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RANGE EXTENSION OF THE EASTERN COTTONTAIL RABBIT (*SYLVILAGUS FLORIDANUS*) IN QUINTANA ROO, MEXICO

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ABSTRACT.—The eastern cottontail rabbit (*Sylvilagus floridanus*; ECR) is highly adaptable to human activities and widely distributed across the Yucatan Peninsula. However, the eastern part of the peninsula, where the Mexican state of Quintana Roo is located, had only marginal records. Herein, we report the collection of one individual and the observation of 7 different individuals of the ECR in northeastern Quintana Roo. These records increase the range of the species by 66 km into the eastern portion of the Yucatan Peninsula. The absence of previous records of the species—even though the mammalian fauna of the region has been surveyed both historically and recently—probably indicates that the species has expanded its range. Further research is required to determine factors that contribute to the species' range expansion as well as its effects on other species.

RESUMEN.—El Conejo cola de algodón (*Sylvilagus floridanus*; CCA) es una especie de conejo de talla mediana, altamente adaptable a las actividades humanas que tiene una amplia distribución en la Península de Yucatán. Sin embargo, el este de la Península donde se localiza el estado de Quintana Roo presenta sólo registros marginales. En esta nota reportamos una colecta y siete observaciones del CCA en el noreste de Quintana Roo que incrementan el área de distribución de la especie en 66 km. La ausencia de registros previos a pesar de que existen prospecciones de mamíferos en la región, probablemente indica que la especie ha incrementado su área de distribución. Es necesario determinar los factores que podrían estar favoreciendo la expansión de la especie en la región, así como los posibles efectos en las comunidades naturales.

The eastern cottontail rabbit (*Sylvilagus floridanus*; ECR) is a medium-sized rabbit (average total length = 427.0 mm, range 395 to 456 mm) with an extensive distribution that goes from southern Canada to the north of South America (Chapman et al. 1980). The ECR is a species usually found in a wide variety of disturbed, early successional or shrub-dominated habitats that include an abundance of forage and dense understory cover. This habitat preference has allowed the ECR to increase its populations as a response to the land-use change of forested areas to agriculture (Chapman and Litvaitis 2003).

On the Yucatan Peninsula in Mexico, cottontail rabbits have been recorded since the late Pleistocene (Arroyo-Cabrales et al. 2010), and the ECR has been commonly found in all the mammal surveys performed in the state of Yucatan (Elliot 1907, Nelson 1909, Gaumer 1917, Jones et al. 1974, Escobedo-Cabrera and Lorenzo 2011; Fig. 1). However,

on the eastern part of the Yucatan Peninsula, particularly in the state of Quintana Roo, many mammal surveys failed to find the species (Pozo de la Tijera and Escobedo-Cabrera 1999, González-Romero and López-González 2000, Faller-Menéndez et al. 2005, Urquiza-Haas et al. 2011), and the surveys that recorded the species found the ECR only in a limited number of localities in western Quintana Roo (Navarro et al. 1990, Cervantes et al. 1997, Escobedo-Cabrera and Lorenzo 2011; Fig. 1). Also, use of the ECR by subsistence hunters in the Yucatan Peninsula is common in the areas where the species is present (León and Montiel 2008, Reid 2009), but the ECR has not been reported as being hunted on the eastern Yucatan Peninsula (e.g., Jorgenson 1995, Quijano-Hernández and Calmé 2002, Ramírez-Barajas and Naranjo-Piñera 2007), indicating it is probably absent in that area.

As part of a study to determine the effect of a new road on native wildlife, we performed

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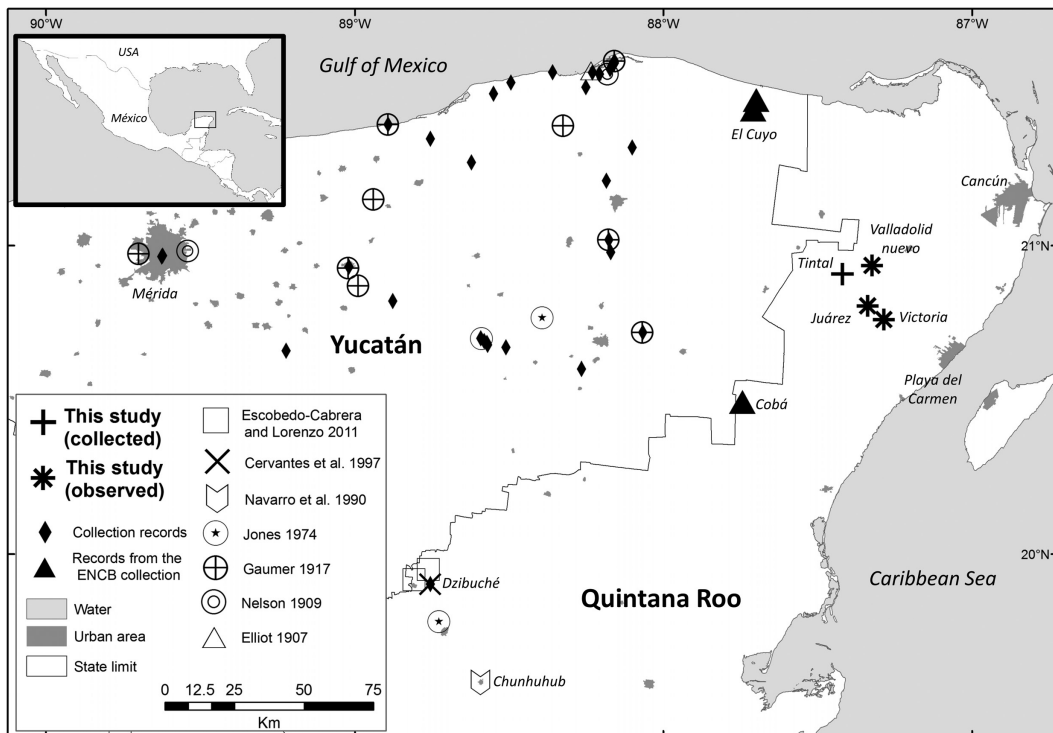


Fig. 1. Locations of the collected and observed new records of the eastern cottontail (*Sylvilagus floridanus*) in the northeast portion of the Yucatan Peninsula. Collection records were obtained by searching the Global Biodiversity Information Facility (GBIF) and the Mammal Networked Information System (MANIS). Literature records were obtained from Elliot (1907), Nelson (1909), Gaumer (1917), Jones (1974), Navarro et al. (1990), Cervantes et al. (1997), and Escobedo-Cabrera and Lorenzo (2011). Filled triangles highlight the locations of the Cobá and El Cuyo records from the Colección de Mamíferos de la Escuela Nacional de Ciencias Biológicas (ENCB).

extensive fieldwork in northeastern Quintana Roo during 2013 to 2015. During the fieldwork, we observed the ECR on 7 occasions in the area and collected one that was road killed. These records document first-time observations of the species in the eastern portion of Quintana Roo and expanded the ECR range by 66 km from the previously known records of the species (Fig. 1).

The study area was in the Solidaridad and Lázaro Cárdenas municipalities of Quintana Roo, México (Fig. 1). The area is mainly flat with an average altitude of 10 m asl. Climate in the region is warm (mean annual temperature 26–28 °C) with summer precipitation (1000–1500 mm per year; Instituto Nacional de Estadística y Geografía 2015). The original vegetation in the area was tropical evergreen forest (Rzedowski 2006), but due to regular hurricanes and slash-and-burn agricultural fires, most of the area is covered by a gradient

of successional stages that include induced pastures and seasonal agriculture, second-growth forests, and mature tropical forests.

The main goal of the study was to identify the diversity and abundance of mammals in an area where a new road was proposed for construction. To accomplish these objectives, we worked intensively from November 2012 to May 2015, driving and walking through the study area to observe the presence of wildlife. Also, we set 56 camera trap stations inside the tropical evergreen forests and the mature second-growth forests of the region (30 Digital Cuddeback Attack, Non Typical, Inc., De Pere, WI; 26 Digital LTL Acorn 5210 A, Old-Boys Outdoors, Stone Mountain, GA). The cameras were active 24 h per day for at least 65 days per year for a total effort of 7280 camera days (one camera day equals one camera station in operation for 24 h). During the fieldwork on 16 April 2014, we collected one



Fig. 2. Photograph of the eastern cottontail (*Sylvilagus floridanus*) collected as a roadkill on Federal road number 80 Mérida-Cancun. This image is deposited in the Photograph Collection of Vertebrates "Alvar González Christen" in the Instituto de Investigaciones Biológicas, Universidad Veracruzana (Mammals Cat. IIB-UVMam 0008f). Photograph by Alejandro Jesús-de la Cruz.

adult female ECR that was road killed along Federal road number 80 Mérida-Cancun in an area surrounded by induced grasslands, 3 km east of the town of Tintal, Quintana Roo (20.9078, -87.4188; total length 465 mm, tail length 81 mm, ear length 83 mm, hind foot length 116 mm; Figs. 1, 2). We identified the specimen as an ECR by the size and the presence of the white tail, which is the most conspicuous character that differentiates the ECR and the forest rabbit (*Sylvilagus gabii*), the only other rabbit whose distributional range is close to the study area (Reid 2009). The collected specimen (skull, skin, and partial skeleton) was deposited in the Mammal Collection of the Instituto de Investigaciones Biológicas, Universidad Veracruzana (VER.-MAM-191-10-06 SEMARNAT) with the catalog number IIB-UVMam 04234. Additionally, on 7 different occasions between 2013 and 2014, we observed solitary ECRs in open habitats (induced grasslands or early stages of second-growth forest) located along routes that we were traveling in the study area (Fig. 1, Table 1). Due to the distance from the observer to the ECRs, we were not able to identify the sexes of the observed individuals. We did not capture any photographs with the camera traps.

We performed an intensive search for ECR records from the states of Yucatan and

Quintana Roo in publications and web-based mammal collections databases (e.g., Global Biodiversity Information Facility GBIF; <http://www.gbif.org>; Mammal Networked Information System, MANIS <http://manisnet.org>). We found 20 previously published records of the ECR in both states (5 in Quintana Roo and 15 in Yucatan; Fig. 1) and 37 unique collection records (2 from Quintana Roo and 35 from Yucatan; Fig. 1). We found that the closest ECR records to our records were the Cobá and El Cuyo specimens, which are deposited in the Colección de Mamíferos de la Escuela Nacional de Ciencias Biológicas-Instituto Politécnico Nacional (ENCB; Catalog numbers 16560, 34219, and 42609). The measured distances between the specimen that we collected and the 2 easternmost records in Cobá and El Cuyo were 64 km and 55 km, respectively (Fig. 1). Of the ECRs observed during the study, the records at the Nuevo Valladolid locality were the farthest from both specimens deposited in the ENCB (66 km from Cobá and 67 km from El Cuyo; Table 1, Fig. 1), making these observations the easternmost location of the ECR on the Yucatan Peninsula.

ECRs in Quintana Roo have been recorded only from localities in the western portion of the state, close to the Yucatan State border (Navarro et al. 1990, Cervantes et al. 1997, Escobedo-Cabrera and Lorenzo 2011; ENCB 16560; Fig. 1). Mammal surveys performed in eastern Quintana Roo did not find the species (e.g., Pozo de la Tijera and Escobedo-Cabrera 1999), and there are no records of the species as prey for subsistence hunters in the state (e.g., Jorgenson 1995, Quijano-Hernández and Calmé 2002, Ramírez-Barajas and Naranjo-Piñera 2007). These 2 pieces of evidence suggest that the new observed records could be part of a species range expansion in the region.

The land-use change from forested areas to agriculture has been proposed to benefit the ECR (Chapman and Litvaitis 2003). Also, previous work in southeastern Mexico has clustered the ECR within a group of species that will increase in population size and range due to land-use change from forest to open anthropized habitats (Cuarón 2000). Our observations that the ECR in the study area was in open habitats (induced grasslands and early stages of secondary forests; Table 1), together with the fact that we did not get any

TABLE 1. Locations and habitats where eastern cottontail rabbits (*Sylvilagus floridanus*) were observed in eastern Quintana Roo, México, during 2013 and 2014. The field indicating the distance to the closest record refers to the measured distances to the eastern cottontail rabbit records of El Cuyo and Cobá, specimens of which are deposited in the Mammal Collection of the Escuela Nacional de Ciencias Biológicas-Instituto Politécnico Nacional, México.

Location	Latitude	Longitude	Date	Habitat	Distance to closest eastern cottontail rabbit record (km)		
					El Cuyo, Yucatán	Cobá, Quintana Roo	
Valladolid Nuevo	20.9351	-87.3231	5 January 2013	Induced grasslands along road shoulder	66	67	67
Valladolid Nuevo	20.9351	-87.3231	25 January 2013	Induced grasslands along road shoulder	66	67	67
Juárez	20.8038	-87.337	8 February 2013	Induced grasslands	55	80	80
Victoria	20.7601	-87.2845	17 March 2013	Early stages of a secondary growth forest	89	56	56
Valladolid Nuevo	20.9351	-87.3231	12 April 2013	Induced grasslands along road shoulder	66	67	67
Tintal	20.897	-87.4385	10 April 2014	Induced grasslands	57	64	64
Valladolid Nuevo	20.9351	-87.3231	25 April 2014	Induced grasslands along road shoulder	66	67	67

camera-trap photos of the species in forested areas, could support this account.

In the state of Quintana Roo from the year 2000 to 2013, more than 330,000 ha of mature forests were transformed to induced grasslands and second-growth forests (Ellis et al. 2017). The northeastern portion of the state still suffers the loss of large tracts of tropical forests mostly due to expansion of subsistence agriculture, urban expansion associated with growth of tourist activities in the cities of Cancún and Playa del Carmen, and the effect of hurricanes that frequently cross the region, causing damage to the forest and favoring forest fires (Ellis et al. 2017). The transformation of the forest to open (croplands and induced grasslands) and partially open habitats (second-growth forests) could be contributing to the expansion of the ECR to new localities in the region.

The ECR is commonly used by subsistence hunters in the Yucatan Peninsula and Central America, but it is also considered a nuisance species in the region because it feeds on corn (Reid 2009). Human-induced and natural habitat transformation in the northeastern portion of Quintana Roo may increase habitat availability for the ECR. The consequential expansion of the species could pose a threat of damage to croplands of the region. It is important to understand the potential role that species such as the ECR play while expanding their original distribution ranges due to habitat changes in the Yucatan Peninsula and how these changes affect the mammal community dynamics in the region, the potential use of the species as a resource for human subsistence hunters, and the potential for increasing human-wildlife conflicts.

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