Conservation Biology of Freshwater Turtles and Tortoises:
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Myuchelys georgesi (Cann 1997) – Bellinger River Turtle

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Summary. – The Bellinger River Turtle, *Myuchelys georgesi* (Family Chelidae), is a turtle of moderate size (carapace length to 240 mm in females, 185 mm in males) with a distribution restricted to the small coastal drainage of Bellinger River in New South Wales, Australia. The species is widely distributed within the drainage basin and has been locally abundant, but with a very restricted range. Its preferred habitat is the deeper pools of the clear-water upstream reaches of the river, where water flows continuously in most months over a bedrock basement and a streambed of boulders, pebbles, and gravel. The species takes advantage of the highly oxygenated water with low particulate load by supplementing its oxygen uptake through cloacal breathing, reducing its obligation to come to the surface to breathe. *Myuchelys georgesi* is essentially an omnivore, with tendencies leaning toward carnivory. A high proportion of its diet comes from benthic macro-invertebrate communities that are relatively sedentary and live in immediate association with the substratum, but with some terrestrial fruit and aquatic vegetation also eaten. Breeding occurs in the austral spring and early summer. Current threats to its persistence include habitat modification and loss of native riparian vegetation, associated turbidification and sedimentation, predation by the introduced European fox, competition with the recently introduced *Emydura macquarii,* and a severe recent die-off caused by unknown factors, possibly viral disease, leading to greatly heightened sudden risk of extinction.

Distribution. – Australia. Restricted to the small Bellinger River drainage of northeastern coastal New South Wales.

Synonymy. – *Elseya georgesi* Cann 1997, *Wollumbinia georgesi*[1], *Elseya latisternum georgesi, Myuchelys georgesi.*

Subspecies. – None currently recognized.

Status. – IUCN 2015 Red List: Data Deficient (DD, assessed 1996), TFTSG Draft Red List: Critically Endangered (CR, assessed 2015); CITES: Not Listed; Australian EPBC Act: Not Listed; All State and Territory legislation: Not Listed; NSW Threatened Species Conservation Act Draft: Critically Endangered (assessed 2015).

Taxonomy. — *Myuchelys georgesi* was described as belonging to the genus *Elseya* (Cann 1997, 1998). The genus *Elseya* has a chequered history. It was erected for *Elseya dentata* Gray 1863 and *Elseya latisternum* (Gray, 1867) with *E. dentata* later designated as the type species (Lindholm 1929). Boulenger (1889) redefined the genus as being characterized by the alveolar ridge, a longitudinal ridge on the maxillary triturating surface, present only in *E. dentata*, and placed the taxa *latisternum* and *novaeguineae* in the genus *Emydura*. Goode (1967) expressed little faith in the alveolar ridge as a taxonomic feature at the generic level, citing cases of variation in this feature among species of well-recognized cryptodiran turtle genera, and transferred *latisternum* and *novaeguineae* back to *Elseya*. Later, Gaffney (1979) treated *Elseya* (including species now in *Myuchelys*) as a junior synonym of *Emydura*, with support from Frair (1980: serology) and McDowell (1983: morphology), though material from species of *Myuchelys* was not available to Gaffney. Georges and Adams (1992) used allozyme approaches to demonstrate that *Elseya. latisternum*, *E. georgesi, E. bellii,* and *E. purvisi* formed a clade paraphyletic with respect to the remaining species of *Elseya*. The common ancestor of *Elseya* has *Emydura*

[1] Notwithstanding its inclusion in this synonymy, the authors do not consider the name *Wollumbinia* to be an available name for the reasons outlined in Georges and Thomson (2010).

Figure 1. *Myuchelys georgesi* from the Bellinger River of coastal New South Wales, Australia. Note the prominent and well-defined head shield with its projection down the parietal ridge toward the tympanum. Photo by John Cann.

among its descendants, a result confirmed by more recent studies (Georges et al. 1998; Fielder et al. 2012; Guillon et al. 2012; Le et al. 2013). While this result concurred with the morphological analyses of McDowell (1983), the prevailing view was that the paraphyly was best resolved by splitting the genus *Elseya* (foreshadowed by Legler, 1981) rather than adopting the sweeping synonymy recommended by McDowell and Gaffney (see Legler and Cann 1980; Georges and Adams 1992; Thomson and Georges 2009).

Thompson and Georges (2009) erected the genus *Myuchelys* with *M. latisternum* as the type species, and

Figure 2. Lateral, ventral and dorsal views of male *Myuchelys georgesi* from the Bellinger river, coastal New South Wales, Australia. Photos by Arthur Georges.

including also *M. georgesi*, *M. purvisi,* and *M. bellii*. They acknowledged that diagnosis of the new genus was on the basis of shared primitive characters only, with no morphological synapomorphy identified to unite the four species, relying rather on synapomorphies derived from molecular data (Georges and Adams 1992; Georges et al. 1998). The genus *Elseya* was restricted to include only the species *E. dentata* (type species), *E. irwini, E. lavarackorum, E. albagula,* and *E. branderhorsti*, diagnosed in particular by a prominent alveolar ridge on the maxillary triturating surface (Boulenger 1889).

The relationships of a New Guinea clade (subgenus *Hanwarachelys*), comprising *E. novaeguineae*, *E. schultzei,* and *E. rhodini*, are uncertain: molecular data place this clade between the Queensland clade (subgenus *Pelocomastes*) and Northern Territory clade (subgenus *Elseya*) of *Elseya* (sensu stricto) (Georges and Adams 1992; Le et al. 2013; Todd et al. 2014; Thomson et al. 2015). The alveolar ridge is absent or very poorly developed and a number of other external morphological features place it with *Myuchelys* (Georges and Thomson 2010). However, these characters are considered to be either secondarily derived or shared primitive characters in a more recent morphological analysis by Thomson et al. (2015), who placed the three New Guinea species in the genus *Elseya*.

Populations of what were then regarded as belonging to the genus *Elseya* from the Bellinger and Manning rivers were collectively known to be distinctive from other short-necked Australian chelids (Cann 1972, 1978; Legler 1981) long before the descriptions appeared. They are of particular interest because they are a cryptic species pair, *M. purvisi* and *M. georgesi*, morphologically difficult to distinguish on examination of any substantive external characters. The Bellinger River form was established as distinct from the Manning River form when shown that it has 20% fixed allelic differences, albeit in allopatry (Thomson and Georges 1996), and that it differs in a major skeletal morphological character: *M. purvisi* has a well-developed series of exposed neural bones consistently lacking in *M. georgesi* (Thomson and Georges 1996). Neural bones in most chelid turtles are reduced subsurface bony elements of the carapace lying immediately above the vertebral column (Thomson and Georges 1996). The Bellinger River form, *M. georgesi*, was named and described in a magazine (Cann 1997), not subject to peer review; but later reproduced in a more widely available book (Cann 1998).

Figure 3. Lateral, ventral and dorsal views of a hatchling *Myuchelys georgesi* from the Bellinger River, coastal New South Wales, Australia. Photos by John Cann.

An interesting feature of the phylogeny of Australian short-neck chelid taxa is that the cryptic species pair, *M. georgesi* and *M. purvisi*, may not be sister taxa (Georges and Adams 1992; Georges et al. 1998; Fielder et al. 2012; Guillon et al. 2012; Le et al. 2013). Mitochondrial sequence evidence and limited nuclear sequence evidence suggest that *M. latisternum*, *M. bellii,* and species of the genus *Emydura* have arisen from a common ancestor with *M. georgesi* after their divergence from *M. purvisi*, an arrangement at odds with the multiple nuclear gene data (n = 54) of Georges and Adams (1992). An attempt to resolve this paraphyly was proposed through the erection of a monophyletic genus for *M. purvisi* (*Flaviemys*, Le et al. 2013), but this action has been questioned following the generation of additional nuclear sequence data (Spinks et al. 2015).

The rivers that these formerly cryptic species occupy are similar—clear, continuously flowing, over a stony bed—and in an area of long-term geological stability. There are two evolutionary scenarios to explain this aspect of the phylogeny (Georges and Thomson 2006). Either *M. georgesi* and *M. purvisi* have evolved independently, but in parallel, to maintain their striking similarity since they diverged, or they have jointly retained the primitive features of their common ancestor. The latter interpretation is much more likely, and if true, we have a rare window in time to view the ancestral form of *M. latisternum*, *M. bellii* and, if the paraphyly of *Myuchelys* is sustained, *Emydura*. *Emydura* may have evolved through the retention into adulthood of juvenile characters (neoteny), whereas *M. latisternum* and *M. bellii* may have evolved through the earlier development of characters normally appearing only in very aged individuals of *M. georgesi* (gerontony) (Fielder 2013).

Description. — Adults are of intermediate size in comparison with other chelid turtles. Carapace length in

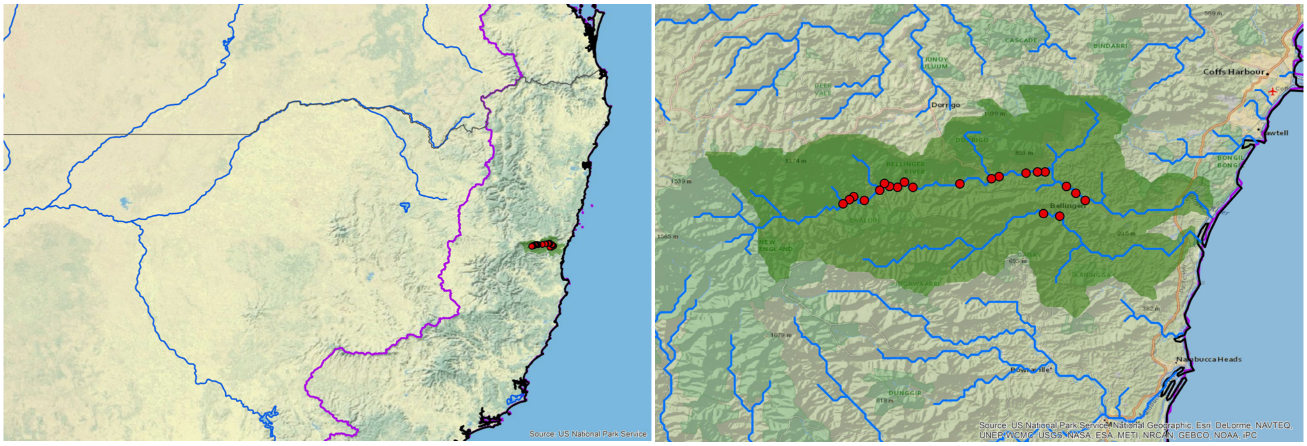

Figure 4. Distribution of *Myuchelys georgesi* in eastern Australia (overview and close-up). Purple lines = boundaries delimiting major watersheds (level 3 hydrologic unit compartments – HUCs); red dots = museum and literature occurrence records based on Cann (1998) plus more recent data, and the authors' personal data; green shading = projected historic native distribution based on GIS-defined level 10 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; TTWG 2014), and adjusted based on authors' subsequent data.

females: mean 175 ± 3.5 mm (range, 120–240 mm, n = 120); in males: 160 ± 0.8 mm (range, 110–185 mm, n = 222) (Fig. 1). Carapace uniform dark brown (Fig. 2); broadly oval, only slightly broader anteriorly than posteriorly, with smooth margins; scutes smooth without rugations; cervical (nuchal) scute absent except as rare variant; suture between the second and third costal scutes contacting the seventh marginal scute; suture between the third and fourth costal scutes contacting the ninth marginal scute. Shell lacking well-developed series of exposed neural bones.

Plastron in adults is gray or cream, with or without blotches and mottling (Fig. 2); borders between the plastral scutes rendered distinct by darker coloration; gular scutes separated by the intergular scute, which is not in contact with the pectoral scutes; pronounced angle between plastron and bridge at the level of the abdominal scute.

Head unspecialized; dorsal surface with a prominent head shield, entire, extending posteriorly and laterally down the side of the head toward, but not contacting the tympanum; surface of the temporal region covered with distinct irregular scales of low relief; maxillary triturating surfaces simple, no prominent medial alveolar ridge; two prominent barbels; iris golden, without leading or trailing dark spots; cream or yellow stripe extends from the corner of the mouth, through the lower extent of the tympanum to extend down the full length of the neck; temporal stripe absent.

Neck slate gray dorsally, with low rounded tubercles; gray ventrally with or without cream flecks. Forelimbs each with five claws, hindlimbs with four claws; slate gray above, lighter shades of gray below. Tail gray without distinctive markings; round in cross section; short, always shorter than half of carapace length; precloacal tail length greater than postcloacal length only in adult males.

Hatchlings almost circular in outline, brightly colored with cream or yellow ventral surfaces to the shell, head, limbs and tail. Light stripe from corner of mouth down the neck commonly bright yellow (Fig. 3). Dark margins to the plastral scutes absent at this age. Hatchling dimensions have not been recorded.

Distribution. — Restricted to the small Bellinger River drainage (1000 km^2; NSW Department of Water and Energy 2008), which includes both the Bellinger and Kalang rivers, located 600 km north of Sydney on the mid-north coast of New South Wales, Australia (Fig. 4). The Kalang River flows into the Bellinger just upstream of the common river mouth at Urunga.

Habitat and Ecology. — The Bellinger catchment is characterized by deeply dissected valleys, which in the northern and western portions of the basin cut through a plateau capped by Tertiary basalt and into the underlying Lower Palaeozoic sediments (Warner 1992). The tributaries descend, via a basalt escarpment, into steep confined bedrock valleys, then into wider valleys with discontinuous floodplain and terrace assemblages which eventually grade onto the coastal plain. *Myuchelys georgesi* occupies the deeper pools of the middle reaches of the river, between the escarpment and the lower tidal reaches (Fig. 6), which extend for ca. 25 km upstream in the Kalang River and for ca. 20 km to the township of Bellingen in the Bellinger River. The river in the region occupied by *M. georgesi* is a continuously flowing clear-water stream with a bedrock basement and a streambed of boulders, pebbles, and gravel (Fig. 5). The species takes advantage of the highly oxygenated water with low particulate load by supplementing its oxygen uptake through cloacal breathing, reducing its obligation to come to the surface to breathe (King and Heatwole 1994a, 1994b).

Figure 5. Typical habitat of *Myuchelys georgesi* in the Bellinger River of coastal NSW, Australia. The Bellinger River, in the upper reaches favored by the species, is an oligotrophic, clearwater stream, continuously flowing in most months over a stony bed. Photo by Darren Fielder.

The climate is subtropical, with high annual rainfall, typically ranging from 1500 to 2200 mm, but with strong inter-annual rainfall variability. Floods are intense and frequent (Reinfelds et al. 2004). In the Bellinger Valley, alluvial river reaches are more degraded than in the Kalang Valley, and this reflects the greater degree of disturbance in the lower Bellinger River, resulting from clearance of riparian vegetation and gravel extraction (Cohen et al., 1998). Historically the rivers would have had a dense riparian forest extending down to the water. Downstream of Thora, the lower Bellinger River is particularly degraded, with the channel width greatly enlarged, pools indistinct, and the current river structure providing little aquatic and riparian habitat (Cohen et al. 1998). The lower Kalang River is more stable and may be more representative of pre-European conditions (Cohen et al. 1998).

Myuchelys georgesi occurs in sympatry with *Emydura macquarii* and *Chelodina longicollis* in the Bellinger and Kalang catchments. Of the three species, *M. georgesi* occurs at highest densities, with *C. longicollis* rare, even in preferred habitats (e.g. farm ponds; Spencer, unpubl. data). The population of *E. macquarii* is thought to have been introduced to the Bellinger River (Georges et al. 2011).

Myuchelys georgesi is common throughout its range, but is not so commonly seen, as it prefers deep waterholes with a reasonable vegetation cover of *Hydrilla* and a rocky substrate (Spencer et al. 2014). Even at night, when *E. macquarii* is regularly observed in aquatic vegetation of littoral zones, *M. georgesi* is rarely observed (Spencer et al. 2007). *Myuchelys georgesi* is also more common in waterholes with significant amounts of potential basking substrate (e.g., emerged logs and rocks) (Spencer et al. 2007).

Densities of *M. georgesi* in the upper reaches of the Bellinger River are three times higher than populations in the lower reaches of the river (Spencer et al. 2007; Fig. 6). Juveniles are less common than adult turtles in all populations (Fig. 7), but more common than adults in turtle populations in the Murray River (Spencer and Thompson 2005), where nest predation rates by foxes are >93% (Thompson 1983; Spencer 2002). Hatchlings and juveniles have greater survivorship in moderate to deep water holes devoid of catfish (*Tandanus tandanus*) (Blamires and Spencer 2013).

Myuchelys georgesi is essentially an omnivore, with tendencies leaning toward carnivory (Allanson and Georges 1999). A high proportion of its food comes from benthic macro-invertebrate communities (>95% frequency of occurrence in stomach contents), but with some terrestrial fruit and aquatic vegetation also eaten (Spencer et al. 2014). The species feeds upon prey that are relatively sedentary and live in immediate association with the substratum, such as cased caddis-fly larvae (Leptoceridae) and lepidopteran larvae (Pyralidae). Like *Emydura*, this species lacks the specialized morphological adaptations and behavior of *Chelodina* (Pritchard 1984) required to secure fast-moving prey such as fish and adult coleopterans and hemipterans. Within these constraints, the wide range of foods taken gives no indication that *M. georgesi* is selective in what it eats, though substantive data to allow a comparison between diets and prey availability are lacking (see Georges et al. 1986). Competition between

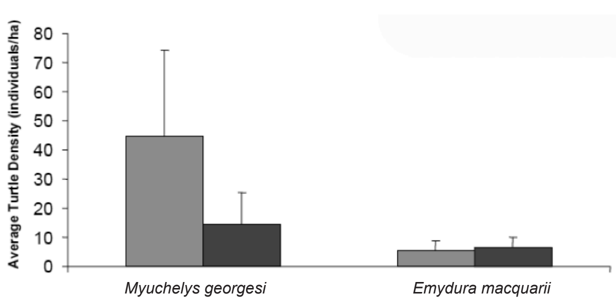

Figure 6. Turtle densities in the upper and lower regions of the Bellinger River of coastal NSW, Australia. Upstream of Thora township – light gray; downstream of Thora – dark gray.

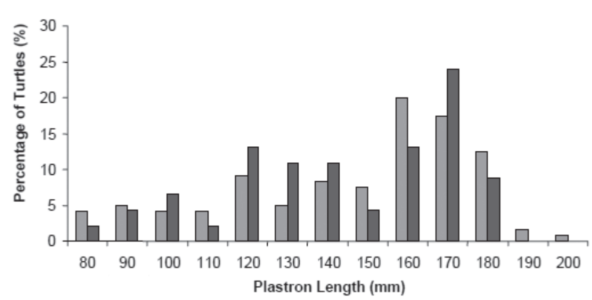

Figure 7. Size structure of female and juvenile *Myuchelys georgesi* (light gray) and *Emydura macquarii* (dark gray).

species of short-necked turtles is likely to occur when in sympatry, because species of *Emydura* adapt their diets to various habitats and water quality (Spencer et al. 2014). Interspecific competition may occur between *E. macquarii* and *M. georgesi* in the Bellinger River because of similar habitat preferences, diets, and life histories (Spencer et al. 2014).

Data on reproductive biology are limited, but *M. georgesi* has a breeding cycle typical of Australian short-necked species of the temperate zones—breeding occurs in the austral spring and early summer (October–December) (Cann 1998:222). The species lays one, probably two clutches per year. The eggs are oblong (33 x 21 mm), hard-shelled and white with a mass in the range of 4.0–6.1 g (Cann 1998). Clutch sizes have not been documented.

Population Status. — The species has heretofore been widely distributed and locally common within its very small coastal drainage. However, a recent disease outbreak causing massive mortality has severely impacted populations (see below).

Threats to Survival. — *Myuchelys georgesi* is vulnerable to decline and extinction simply by virtue of its extremely restricted distribution (Georges 1994). Local extinction for this species, arising from whatever threats there may be, now or in the future, means global extinction. As with many species, habitat modification arising from water resource development, pollution, disease, habitat alteration within the catchment leading to changes in sediment load and water quality, and the added pressures of introduced predators such as the European fox are potential threats to the persistence of this species in the Bellinger River.

In particular, a catastrophic die-off of *M. georgesi* in the Bellinger River has recently occurred. On 18 February 2015, distressed and dead turtles were found by canoeists in the Bellinger River. NSW National Parks and Wildlife rangers, NSW Wildlife Information, Rescue and Education Service (WIRES) volunteers and local residents subsequently located 30 turtles that were affected (ABC News 2015). The tally then increased to 52 and, as of this writing (August 2015), more than 400 turtles are known to be dead. The real toll is far greater, with many more washed away during a flood in late February (Spencer 2015).

Affected turtles display symptoms of blindness, growths around the eyes (septicemic cutaneous ulcerative disease, or SCUD) and are extremely lethargic and emaciated (Fig. 8). Veterinary assessment has indicated that turtles have suffered blindness and succumbed to internal organ necrosis, particularly of the spleen, liver, kidney, and blood vessels (NSW DPI 2015). Mortality rate of infected animals has been 100%. The spread of mortality has been rapid, both upstream and downstream, and at least 95% of the range of the species is now affected. The etiology of this mortality event is yet to

Figure 8. A specimen of *Myuchelys georgesi* afflicted with a mystery disease that has caused large numbers of turtles to die in the Bellinger River, its natural range. The disease causes blindness leading to emaciation, internal organ failure, and ultimately death. Photo by Rowan Simon.

be definitively determined, although affected turtles present with acute, sudden inflammatory lesions consistent with the presence of an infectious or parasitic agent, which has been identified tentatively as viral (NSW DPI 2015). This disease outbreak is a major threat to populations of *M. georgesi*, in what is already a very restricted distribution, and may herald imminent extinction.

Other threats arise from habitat alteration. Clear, rain-fed, oligotrophic, continuously flowing waters over a rock and pebble bed are attributes of upstream tributaries that are the hallmark of *Myuchelys* species generally. *Myuchelys georgesi* draws the bulk of its diet from the macroinvertebrate fauna closely associated with the river bed (Allanson and Georges 1999). Increased sedimentation can result from bank erosion, removal of vegetation and consequential increased runoff and erosion within the catchment, altered flow regimes, livestock access, and the introduction of European carp. Sedimentation from such disturbances smother the stream bed by filling interstitial spaces and restricting growth of aquatic macrophytes, both of which provide refugia and habitat for aquatic macro-invertebrates. Consequential changes in the sedentary benthic macro-invertebrate fauna, as have occurred in many other Australian streams, may substantially impact these turtle populations. Their reliance on sedentary benthic macro-invertebrates may exacerbate their vulnerability, already high because the species occupies a single small drainage. The species is particularly vulnerable after high rainfall and flooding events, because increased silt and sand accumulation potentially restricts the establishment of aquatic vegetation; significant numbers of turtles are captured without food in their stomachs after such events (Spencer et al. 2007).

Further, the closed forest of the riparian zone and gravel beds are hypothesized to give this species an advantage over other, often very abundant, riverine turtles in the genus *Emydura* that do better in more open habitat and lentic ecosystems. Indeed, habitat changes brought about by agriculture, forestry, and pastoralism in the Bellinger catchment have opened up the riparian canopy and increased the accumulation of finer sediments, both considered conducive to the establishment of populations of *E. macquarii*, a potential competitor with *M. georgesi* (Spencer et al. 2014). Species of *Myuchelys* are known to hybridize with species of *Emydura* in the wild (e.g., *M. latisternum* and *E. macquarii krefftii*, Colin Limpus, pers. comm.). If *E. macquarii* is a recent human-assisted introduction to the Bellinger River, there is a risk to the genetic integrity of *M. georgesi* from hybridization and introgression (Georges et al. 2011).

Australian freshwater turtles currently face many threats that permeate every life history stage, from egg to adult. The life history of turtles involves high but fluctuating rates of egg and juvenile mortality, balanced by extreme iteroparity (i.e., long-lived, highly fecund), in which threats to adult survival are low. Humans have impacted this selective regime at several life history stages. Mortality of eggs and young has increased, primarily because of predation by foxes (Thompson 1983), and adult mortality is increasing (Spencer and Thompson 2005). Size distributions of *M. georgesi* reflect limited, but regular juvenile recruitment into the population (Fig. 7), and artificial nest experiments result in nest mortality rates of 17–67% (Blamires et al. 2005), well below rates recorded for other species throughout the Murray River (Thompson 1983; Spencer 2002). A significant proportion of nest mortality in the Bellinger-Kalang riparian zones also includes predation from native monitor lizards and trampling from cattle (Blamires et al. 2005).

Predation by foxes and dogs on nesting females is also a significant threat (Spencer et al. 2007), although exact rates of predation are unknown. However, population modelling indicates that populations of *M. georgesi* have until recently been stable in the Bellinger-Kalang Rivers (Blamires et al. 2005). Recent analysis indicates that catfish presence influences juvenile, but not adult, water hole use and populations are sensitive to variations in water hole depth and exposure of juveniles to predators (Blamires and Spencer 2013).

Conservation Measures Taken. — *Myuchelys georgesi* was initially listed on the IUCN Red List as Data Deficient in 1996 (as "*Elseya* sp. 3"), an assessment it has officially kept since then, now listed as *Elseya georgesi*. The IUCN Tortoise and Freshwater Turtle Specialist Group provisionally assessed the species as Vulnerable based on a 2011 Red Listing workshop in Brisbane, Australia, but is now (2015) assessing it as Critically Endangered based on present data.

The species is not listed by CITES. There are no Protected Areas in the Bellinger River catchment that include populations of *M. georgesi*, though the range of the species may extend marginally into New England National Park and Dorrigo National Park.

No specific conservation measures are in place for the species, attention having previously been deflected to the so-called "Bellinger River *Emydura*", subsequently shown to be an unremarkable population of the widespread species *E. macquarii* sharing mitochondrial haplotypes with adjacent drainages (Georges et al. 2011). The "Bellinger River *Emydura*" has been taken off the New South Wales threatened species list and has been delisted under the national Environment Protection and Biodiversity Conservation (EPBC) Act 1999. *Myuchelys georgesi* is not yet listed (but see Conservation Measures Proposed).

In response to the disease outbreak, a multi-agency Incident Management Team (IMT) was established in the township of Bellingen on 9 March 2015. The purpose of the IMT was emergency management, built around objectives of ensuring public health and safety, understanding the extent of mortality, maximizing animal welfare, minimizing the spread of any potential pathogens, and maintaining good information flows to the local community. The IMT was supported in its work by a large team of specialists from the Office of Environment and Heritage (OEH), including NSW National Parks and Wildlife Service (NPWS) and Regional Operations Group and Heritage Division (ROGHD), the EPA, Department of Primary Industries (DPI), Local Land Services (LLS), and NSW Health and Bellingen Shire Council (NSW DPI 2015). Diagnostic and conservation plans have been formulated and an expert committee established.

Conservation Measures Proposed. — The conservation status of *M. georgesi* needs to be urgently updated, given its limited distribution, its sensitivities to changes in water quality and quantity, the potential threat of genetic dilution through introgression with the introduced *E. macquarii* (Georges and Spencer 2015), and most seriously, the recent massive population die-off of *M. georgesi* from a suspected viral disease with nearly 100% mortality. The appropriate status level, based on available evidence, should be Critically Endangered at both State and National levels. The NSW Scientific Committee has made a preliminary determination to list *M. georgesi* as Critically Endangered under the Threatened Species Conservation Act 1995, which has been welcomed by the NSW Office of Environment and Heritage. The Australian government's Threatened Species Scientific Committee is now assessing the species status for inclusion in the EPBC Act threatened species list.

An uplisting of the conservation status of *M. georgesi* will enable resources to be directed to investigating the cause of the recent mortality and developing solutions to this new threat, to establishing assurance breeding colonies in order to prevent extinction of the species, to preserving nesting grounds, limiting runoff and silt accumulation in the

Bellinger River, and to assessing and managing the threat of hybridization and introgression with the introduced Bellinger River *Emydura*.

Captive Husbandry. — There is no published information on captive husbandry requirements. An assurance colony of individuals collected from an as yet unaffected area has been established at the University of Western Sydney (18 animals) working with limited information available on the captive husbandry of the species. Genetic analyses are underway to ensure that the captive individuals are representative of the genetic diversity of the natural population, and to ensure that no hybrids between *M. georgesi* and the introduced *E. macquarii* (Georges et al. 2011) are among the captives. The assurance plan is to produce captive-bred progeny from these individuals and to headstart the hatchlings for release.

Current Research. — There are no known research projects of active management occurring in this species**.** A recent community mapping project (http://TurtleSAT.org.au) created for all freshwater turtle populations in Australia, will provide vital information on mortality and nesting hotspots, as well as general information on locations of turtle activity. TurtleSAT relies on reporting by the general public and conservation and community organizations using mobile app geolocation technology and data displayed in real time.

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