of Ecology. New York: Harcourt Brace Jovanovich College Publishers.

BROADLEY, D.G. 1989. *Malacochersus tornieri*. In: Swingland, I.R. and Klemens, M.W. (Eds.). The Conservation Biology of Tortoises. Gland, Switzerland: IUCN/SSC Occasional Paper 5:62-64.

BURKE, R.L. 1991. Relocations, repatriations, and translocations of amphibians and reptiles: taking a broader view. Herpetologica 47:350-357.

DODD, C.K. JR. AND SEIGEL, R.A. 1991. Relocation, repatriation, and translocation of amphibians and reptiles: are there conservation strategies that work? Herpetologica 47:336-350.

ERNST, C.H. AND BARBOUR, R.W. 1989. Turtles of the World. Washington, DC: Smithsonian Institution Press, 313 pp.

IUCN/SSC TORTOISE AND FRESHWATER TURTLE SPECIALIST GROUP. 1989. Tortoises and Freshwater Turtles: An Action Plan for their Conservation. Gland, Switzerland: IUCN/SSC, 47 pp.

JACOBSON, E.R., GASKIN, J.M., BROWN, M.B., HARRIS, R.K., GARDINER, C.H., LAPOINT, J.L., ADAMS, H.P., AND REGGIARDO, C. 1991. Chronic upper respiratory tract disease of free-ranging desert tortoises (*Xerobates agassizii*). J. Wildl. Dis. 27:296-316.

JONATHAN, J., DUNNETT, S.C., AND MCCULLOCH, B. Undated. A further report on the development of Saanane Island, and the role of the zoo in wildlife conservation in East Africa. Report available at Saanane Island project manager's office.

KARESH, W.B., RAPHAEL, B.L., KLEMENS, M.W., DIERENFELD, E.S., AND MOEHLMAN, P.D. 1993. Health survey of the pancake tortoise (*Malacochersus tornieri*). Unpublished report in American Museum of Natural History Library.

KLEIMAN, D.G. 1989. Reintroduction of captive mammals for conservation: guidelines for reintroducing endangered species into the wild. Bioscience 39:152-161.

KLEMENS, M.W. 1995. Repatriation of confiscated tortoises: conscience-clearing expediency or sound wildlife management? Newsl. Re-introduction Spec. Group IUCN Sp. Surv. Comm. 10:5-6.

KLEMENS, M.W. AND MOLL, D. 1995. An assessment of the effects of commercial exploitation on the pancake tortoise, *Malacochersus tornieri*, in Tanzania. Chelonian Conservation and Biology 1:197-206.

LOVERIDGE, A. AND WILLIAMS, E.E. 1957. Revision of the African tortoises and turtles of the suborder Cryptodira. Bull. Mus. Comp. Zool. 115:163-557.

LUCKENBACH, R.A. 1982. Ecology and management of the desert tortoise (*Gopherus agassizii*) in California. In: Bury, R. B. (Ed.). North American Tortoises: Conservation and Ecology. U.S. Fish Wildl. Serv. Wildl. Res. Rept. No. 12, pp. 1-37.

LUIJF, W. 1997. CITES and the tortoise and turtle trade. In: Van Abbema, J. (Ed.). Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles – An International Conference. N.Y. Turtle and Tortoise Society, pp. 125-134.

MOLL, D. AND KLEMENS, M.W. 1996. Ecological characteristics of the pancake tortoise, *Malacochersus tornieri*, in Tanzania. Chelonian Conservation and Biology 2:26-35.

MUSHY, J.M. AND LUDANGA, R.I. Undated. A botanical survey report of plants of Saanane Game Reserve. Mweka CAWM: Moshi, Tanzania.

WOOD, R.C. AND MACKAY, A. 1997. The distribution and status on pancake tortoises, *Malacochersus tornieri*, in Kenya. In: Van Abbema, J. (Ed.). Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles – An International Conference. N.Y. Turtle and Tortoise Society, pp. 314-321.

Received: 13 November 1998
Reviewed: 15 February 2000
Revised and Accepted: 10 July 2000

Chelonian Conservation and Biology, 2000, 3(4):743–745

Aquatic Home Ranges of Female Western Pond Turtles, *Clemmys marmorata*, at Two Sites in Southern California

ROBERT H. GOODMAN, JR.[1] AND GLENN R. STEWART[2]

[1]*Biological Sciences Department, Citrus College, 1000 West Foothill Boulevard, Glendora, California 91741 USA [E-mail: RGoodman@citrus.cc.ca.us];*
[2]*Biological Sciences Department, California State Polytechnic University, 3801 West Temple Avenue, Pomona, California 91768 USA [E-mail: GRStewart@csupomona.edu]*

Movements within animal populations are critical to many life history and ecological processes (Gibbons et al., 1990). Movement and home range data have been reported for the western pond turtle, *Clemmys marmorata*, at different locations throughout its range (Storer, 1930; Bury, 1972, 1979; Rathbun et al., 1992; Holland, 1994; Ernst et al., 1994; Reese, 1996; Holland and Bury, in press). However, no studies have described their range of movements in southern California. Here we compare linear and total aquatic home ranges and pre-nesting movements of western pond turtles, *C. marmorata*, at two locations in southern California.

Methods. — Turtles were captured and marked from 1992–94 as part of a long-term study in the Chino Hills State Park (CHSP), San Bernardino County, California, USA, and the West Fork of the San Gabriel River (WFSGR), Los Angeles County, California, USA. Turtles were individually marked with small (3–4 mm) triangular notches in their marginal shields with a number system devised by Holland (1994). Total carapace length (mm), weight (g), sex, and reproductive status were recorded.

Small (4.1 x 1.8 x 0.8 cm, 16 g) radio transmitters (Telonics®, Mesa, Arizona) were epoxied to the third vertebral shield of 20 adult female turtles (CL >110 mm; Holland, 1994): 9 in the CHSP and 11 in the WFSGR. All turtles were located two to four times monthly with the exception of gravid animals, which were located daily until nesting occurred.

Linear aquatic home ranges were determined from the range of upstream and downstream movements for each turtle. Total aquatic home range was calculated by multiplying the linear aquatic home range of each turtle by the mean stream width within each turtle's linear home range. Pre-nesting movements are defined as the distance traveled by gravid females within the watercourse from their capture site to the approximate location where they moved away from the watercourse to nest. Terrestrial (nesting) excursions (Schubauer et al., 1990) were excluded from this analysis. Means and standard deviations were calculated for each population and two-sample t-tests were used to compare differences.

Figure 1. Aliso Creek, a 1st and 2nd order stream in the Chino Hills State Park, San Bernardino County, CA. Photo by RHG.

Figure 2. West Fork of the San Gabriel River, a 4th and 5th order stream in the Angeles National Forest of the San Gabriel Mountains, Los Angeles County, CA. Photo by RHG.

Site Characteristics. — The first study site was Aliso Creek (Fig. 1), a 1st and 2nd order intermittent stream that drains north to south for about 8.2 km through the CHSP into the Santa Ana River. For most of the year, the creek is slow flowing with a mud bottom and has intermittent sections of surface (maintained by springs) and subsurface water. Depth varies from a few centimeters to 1.5 m, and width ranges from 0.5 to 2.0 m (mean = 1.03 m).

The second study site was the WFSGR (Fig. 2) which is located in the Angeles National Forest of the San Gabriel Mountains near Azusa. The WFSGR is a 4th and 5th order stream approximately 27 km in length and flows from west to east. This study concentrated on a 12 km stretch of this stream. Perennial flow is maintained by releases from Cogswell Dam. The depth varies from a few centimeters to approximately 4.0 m and width ranges from 1.5 to 15 meters (mean = 9.52 m). The flow is moderately rapid over a gravelly to rocky bottom. Quiet pools and large boulders also are present.

Results. — Female CHSP turtles had significantly longer (two-sample t-test, $p = 0.0161$) linear aquatic home ranges (mean = 1273.0 ± 1137.9 m) than female turtles from the WFSGR (mean = 335.2 ± 275.7 m). Movements of turtles (Table 1) in the CHSP ranged from 658 to 4263 m. In the WFSGR, movements ranged from 32 to 966 m.

No significant difference (two-sample t-test, $p = 0.0557$) was observed between the CHSP (mean = 1342.0 ± 1234.6 m^2) and the WFSGR (mean = 3059.1 ± 2248.7 m^2) turtles when total aquatic home range was examined. Total aquatic home range (Table 1) for the CHSP turtles ranged from 661 to 4558 m^2 and for the WFSGR turtles from 294 to 7284 m^2.

Pre-nesting movements (Table 1) for gravid females in the CHSP (mean = 404.9 ± 302.3 m) were significantly greater (two-sample t-test, $p = 0.0002$) on the average than for WFSGR gravid females (mean = 39.8 ± 41.4 m). In the CHSP, movements ranged from 16 to 1038 m and in the WFSGR from 5 to 160 m.

Discussion. — Linear aquatic home ranges and pre-nesting movements of female *C. marmorata* from the Chino Hills State Park and West Fork of the San Gabriel River populations are inversely proportional to watercourse length. That is, the range of linear movements of park turtles (Aliso Creek) is extensive and significantly greater than that of West Fork turtles.

Total aquatic home ranges appear to be about the same in the two populations. Female pond turtles from the WFSGR may travel shorter linear distances because of the greater stream width. Conversely, female CHSP turtles travel greater linear distances to cover the same area. This may increase their total energy expenditure and risk of predation.

Movements within populations are primarily related to feeding, reproducing, basking, and hiding (Gibbons et al., 1990). CHSP turtles moved throughout most of the aquatic habitat when water was present. During the rainy season (December to April), CHSP turtles dispersed throughout Aliso Creek and later returned to spring-fed (perennial) pools. Gravid females then moved to adjacent upland habitat(s) to nest. Movements in the CHSP may depend directly on the availability of surface water and indirectly on the availability of prey and nesting sites along the streamcourse. The smaller linear

Table 1. Aquatic home ranges and pre-nesting movements of female western pond turtles (*Clemmys marmorata*) at two sites in southern California from 1992–94. Abbreviations: CHSP = Chino Hills State Park, WF = West Fork San Gabriel River, SD = standard deviation.

	Linear Aquatic Home Range (m)		Total Aquatic Home Range (m^2)		Pre-Nesting Movements (m)	
	CHSP	WF	CHSP	WF	CHSP	WF
	4263	966	4558	7284	1038	160
	1235	564	1359	5494	709	81
	1120	450	1221	4383	658	48
	1038	403	1204	3925	557	42
	851	403	936	3925	539	36
	822	354	678	3604	536	32
	761	242	742	1992	457	32
	709	161	719	1588	427	25
	658	64	661	664	335	22
		48		498	259	19
		32		294	104	9
					18	7
					16	5
					16	
Mean	1273.0	335.2	1342.0	3059.1	404.9	39.8
SD	1137.9	275.7	1234.6	2248.7	302.3	41.4

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.

Acknowledgments. — We thank the California Department of Parks and Recreation, Chino Hills State Park Cooperating Association, United States Department of Agriculture – Forest Service, and Los Angeles Department of Public Works for jointly funding this study. Special thanks go to D.W. Ryba with his help in the field and D.C. Holland and W.L. Waggener for their valuable comments made on the manuscript.

LITERATURE CITED

BURY, R.B. 1972. Habits and home range of the Pacific pond turtle, *Clemmys marmorata*, in a stream community. Ph. D. Thesis, University of California, Berkeley.

BURY, R.B. 1979. Population ecology of freshwater turtles. In: Harless, M. and Morlock, H. (Eds.). Turtles: Perspectives and Research. New York: John Wiley and Sons, pp. 571-602.

ERNST, C.H., LOVICH, J.E., AND BARBOUR, R.W. 1994. Turtles of the United States and Canada. Washington, DC: Smithsonian Inst. Press, 578 pp.

GIBBONS, J.W., GREENE, J.L., AND CONGDON, J.D. 1990. Temporal and spatial movement patterns of sliders and other turtles. In: Gibbons, J.W. (Ed.). Life History and Ecology of the Slider Turtle. Washington, DC: Smithsonian Inst. Press, pp. 201-215.

HOLLAND, D.C. 1994. The western pond turtle: habitat and history. Report DOE/BP-62137-1, Bonneville Power Admin., Portland, OR, 302 pp.

HOLLAND, D.C. AND BURY, R.B. In Press. *Clemmys marmorata* (Baird and Girard 1852) Western pond turtle. In: Pritchard, P.C.H. and Rhodin, A.G.J. (Eds.). The Conservation Biology of Freshwater Turtles. Chelonian Research Monographs.

RATHBUN, G.B., SIEPEL, N., AND HOLLAND, D.C. 1992. Nesting behavior and movements of western pond turtles, *Clemmys marmorata*. Southwest. Natur. 37:319-324.

REESE, D.A. 1996. Comparative demography and habitat use of western pond turtles in northern California: the effects of damming and related alterations. Ph.D. Thesis, University of California, Berkeley.

SCHUBAUER, J.P., GIBBONS, J.W., AND SPOTILA, J.R. 1990. Home range and movement patterns of slider turtles inhabiting Par Pond. In: Gibbons, J.W. (Ed.). Life History and Ecology of the Slider Turtle. Washington, DC: Smithsonian Inst. Press, pp. 223-232.

STORER, T.M. 1930. Notes on the range and life-history of the Pacific freshwater turtle, *Clemmys marmorata*. Univ. Calif. Publ. Zool. 32:429-441.

Received: 20 November 1998
Reviewed: 30 August 2000
Revised and Accepted: 22 September 2000

Chelonian Conservation and Biology, 2000, 3(4):745–749

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

SCOTT THOMSON[1]

[1]*Applied Ecology Research Group and CRC for Freshwater Ecology, University of Canberra, Canberra, ACT, 2601, Australia [Fax: 61-2-6201-5305; E-mail: thomson@aerg.canberra.edu.au]*

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.*