Home range of the parthenogenetic lizard *Aspidoscelis maslini* (Fritts, 1969), on a beach strand

Home range is the area within which an animal moves to acquire resources (Rose 1982) including food, shelter, mating partners in gonochoristic species, nesting sites (Hirth 1963; Gutiérrez & Ortega 1985) and to escape predators; it may vary in size and shape inter- and intra-specifically with biotic and abiotic factors (Pérez-Pérez et al. 2017). In certain lizard species, biotic factors such as foraging mode and absence of mating activities (e.g., in parthenogenetic species of the genus *Aspidoscelis* Reeder, Cole & Dessauer, 2002) can influence the home range and movement patterns even where actively foraging species (e.g., lizards of the genus *Aspidoscelis*) exhibit larger home ranges (Hulse 1981; Verwaijen & Van Damme 2008). The diploid parthenogenetic whiptail lizard, *Aspidoscelis maslini* (Fritts, 1969), is a product of natural interspecific hybridization between female *Aspidoscelis angusticeps* (Cope, 1878), and male *Aspidoscelis deppii* (Wiegmann, 1834), as demonstrated by genetic studies (Moritz et al. 1992; Reeder et al. 2002; Manríquez-Moran et al. 2014). The descendants from these progenitors are exclusively female. According to Lee (1996), this species is oviparous, terrestrial, diurnal, carnivorous and a wide-ranging forager; moreover, in contrast to other *Aspidoscelis*, females of *A. maslini* are unwary and can be approached closely. Typical habitats selected by *A. maslini* include open sand beaches within its geographic range, viz. parts of the Yucatán Peninsula of Mexico, Belize, and northern Guatemala (Lee 1996). Although Hernández-Gallegos et al. (2015) recorded the home ranges of individuals of *Aspidoscelis cozumelus* (Gadow, 1906), on Isla de Cozumel, Mexico, there is no data pertaining to the home ranges of individuals of *A. maslini*. Nomenclature for the Cozumel species of *Aspidoscelis* is based on Steyskal (1971) who explained the basis for treating this generic name as of masculine rather than feminine gender. Consequently, Tucker et al. (2016) corrected the spelling of *cozumela* to *cozumelus* as recommended by Reeder et al. (2002).

Unfortunately: (1) anthropogenic effects on the open sand beaches by the development of tourism infrastructure may jeopardize the existence of parthenogenetic lizards (Hernández-Gallegos et al. 2015), including *A. maslini*, and (2) most studies including the herpetofauna of the Yucatán Peninsula are concerned with diversity rather than knowledge of ecological relationships (Charruau et al. 2015). The present study includes information about the structure of the home ranges of individuals of *A. maslini*, which was compared with that of other lizards, including both gonochoristic and parthenogenetic species within the genus *Aspidoscelis*.

This study was conducted at a tropical sand beach located in km 95 of the Ciudad del Carmen-Champotón highway, Campeche, Yucatán Peninsula, Mexico (19°4' 35.62" N, 91°3'57.76" W). The habitat is composed of halophytic vegetation with high levels of sunlight, salinity and strong winds; the vegetation comprises both erect and prostrate plants of both shrubby and herbaceous form (Téllez-Valdez et al. 1989). The females of *A. maslini* actively use this beach strand community for thermoregulation, foraging, burrowing, oviposition and protection from predators (Hernández-Gallegos personal observation); to the authors' knowledge, *A. maslini* is the only species of whiptail lizard at the study site. Two seasons can be defined at the Yucatán Peninsula: dry season (March-May), and rainy season (June-February). Precipitation occurs from November to February on cool overcast days, called 'nortes', which significantly decrease the temperature. In an area of 4,000 m^2, nine samples of *A. maslini* were taken from 1999 to 2001 during different climatic seasons including the lizard's reproductive season (Hernández-Gallegos et al. 2003). An opportunity to add to this study more recently was not forthcoming; however, studies such as that of Alvarez et al. (2017) have emphasized the importance of documenting all possible sites and conditions of occupancy for species as a basis for understanding responses to long-term changes in bioclimatic conditions. Thus, validly obtained scientific data on a little-known spe-

Fig. 1: Spatial composition of home ranges of the parthenogenetic lizard, *Aspidoscelis maslini* (Fritts, 1969), from Champotón, Campeche, Mexico. Each polygon represents the home range of one female ($N = 8$). Scale bar = 10 meters. Arrow points to the north.

cies remains perpetually applicable within a historical context. The information the present analysis is based upon originates from samplings ocurred from 1999 to 2001, however according to Díaz De La Vega-Pérez et al. (2013; sampligs from 2008 to 2012) and Méndez-De La Cruz (personal observation; evaluation during 2015), the study site did not change markedly since then with respect to habitat structure, lizard community and the population of *A. maslini*.

During each sampling, capture-mark-recapture techniques were conducted and the date, time of day, and snout-vent length (to the nearest millimeter) were recorded. Using a drift fence trap, females were captured during their activity period (09:00-18:00 h). Individuals were located in the study area based on a bi-coordinate reference using 10 m x 10 m subdivisions of the habitat. To calculate a female's home range, two or more recaptures were considered; home ranges were calculated using the convex polygon method in MCPAAL (Microcomputer Program for the Analysis of Animal Locations) software package, version 1.2 (M. Stüwe 1985, Conservation and Research Center, National Zoological Park, Smithsonian Institution, Washington, D.C.) (Hernández-Gallegos et al. 2015).

A total of 70 females were captured: 62 were recaptured once, six two times, and two three times. Females with two or more recaptures ($N = 8$), based on the date of last capture for each lizard (Table 1), averaged 69.1 ± SE 0.6 mm (range 65-71 mm) in SVL. A total of eight home ranges that averaged 34.9 ± 9.6 m^2 (range 0.7-79.7 m^2) in area, and covered a period of 207.1 ± 49.5 days (range 106-420 days), were obtained. Territory overlaps with conspecifics were largely absent (Fig. 1, Table 1).

The average home range size of *A. maslini* represents the smallest within the genus *Aspidoscelis* recorded to date (Perry & Garland 2002), including both parthenogenetic [616 m^2 in *Aspidoscelis uniparens* (Wright & Lowe, 1965), Hulse 1981; 45.1 m^2 in *A. cozumelus*, Hernández-Gallegos et al. 2015] and gonochoristic species [400 m^2 in *Aspidoscelis tigris* (Baird & Girard, 1852), Jorgensen & Tanner 1963; 306 m^2 in *Aspidoscelis hyperythrus* (Cope, 1863), Rowland 1992]. This result contrasts with theoretical predictions of broad home ranges for widely foraging species (Hulse 1981; Rowland 1992; Verwaijen & Van Damme 2008). Reduced home ranges at coastal habitats in other species of lizards including both sit and wait predators (Rocha 1999; Kacoliris et al. 2009) and wide foraging species (Hirth 1963) have been recorded previously.

Thermoregulatory benefits may explain the small home range at open sand beach habitats for *A. cozumelus* (Hernández-Gallegos et al. 2015). In contrast with previous studies, *A. maslini* in Champotón, Campeche, is thermally stressed, inhabiting environments with low thermal quality (Díaz de la Vega-Pérez et al. 2013), i.e., reduced availability of thermally advantageous microhabitats, and both energy and time invested in movements associated with the thermoregulation are relatively high (Cadena & Tattersall 2009). However, this population exhibits a very high population density (Hernández-Gallegos 2004; Díaz De La Vega-Pérez et al. 2013; Méndez-De La Cruz personal observation; evaluation dur-

Table 1: Body size, capture and home range data from eight individuals of the parthenogenetic lizard *Aspidoscelis maslini* (FRITTS, 1969), on a beach strand in Campeche, Yucatán Peninsula, Mexico. SVL_{α} – Snout-vent-length upon first capture, SVL_{ω} – Snout-vent-length upon last recapture, Duration (days) – Number of days elapsed between first capture and last recapture.

Lizard ID (number of recaptures)	SVL_{α} (mm) – Date	SVL_{ω} (mm) – Date	Duration (days)	Home range (m^2)
2-14 (2)	58 – 04/19/1999	69 – 08/04/1999	107	27.7
2-15 (2)	54 – 04/19/1999	65 – 08/04/1999	107	1.1
2-16 (2)	59 – 04/19/1999	69 – 08/04/1999	107	33.8
3-10 (2)	60 – 04/19/1999	69 – 08/04/1999	107	0.7
3-14 (2)	62 – 04/19/1999	70 – 08/03/1999	106	32.0
8-17 (2)	51 – 08/04/1999	70 – 07/28/2000	359	61.3
3-9 (3)	55 – 04/19/1999	71 – 03/28/2000	344	42.9
5-20 (3)	61 – 06/03/1999	70 – 07/27/2000	420	79.7

ing 2015), which may explain the unusually small home ranges observed, as stated previously in the small home range in *A. cozumelus* (HERNÁNDEZ-GALLEGOS et al. 2015), and other lizards (RUBY & DUNHAM 1987; HAENEL et al. 2003). Even in a reduced home range, *A. maslini* obviously finds both biotic and abiotic resources necessary to survive and reproduce.

Although individuals of *A. maslini* inhabit different environments including tropical rainforests (LEE 1996), it is highly adapted to the environmental conditions present on the open sand beaches with halophytic vegetation at the Yucatán Peninsula, which is in the Caribbean hurricane belt (HERNÁNDEZ-GALLEGOS 2004). According to IUCN, *A. maslini* currently (date of assessment: May 8, 2012) is considered as Least Concern (LEE & CALDERÓN-MADUJANO 2013), and was assessed an Environmental Vulnerability Score (EVS) of 15, placing it in the lower portion of the high vulnerability category (GONZÁLEZ-SÁNCHEZ et al. 2017). To again emphasize, anthropogenic effects by the development of tourism infrastructure may constitute the greatest threat to the existence *A. maslini* along the shoreline. Unfortunately, this situation has caused a wide range of negative consequences, including local extirpation of populations of *A. maslini* (i.e., Puerto Morelos, Quintana Roo; MÉNDEZ - DE LA CRUZ, personal observation), and populations of the other parthenogenetic lizards of the *A. cozumela* complex (HERNÁNDEZ-GALLEGOS et al. 2015).

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AUTHORS: Oswaldo Hernández-Gallegos [1)], Ana Esthela López-Moreno [1)], Fausto R. Méndez-de la Cruz [2)] & James M. Walker [3)]

[1)] Laboratorio de Herpetología, Facultad de Ciencias, Universidad Autónoma del Estado de México, Instituto Literario # 100 Centro, Toluca, Estado de México, C. P. 50000, México.

[2)] Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, A.P. 70-173, C.P. 04510, Distrito Federal, México.

[3)] Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA.