of freshwater turtles (Hamley and Georges 1985).

Reproduction. — *Myuchelys latisternum* in the Albert and Brisbane River drainages in the southern part of its range has been recorded to reach sexual maturity at a SCL

of 125–135 mm in males and 182–189 mm in females (Fielder 2013). Nesting in the wild throughout its range has been recorded to occur between the months of September to March (Cann 2008; Limpus et al. 2011; Freeman, unpubl. data). Courtship and mating has been recorded from animals held in captivity in the Northern Hemisphere (Murphy and Lamoreaux 1979). It was noted that courtship continued throughout the year, with mating observed over the mid-January period (Murphy and Lamoreaux 1979). How this compares to animals in the wild is currently unknown, as courtship and mating behavior has yet to be recorded for *M. latisternum* in its natural range. Heavily gravid females have been captured on the Atherton Tablelands (north Queensland) in November (Freeman, unpubl. data), while on the Fitzroy River four adult females captured between late September and early October had oviductal eggs (Limpus et al. 2011).

There is no indication that *M. latisternum* congregates at mass nesting sites, instead nesting occurs in ones and twos at dispersed localities along the watercourse (Freeman, pers. obs.). Gravid females have been observed on land in the late afternoon in November nesting in soil in recently ploughed paddocks adjacent to Lake Tinaroo in north Queensland (Freeman, pers. obs.). Some of these nests were at least 100 m from the lake edge.

Clutch size varies between 9 and 20 eggs (Cann 2008; Freeman, unpubl. data). Hatchlings from central Queensland measured 30 x 29 mm SCL x carapace width, while hatchlings from northern New South Wales averaged 32.5 x 22.5 mm (Cann 1998).

Population Status. — While *M. latisternum* is considered to be a widespread and common species, there are no data on population trends and very little information on potential threats. However, anecdotal and a limited amount of research and monitoring data would seem to indicate that it should be regarded as secure.

Threats to Survival. — *Myuchelys latisternum* occurs in a range of habitats from largely intact to highly disturbed. Its habitat preference for the upper reaches of the rivers across its range no doubt also helps to protect it, as these areas are usually less developed than the adjacent coastal plain, particularly on the east coast of Australia. However, there is anecdotal evidence of localized declines. For example, it has been reported that in the Fitzroy River there is a paucity of recruitment of juveniles that, combined with an aging adult population, may be indicative of a population under stress (Limpus et al. 2011). Some juvenile mortality is known to occur as a result of being caught in "opera house" crayfish traps as well as mortality associated with illegal crab traps (Freeman, pers. obs.). Similarly, the draining of isolated pools associated with water infrastructure and road construction has been identified as a threat to local populations of this species on the Fitzroy River (Limpus et al. 2011), while the presence of dams and weirs can cause an increase in the incidence of physical injury. Studies in the Burnett River catchment in central Queensland identified a higher incidence of damaged turtles (including *M. latisternum*) below dams and weirs compared to areas in the same river system without weirs and dams (Hamann et al. 2007). It was suggested that the timing of severe injuries coincided with major and sudden water releases which either forced turtles out of concrete release chambers or over the top of weir walls, resulting in impact injuries and deaths as turtles collided with rock or concrete substrate (Hamann et al. 2007). It has also been observed that the impoundment of free flowing drainages has significantly reduced the prey abundance, species richness, and dietary breadth available to this species in southeastern Queensland, although the impact of this change on populations of *M. latisternum* in this region is unknown (Tucker et al. 2012).

Overall, the impact of these potential and known threats on *M. latisternum* populations appear to be minor, with no current indication of widespread population declines or local extirpations. However, no systematic population assessments have been carried out to confirm this.

Conservation Measures Taken. — *Myuchelys latisternum* is protected in the Northern Territory under the Territory Parks and Wildlife Conservation Act 1998, in Queensland under the Queensland Nature Conservation Act 1992, and by the New South Wales National Parks and Wildlife Act 1979 and the National Parks and Wildlife Regulation 2009. In all states in which it occurs it is considered as "common" or "least concern", and it is not listed nationally.

The species was assessed as Least Concern for the IUCN Red List in 1996, and was provisionally reassessed as Least Concern by the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group in 2011. It is not listed by CITES.

The species is currently known to occur in numerous protected areas along the east coast of Queensland and in northern New South Wales, including Jardine River National Park, Oyala Thumotang National Park, Cape Melville National Park, Crater Lakes National Park, Wooroonooran National Park, Girringun National Park, Bowling Green Bay National Park, White Mountains National Park, Porcupine Gorge National Park, Eungella National Park, Blackdown Tableland National Park, Kroombit Tops National Park, Conondale National Park, Carnarvon National Park, D'Aguilar National Park, Great Sandy National Park, Cudgen Nature Reserve, Mebbin National Park, and Yarringully Nature Reserve.

The isolated population on the Nicholson River drainage on the Gulf of Carpentaria occurs in Boojamulla (Lawn Hill) National Park, while in the Northern Territory

the species is known to occur in Kakadu, the largest terrestrial National Park in Australia.

Conservation Measures Proposed. — No specific measures proposed at this time. The species occurs over a huge distributional area, and throughout this range many populations occur within conservation reserves, while at the same time they are also protected under state environmental legislation. While the current state of knowledge of the biology of this species is poor, there is no indication of range contraction or significant population declines anywhere where they occur, although there are anecdotal accounts of localized population declines.

Generalized ongoing monitoring of population status of the species should be carried out occasionally across its range. Further analysis of phylogeographic variation should be pursued in case there are unrecognized evolutionarily significant units within its broad range.

Captive Husbandry. — While not common in captivity it is generally considered a robust, adaptable species that is easy to maintain (Cann 1998).

Current Research. — A study of the phylogeography of this species is currently underway across its range. There is no specific ecological research being conducted on this species at this time, although it is often caught incidentally during research on other species. The species readily enters baited traps and can be caught by hand while snorkeling.

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