aquatic home ranges and pre-nesting movements of WFSGR turtles may reflect the greater stability as well as the greater width of this stream. Thus, their range of movements may depend directly on the perennial availability of water from Cogswell Reservoir and indirectly on the availability of food resources and nesting habitat.

The western pond turtle appears to be declining in abundance rangewide, especially in the northernmost part and southern half of its range (Holland and Bury, in press). Adequate protection and management of this species will depend upon a thorough knowledge of many aspects of its ecology. The data presented here indicate that considerable variation in home range and pre-nesting movements can exist within a small geographic area, and may be related to watercourse size and flow characteristics.

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The Identification of the Holotype of *Chelodina oblonga* (Testudines: Chelidae) with a Discussion of Taxonomic Implications

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For a stable nomenclature to develop within any group of species it is important that common usage is justified by accurate identification of holotypes. Unfortunately it occurs at times that the holotype represents a species that is not the same as that to which the name has been applied for a considerable time. When mistakes are found corrections should be made in accordance with the rules and guidelines of the International Code of Zoological Nomenclature (ICZN, 1999).

The genus *Chelodina* was described by Fitzinger (1826) to apply to the Australian long-necked turtles with the type species, *Chelodina longicollis* (Shaw, 1794), being the only member at the time. Gray (1841) added *C. oblonga* to this genus. Subsequent early additions to the genus were *C. colliei* (Gray, 1856a), *C. expansa* (Gray, 1857), *C. novaeguineae* (Boulenger, 1888), *C. rugosa* (Ogilby, 1890), and *C. siebenrocki* (Werner, 1901). The two species *C. oblonga* (from "Western Australia") and *C. colliei* (from "Swan River" [Perth, Western Australia]) were maintained as separate species by Gray until his last published work (Gray, 1873). In addition, he assigned turtles subsequently collected in Port Essington, Northern Territory, to his concept of *C. oblonga* (Gray, 1844, 1856b, 1873). However, *C. colliei* was later synonymized under *C. oblonga* by Boulenger (1889) and has not been recognized as distinct since then. Later, *C. rugosa* (from "Cape York") and *C. siebenrocki* (from "Deutsch-Neu-Guinea") were also synonymized under *C. oblonga* by Siebenrock (1909, 1915). This usage persisted in most subsequent Australian literature for the next half century, with all similar-appearing long-necked turtles from northern and western Australia referred to as *C. oblonga*. (e.g., Worrell, 1963). However, Mertens and Wermuth (1955) and Wermuth and Mertens (1961) resurrected the New Guinea species *C. siebenrocki* from the synonymy of Australian *C. oblonga*, and Goode (1967), recognizing that northern Australian long-necked turtles were in fact very similar to the New Guinean *C. siebenrocki*, then utilized that name (erroneously) for the northern Australian form and restricted usage of the name *C. oblonga* to the southwestern Australian form from Perth. Cogger and Lindner (1974) and Burbidge et al. (1974) then corrected Goode's usage by resurrecting the earlier name *C. rugosa* instead of *C.*

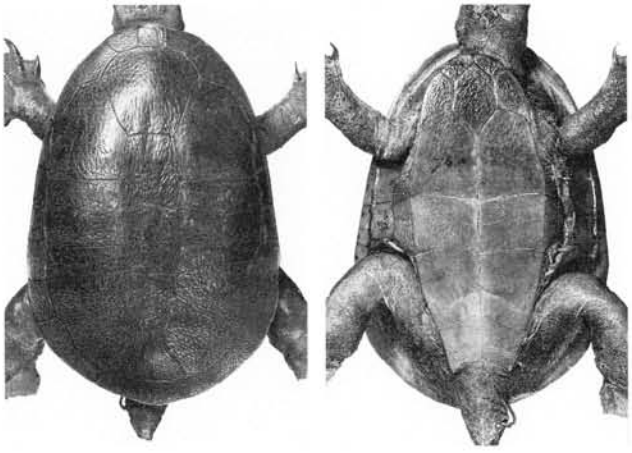

Figure 1. Dorsal and ventral views of the holotype of *Chelodina oblonga* (BMNH 1947.3.5.89)

siebenrocki for the northern Australian form. Since then, major field guides such as Cogger (1975, 1979, 1983, 1985, 1992), checklists and catalogues such as Iverson (1985, 1992) and Cogger et al. (1983) and numerous journal papers have utilized the name *C. rugosa* for the northern Australian form. *Chelodina siebenrocki*, if valid at all (it may be synonymous with *C. rugosa*), is restricted to New Guinea (Rhodin and Mittermeier, 1976).

Current prevailing usage for 33 years since 1967 has the restricted name *Chelodina oblonga* referring to the isolated long-necked turtle endemic to the southwest corner of Western Australia in Perth; a population which represents a valid species (Burbidge et al., 1974; Georges and Adams, 1992). The same prevailing usage for 26 years since 1974 has the name *Chelodina rugosa* referring to the long-necked turtles ranging from Cape York across northern Australia to Northern Territory and northern Western Australia. The name *Chelodina colliei*, originally used for the Perth population, has not been used for over 111 years since being synonymized in 1889.

The genus *Chelodina* has been subdivided into functional subgeneric groups known as *Chelodina* "A" (*Chelodina longicollis* group) and *Chelodina* "B" (*Chelodina expansa* group) by numerous recent authors (Goode, 1967; Burbidge et al., 1974; Legler, 1981; Georges and Adams, 1992; Rhodin, 1994a, 1994b). The *Chelodina longicollis* group includes the species *C. longicollis*, *C. steindachneri*, *C. novaeguineae*, *C. reimanni*, *C. mccordi*, and *C. pritchardi*. The *Chelodina expansa* group includes the species *C. expansa*, *C. rugosa*, *C. siebenrocki*, *C. parkeri*, *C. kuchlingi*, and *C. burrungandjii*. The species *C. oblonga* has been difficult to assign to either group. Goode (1967) placed it in group "B" with *C. expansa*, Burbidge et al. (1974) placed it alone in a new group "C" and Georges and Adams (1992) had it variously allied to either group "B" or group "A" depending on their analytic methodology.

John Gilbert collected the holotype of *C. oblonga* when he was in Australia in 1839. He began his travels in Perth, then went on to Sydney, and finally to Port Essington, Northern Territory, before leaving (Cann, 1998). Although it has recently been assumed that he obtained his specimen in Perth (Gray [1841] cited it only as coming from "Western Australia"), it now appears that it may actually have been collected in northern Australia.

In this paper a morphological analysis of the holotype of *C. oblonga* is reported, revealing that it is most similar to *C. rugosa* from the Northern Territory and not similar to the population of *Chelodina* from Perth currently referred to as *C. oblonga*. The taxonomic implications of this discovery are discussed.

Methods. — The holotype of *Chelodina oblonga* (BMNH 1947.3.5.89; old no. [18]40.12.9.81; original no. 74a) (Figs. 1, 2) was examined at the British Museum of

Figure 2. Ventral view of the holotype of *Chelodina oblonga*. with the plastron removed. To the left of the thoracic vertebrae is a disarticulated section of the cervical spine. To the right the rugosity of the retrahens capitus collique muscle can be seen as a faint white "scar" parallel to the thoracic vertebrae.

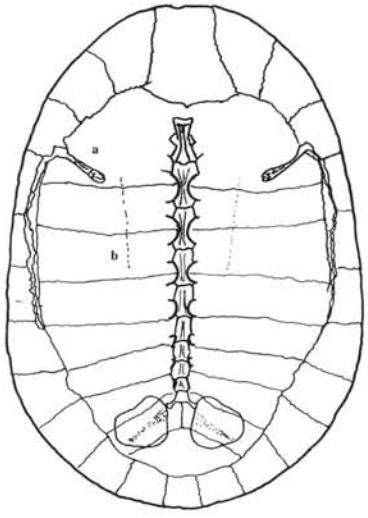

Figure 3. Ventral carapace surface of *Chelodina siebenrocki* (UC 0212). (a) anterior bridge strut; (b) attachment site rugosity of the retrahens capitus collique muscle.

Natural History (London) and compared to the skeletal material of Australian chelids currently housed at the University of Canberra and other museums (see Appendix A). Characters that had previously been determined to be diagnostic within the genus *Chelodina* were utilized to identify the holotype (Thomson and Georges, in prep.). Only those characters useful in this identification are described in this paper. No polarity is given as it is not the purpose of this paper to perform a phylogenetic analysis — all characters will be fully described in a later work which includes a comprehensive phylogenetic analysis of the genus *Chelodina*. Character terminology follows that of Zangerl (1969), with modifications suggested by Pritchard and Trebbau (1984), and bridge strut terminology follows that of Thomson et al. (1997).

Character A: Anterior Bridge Strut. — 0. Anterior bridge strut (called axillary buttress by some authors) does not extend significantly onto pleural one. It curves posteriorly to run perpendicular to the rib gomphosis. 1. Anterior bridge strut extends postero-medially to contact the rib gomphosis at a point approximately halfway to the thoracic vertebrae. No buttressing of the sutural surface present. 2. Anterior bridge strut extends postero-medially to cross the rib gomphosis at a point approximately halfway to the thoracic vertebrae and continue some distance posteriorly to it. Heavy buttressing of the sutural surface present, increasing medially.

Character B: Retrahens Capitus Collique Muscles. — 0. Enlargement of the retrahens capitus collique muscles and subsequent rugosity on the ventral surface of the carapace. This rugosity extendsfrom a point adjacent to the first thoracic vertebrae to the fifth thoracic vertebrae (Fig. 3). 1. No such enlargement of the retrahens capitus collique muscles and hence no rugosity is evident on the undersurface of the carapace.

Character C: Longissimus Dorsi Muscles. — 0. Longissimus dorsi are small with no enlargement of the rib heads and arches. 1. Longissimus dorsi anteriorly enlarged with the first three vertebrae possessing enlarged rib heads and arches to accommodate them. 2. Longissimus dorsi enlarged throughout their length with all vertebrae possessing some degree of enlarged rib heads and arches.

Results. — The *C. expansa* group can be diagnosed by the possession of enlarged retrahens capitus collique muscles which is evidenced in skeletal material by rugosities on the undersurface of the carapace. They are further diagnosed by the possession of a large anterior bridge strut that continues to further than halfway to the thoracic vertebrae from its origins on the fourth peripheral. The longissimus dorsi muscles in this group are enlarged anteriorly only with expansion of the rib heads restricted to the first few vertebrae.

The *C. longicollis* group does not possess the enlarged retrahens capitus collique muscles or their associated features. With the exception of the *C. novaeguineae* complex this group has a rather small anterior bridge strut and there is no enlargement of the longissimus dorsi muscles except in *C. oblonga* (Perth population) where the longissimus dorsi are greatly enlarged throughout the length of the thoracic vertebrae.

The holotype of *C. oblonga* is a dry mount specimen in which the plastron is able to be removed allowing viewing of the internal structures of the shell (Fig. 2). It has enlarged retrahens capitus collique muscles as evidenced by the rugosities on the undersurface of the carapace. An enlarged anterior bridge strut and anteriorly enlarged longissimus dorsi are also present (Table 1). In the three characters examined, the holotype of *C. oblonga* appears indistinguishable from *C. rugosa* and completely different from *C. oblonga* from Perth (Table 1).

The holotype specimen is identical to the specimen originally illustrated by Gray (1841), down to the details of an apparently longitudinally split fifth vertebral scute and the slight variation of the sutural contacts between the abdominal and femoral scutes (i.e., the specimen currently labeled as the holotype is the same specimen originally described and figured by Gray).

Discussion. — The three characters described here can diagnose the carapaces of the two groups within *Chelodina*. It is apparent that the holotype of *C. oblonga* is not the same as the current concept of *C. oblonga* from Perth. It would appear that the holotype is in actuality a specimen of what is currently referred to as *C. rugosa* from the Northern Territory, and that it may possibly have originated in Port Essington. Further morphological evidence of the distinction between the *C. oblonga* holotype and the current concept of *C. oblonga* from Perth can be gleaned from the description of *C. colliei* (Gray, 1856a), the next available name for the Perth species. In that paper Gray stated that *C. colliei* (I hereby designate BMNH 1947.3.5.91 as lectotype) could be differentiated from *C. oblonga* by the highly revolute marginals possessed by the former. The holotype of *C. oblonga* does not possess this character at all and this would indicate that Gray (1856a) intended that these be two separate species.

Since the name *Chelodina oblonga* (based on the holotype) technically applies to the Northern Territory form of the northern long-neck turtle currently known as *C. rugosa* and since *C. oblonga* is the senior synonym of *C. rugosa*, the Principle of Priority of the International Code of Zoological Nomenclature (ICZN, 1999; Article 23) might require a name change for the northern form. In addition, it might also be necessary to resurrect the name *Chelodina colliei* Gray, 1856a, for the southwestern Australian species from Perth. However, such changes would have major destabilizing effects on current prevailing usage of Australian chelid nomenclature.

The ICZN (1999; Article 23.9) allows for the preservation of junior synonyms that have consistent usage. However, to apply this rule to the *C. oblonga* – *C. rugosa* synonymy one

Table 1. Distribution of character states among the taxa of *Chelodina* examined; *long* = *longicollis*, *nov* = *novaeguineae*, *exp* = *expansa*, *rug* = *rugosa*, *obl* (h) = *oblonga* (holotype), *obl* (P) = *oblonga* (Perth population).

	long	*nov*	*exp*	*rug*	*obl* (h)	*obl* (P)
Char. A	0	1	2	2	2	0
Char. B	0	0	1	1	1	0
Char. C	0	0	1	1	1	2

must petition the ICZN and demonstrate that (1) the junior name (*C. rugosa*) has in the past 50 years been utilized by at least 10 authors in 25 publications and (2) that the senior name (*C. oblonga*) has not been used since 1899. Since *C. oblonga* is still currently in use and has been for 159 years since 1841, this article does not apply here.

The ICZN (1999; Article 75.6) also allows for the conservation of prevailing usage by designation of a neotype. This rule applies to a situation as described here, where the holotype of a species name under prevailing usage is discovered to actually represent a specimen of a different species. One must then petition the ICZN to use its plenary power to set aside the original holotype and designate a neotype for the species. In this case, that would require that a neotype of *C. oblonga* be designated from a collection of animals from Perth, thereby allowing current prevailing usage of both names (*C. oblonga* and *C. rugosa*) to continue, and to avoid resurrection of the name *C. colliei* which has not been used for over 100 years.

Alternatively, trying to maintain the species concept as originally described by Gray (1841, 1856a) but erroneously synonymized by Boulenger (1889), one can petition the ICZN to suppress the name *Chelodina oblonga* Gray, 1841, and to place this name on the list of unavailable names. If successful, such a petition would establish *Chelodina rugosa* Ogilby, 1890, as the available name for the northern long-neck turtle and resurrect *Chelodina colliei* Gray, 1856a, as the name of the species from Perth.

Until such time as a petition to the ICZN can be resolved, the recommendations of the ICZN (1999; Article 82.1) demand that prevailing usage be maintained and hence the current name for the northern long-neck turtle remains *C. rugosa* and that for the Perth species remains *C. oblonga*.

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APPENDIX A
Specimens Examined

Chelodina oblonga (Perth population): BMNH 1946.1.22.5, 1947.3.5.90-91, 1899.5.4.1, 64.12.22.9 QM 59272, 59273, 59274, 59283, UC 161-163, 2103; *C. oblonga* (holotype): BMNH 1947.3.5.89; *C. expansa*: AM 1242, 18860-64, 18883, 33209, 40176, 123066, AMNH 103699, 108948-49, BMNH 1947.3.4.21, 1947.3.5.88, QM 12387, 18360, 21742, 21936, 35344, 48015, 48020, 48032, UU 14324, 14328, 14333, 14335, 14369, 14554, 16821, 16825, 17778-79, 17801, 17818, 18800-01; *C. longicollis*: AM 3223, 3226, 8633, 12754, 132778, 142846, 142877-78, 146186, AMNH 2323, 76569, MCZ 8369, 8377, 86783, MNHN 9403, 9405, BMNH 1947.3.5.86, QM 3560, 18359, 21372, 24024, 24134, 35679, 35768, 45021-22, 45022, 48043, 48049, 50583-84, 59266-68, 59281-82, UC 134, 164, 166, 169, 174, 199, 252, 253, 255, 257-58, 263, 265, 268, 270, 285, 288-89, 462, 465-67, UU 14451, 14453, 14458, 16802, 17835, 17837, 17838-42; *C. novaeguineae*: AM 129346, 132784-85, 135351, AMNH 86543-47, MV 4-6, BMNH 1908.2.25.1, NTM 16324-25, 17074, 31790, QM 4486, 4488, 4491, 5269, 10265, 13326, 15560, 15900, 20627-28, 20630-31, 20633, 20635, 26344, 31505-08, 35136, 36751, 37566, 37819, 45005, 47923, 48940, 49917, 50730-32, 50736-37, 50997-98, 53064, 53635, 56408-12, 56447-57, 58412, UC 324-25, UU 14715-18; *C. rugosa*: QM 3852, 17514, 17633-34, 20629, 20632, 20634, 20636-39, 33368, 35146, 37622, 40078-79, 45850, 47912, 47913-14, 50738, 50995-96, 53063, 53065-67, 53324, 57649, 58426, 59264, UC 256, 2102; *C. steindachneri*: AM 33117, 100425-33, 104219, 110940-41, 102689-90, AMNH 118763-64, 101977-79, MCZ 33501, 134469, 134871-72, BMNH 1958.1.7.24, 1958.1.7.25, NWC 521, UC 248, 266, 271, 281, 284, 290, UU 14719-21, 16781; *C. siebenrocki*: UC 0212.

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Observations of Male Green Turtles (*Chelonia mydas*) on the Nesting Beach at Tortuguero National Park, Costa Rica

SEBASTIAN TROËNG[1]

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Most descriptions of male green turtle (*Chelonia mydas*) behavior have been of turtles at sea (Booth and Peters, 1972; Ehrhart, 1982; Limpus, 1993; Hirth, 1997). Exceptions are observations of green turtles in the Indo-Pacific region where males occasionally emerge on land to bask (Whittow and Balazs, 1982). In addition, in Cyprus male green turtles have been seen twice on land while still attached in mating positions to females coming to nest (Broderick and Godley, 1997). Both times, the male dismounted and returned to the sea after the female had ascended 5–10 m up the beach. Broderick and Godley (1997) speculated that the male may have been sneaking copulation at a time when no other males had access to the female or mate guarding the female to ensure that other males could not seek copulation. At the Bermuda Aquarium, a captive male green turtle has emerged on land on at least three separate occasions to make a false "nest" — each time the male dug a false egg chamber, then filled it in with sand and disguised the site before returning to the water (J. Gray, *pers. comm.*). At the Cayman Turtle Farm, male turtles have been observed on land digging body pits but there are no reports of male turtles constructing false egg chambers (J. Parsons, *pers. comm.*).

Tortuguero National Park on the Caribbean coast of Costa Rica is the site of the largest green turtle rookery in the Atlantic (Carr et al., 1978; Bjorndal et al., 1999). Green turtle monitoring was initiated there in 1955 and has been conducted every nesting season since (Carr et al., 1978; Bjorndal et al., 1999). Male green turtles are rarely encountered as all monitoring activities are land-based. However, males from this population are caught and tagged during their reproductive migration through Bocas del Toro Province, Panama (A. and P. Meylan, *pers. comm.*).

In 1998, several interesting observations of male green turtles were made in conjunction with the regular monitoring activities in Tortuguero. During the early part of the nesting season, in June and July, green turtles mating in the surf zone close to the beach were seen almost daily during morning nest surveys. On at least three separate occasions mating couples were washed up on the beach by the powerful swell. In these cases, the pairs remained mated for 1–2 minutes before they sepa-