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Long-term survival of *Malpolon monspessulanus* on a military base, including a method for estimating total length from a sloughed skin

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RESUMEN: Mediante el uso de la longitud de la sutura parietal-prefrontal y la longitud total de individuos en colección, estimamos a partir de una muda la longitud total de un ejemplar de *Malpolon monspessulanus* cuando estaba vivo con el 94% de precisión. Teniendo en cuenta el rango de longitud total para individuos de esta especie registrados en la Base Naval de Rota, consideramos destacable la capacidad de *M. monspessulanus* para sobrevivir en una comarca donde la densidad de población humana ha incrementado de forma notable.

If we consider human population increase to be, at least in part, restrictive of snake population expansion and survival, then we expect that surviving snake populations inhabiting areas during and after human population increase are likely to have a shorter

life span than populations inhabiting those areas before the human population increase. Snakes exhibit indeterminate growth and, within a given set of ecological conditions (frequency of predation, quality of food sources, levels of intra- and inter-spe-

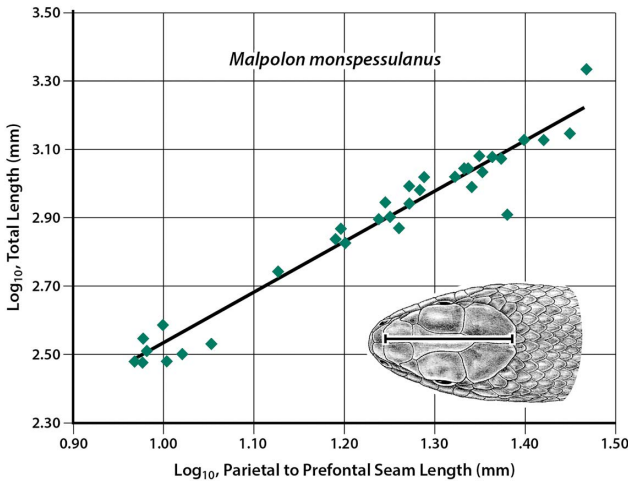


Figure 1: Log (base 10) summary of the relationship between parietal to prefrontal seam length and total length in *M. monspessulanus* from Cádiz Province, Spain, 1969-1971.

Figura 1: Relación entre el logaritmo (base 10) de la longitud escama parietal – escama frontal y el logaritmo de la longitud total en *M. monspessulanus* en ejemplares medidos de Cádiz (España) en 1969-1971.

cific competition, frequency of negative human-interaction, etc.), maximum total length achieved by individuals provides insight into population health and stability (Andrews, 1982; Sebens, 1987; Shine & Charnov, 1992). Museum herpetological collections may contain sufficient material for assessing the historic structure of a snake population from within a specific area. Herpetologists today, however, may be prohibited by personal ethics or legislative restrictions from collecting and preserving today's population representatives, making contemporary data documenting population structure, especially within snake species, difficult to obtain. Field investigations often include discovery of sloughed skins but, because of distortion and damage incident to the shedding process, length data from sloughed skins easily identified as to species generally have been considered unreliable indicators of a snake's total length.

There are 33 specimens of *Malpolon monspessulanus* from Cádiz Province preserved at Carnegie Museum of Natural History (Pittsburgh, Pennsylvania, U.S.A.) and three are preserved at the Museo Nacional de Ciencias Naturales in Madrid. Members of this assemblage ran-

ge in total length [in preservative] from 299 to 2162 mm; the largest *M. monspessulanus* recorded from Cádiz Province 1969-1972 (CM 54286, 2162 mm), a male, found 7 January 1971 in what is now part of the Parque Natural de Los Alcornocales (N36.15504 W5.63401) serves as the largest specimen recorded from Iberia to date (Pleguezuelos, 2014), and we were curious to see if one might obtain a reasonably accurate total length from a sloughed skin by utilizing a simple allometric comparison with museum specimens.

When a snake sloughs its skin, the body portion of the skin becomes quite distended, but head plates appear less elastic, and the allometric relationship between these plates and original body length likely remains intact. The length of the seam from the posterior margin of left and right parietal scales to the anterior margin of left and right prefrontals (see Figure 1) provides a reliably stable measurement that can be compared with snout to tail tip length by a regression procedure to produce a statistically-reliable estimate of maximum total length (see below). Because of serious head damage inflicted upon 2 of the salvaged road-killed specimens, measurements from only 34 of the 36 available museum specimens were utilized to produce the relationship presented in Figure 1 (only 33 symbols appear

on Figure 1; CM 51113 and CM 53180 overlap at 1.28, 2.98 because seam length in each was 19.2 mm, and total lengths were 957 mm and 955 mm, respectively). The regression formula derived from these data:

Total length = 67.5 (seam length [mm]) – 364.6, has a correlation ($r = 0.943$, $df = 32$) of 94% and the probability (P) for a chance relationship of $<<0.001$. The standard errors for the calculated slope “m” (67.5) and the “y” axis intercept (-364.6) are 4.3 and 81.3, respectively.

Reduction in snout-vent length (SVL) following 35 years in preservative was 5.6% among 62 *M. monspessulanus* from southeastern Iberia ($r^2 = 0.99$, $p = 2.2 \cdot 10^{-16}$; C. López & J.M. Pleguezuelos, University of Granada, personal communication); three similar comparisons following 33 years in preservative varied between 1.0% and 6.0% for our small sample. Because there was no difference in shrinkage between sexes (C. López & J.M. Pleguezuelos, personal communication), utilizing 5.6% as correction factor for determining actual in-life total length from in-preservative total length for *M. monspessulanus* adjusts total lengths in the complete Cádiz Province assemblage to between 317 mm and 2290 mm for specimens collected between September, 1969, and September, 1971.

Between 1969 and 1971 three specimens taken on the Base Naval de Rota ranged in total (corrected, in-preservative) lengths from 844 to 1167 mm. During 2-5 June, 2008; 10-14 October, 2008; 25-29 March, 2009; and 11-16 July, 2010, the U. S. Naval Facilities Engineering Command, Atlantic (NAVFAC) and Naval Station public works department, undertook a directed, 300 man-hour, survey of amphibian and reptile populations on the Base Naval de Rota (Petersen, 2010). This NAVFAC-directed project recorded three *M. monspessulanus*, two in 2008, one in 2009,

and none in July, 2010. The March, 2009, specimen measured 1345 mm total length (SVL 1100 mm, Tail 245 mm).

A sloughed *Malpolon* skin (CM 157696, seam length 30.6 mm), collected on the Base Naval de Rota, measured at 2 m total length upon collection, labeled, dried, and conserved by Miguel Moya Moya of Jerez de la Frontera was presented to us in April, 2013. Applying the 95% confidence limits to the total length calculation resulting from the regression formula above placed the actual total length of the snake to between 1284 mm and 1791 mm.

Military bases, generally free from civilian housing, industrial development, and unrestricted personnel access, can serve as wildlife refuges. The Base Naval de Rota (total area 24 km², established 1953), positioned between El Puerto de Santa María and Chipiona in northwestern Cádiz Province with 0.154 km² of wetland, and 23.98 km² of terrestrial habitat, serves as an example of such a potential refuge. Human populations in Sanlúcar de Barrameda, Chipiona, Rota, El Puerto de Santa María, and Jerez de la Frontera have increased 56% (from 266,909 persons to 416,179 persons) between 1972 and 2013 (Foro-Ciudad Cádiz, 2015). In concert with human expansion, roadway quality has improved, vehicle traffic and the number of hectares supporting housing have increased, and formerly “natural” areas have been converted to intensive agricultural use. That *M. monspessulanus* was able to survive to such a large size in a heavily-trafficked area in 1972 is remarkable; more recent NAVFAC surveys confirm that *M. monspessulanus* continues to resist human intrusion into its habitat. Future surveys, however, are necessary to verify continued existence in a somewhat-protected area increasingly surrounded by humans.

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SPECIMENS EXAMINED: CM 51065, 51113, 51344, 52064, 52448, 53180, 53193, 53219, 53220, 53222, 53237, 53254, 53255, 53349, 53368, 53394, 53420, 53920, 54286, 54697, 54698, 54849, 54875, 55272, 55478, 55490, 55491, 55496, 55505, 55508, 60966, 157696 (sloughed skin), MNCN 12034, 12036, and 12037.

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Xantismo en la culebrilla mora (*Trogonophis wiegmanni*) en las Islas Chafarinas (NW África)

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Desde hace décadas, los casos de anomalías pigmentarias se han reportado con cierta frecuencia en diferentes grupos animales (Gray & McKinnon, 2007). El xantismo se incluye dentro de estas anomalías, caracterizándose por la presencia predominante de pigmento amarillo en la coloración del animal (Bearez *et al.*, 2006; García-Roa & Sainz, 2012). En reptiles, la aparición en estado natural de coloraciones alternativas con fenotipo xántico ha sido escasamente documentada (ej., Amaral, 1934; Bearez *et al.*, 2006; Travaglia-Cardoso & Parpinelli, 2006; Sueiro *et al.*, 2010). En relación a

los anfisbenios, pocos trabajos han reportado variaciones en la coloración típica (Malkmus, 1997; Barbadillo *et al.*, 1999; Cabana & Vázquez, 2008).

La culebrilla mora (*Trogonophis wiegmanni*) es un reptil endémico magrebí de hábitos fosoriales, cuya distribución en la Unión Europea se circunscribe a los territorios españoles de Ceuta, Melilla e Islas Chafarinas (Bons & Geniez, 1996; Fahd *et al.*, 2002), siendo sus poblaciones especialmente abundantes en estas últimas islas (Martín *et al.*, 2011; García-Roa *et al.*, 2014; Figura 1). *T. wiegmanni*, consta de dos subespecies, *T. w. elegans*, cuya distribu-