

# NATURAL HISTORY AND CONSERVATION STATUS OF *CROTALUS PYRRHUS* COPE, 1866 (SQUAMATA: VIPERIDAE) FROM ISLA EL MUERTO, GULF OF CALIFORNIA, MEXICO

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**Figure 1.** Isla El Muerto, as seen from the Peninsula of Baja California, near San Luis Gonzaga, Ensenada. Photo by Eli García-Padilla

## ABSTRACT

The species of rattlesnakes that inhabit the islands of the Gulf of California in México represent a group of vertebrates that are endangered (García-Padilla *et al.*, 2018). The main pressures they face are invasive species and illegal capture for commercialization (Mellinck, 1995). Presently, aspects of natural history and conservation status for many populations of various species still remain virtually unknown to science. During May-June of 2009, we visited Isla El Muerto where there exists an insular population of the rattlesnake *Crotalus pyrrhus* (Meik *et al.*, 2015). The taxonomic status of this species has been discussed, but almost nothing has been published about its ecology and natural history. Here, we present new data concerning the distribution, relative abundance, and conservation status of this insular population of this species. We established that this species might be less abundant than previous authors mentioned; the estimated relative abundance we obtained is 0.22 snakes/hour. Also, we identified that the conservation status provided by Mexican (NOM-059 SEMARNAT, 2019) and international (IUCN) systems needs to be revised and modified to allocate this species to a higher level of protection. We believe that this information can be used as a basis for promoting and achieving the effective protection and conservation of this population of *C. pyrrhus* and its habitat for perpetuity.

## RESUMEN

Las especies de serpientes de cascabel que habitan las islas del Golfo de California en México, representan un grupo de vertebrados terrestres vulnerables y amenazados (García-Padilla *et al.*, 2018). Las principales presiones que enfrentan son las especies invasivas, y el tráfico ilegal de especies para su comercialización. Al presente muchas poblaciones de especies insulares permanecen virtualmente desconocidas para la ciencia en aspectos de su historia natural y estatus de conservación. Durante los meses de mayo y junio de 2009 visitamos la Isla El Muerto donde habita una población insular de *Crotalus pyrrhus* (Meik *et al.*, 2015). El estatus taxonómico de esta especie ya ha sido discutido formalmente, sin embargo, casi nada ha sido publicado acerca de su ecología e historia natural. Nosotros presentamos aquí nuevos datos acerca de la distribución, abundancia relativa y estatus de conservación de esta especie. Encontramos que *C. pyrrhus* podría ser menos abundante de lo que previos autores señalan; la abundancia relativa que estimamos es de 0.22 serpientes/hora. También identificamos que el estatus de conservación otorgado a esta especie por organismos nacionales (NOM-059 SEMARNAT, 2019) e internacionales (UICN) necesita ser revisado y modificado urgentemente para considerar a esta especie en una categoría más alta de protección. Esperamos que esta nueva aportación científica sea la base para alcanzar la efectiva protección y conservación de *C. pyrrhus* y su hábitat perpetuamente.



**Palabras claves:** Golfo de California; Isla El Muerto; serpiente de cascabel, conservación; historia natural; Golfo de California

**Key words:** Gulf of California, Isla El Muerto, rattlesnake; natural history, conservation

## INTRODUCTION

Mexico is considered as one of the five most megadiverse countries worldwide (Llorente-Bousquets and Ocegueda, 2008). Specifically, it is competing with Australia for being the first or the second most diverse country for crocodylians, squamates, and turtles with a total of 975 species of which 586 (60.1%) are endemic at the country level (Ramírez-Bautista *et al.*, 2023).

Rattlesnakes of the genus *Crotalus* are a typical component of herpetofaunas in Mexico, which reach their highest level of diversity and endemism in the central highlands of the country (Campbell and Lamar, 2004). Currently, 46 species of rattlesnakes are recorded from Mexico (Beaman and Hayes, 2008; Wilson *et al.*, 2013; Ramírez-Bautista *et al.*, 2023; García-Padilla *et al.*, 2024), 15 of which are distributed on the Pacific coast islands and those of the Gulf of California associated with the Peninsula of Baja California (Grismer, 1999b, 2002; Campbell and Lamar, 2004; García-Padilla *et al.*, 2018, 2024).

The islands associated with the Peninsula of Baja California harbor significant diversity and endemism of herpetofaunal species, including rattlesnakes. Presently, most of these islands are protected by Mexican and international legislation, and in 1978 the islands in the Gulf of California were declared as a Patrimony of Humanity by UNESCO (CONANP, 2000).

Insular species and mainland species with insular populations, such as the rattlesnakes, merit special attention due to their restricted geographic distribution, and because they are under significant pressure from habitat destruction, outright slaughter, introduction of exotic species, and illegal collecting and traffic for the pet trade black market (Dodd, 1987; Mellinck, 1995; Arnaud, 2015).

Due to the scarcity of scientific information about the status of insular populations (Grismer, 2002), it is particularly important to study certain natural history aspects such as distribution and relative abundance so as to define more accurately their conservation status. Thus, the purpose of this paper is to provide information on these topics with respect to the population of *Crotalus pyrrhus* on Isla El Muerto. The general known distribution of this species is in southern California, extreme southern Nevada, extreme southwestern Utah, and western Arizona, in the United States; and in Baja California and extreme northwestern Sonora, in Mexico (Campbell and Lamar, 2004; Meik *et al.*, 2015). The population on Isla El Muerto was described as *C. mitchellii muertensis* by Klauber (1949). Then it was elevated to full species by Grismer (1999), and recently it was synonymized with *C. pyrrhus* by Meik *et al.*, (2015).

## MATERIALS AND METHODS

Two field trips were made to Isla El Muerto during the dry season (in May and June of 2009), the time indicated by Grismer (2002) to be the period of major activity of *Crotalus pyrrhus* on the island. Each trip consisted of a stay of five days and four nights.

Searching for *Crotalus pyrrhus* was undertaken in all available habitats on the island, including canyons, flat-topped hills and their slopes, and beaches. Every individual found was georeferenced with the use of GPS (Garmin®). With the help of the software Arc View®, we designed a map of the island marked with the point of collection for every individual.

Nocturnal surveys were conducted by a group of five people. Every canyon, hill, and beach was sampled, with the time quantified by use of a chronometer. The hunters walked slowly, separated from one another by a space of 10 m. searching every available microhabitat. Surveying was undertaken a half an hour after sunset and was completed when the selected site was totally traversed. The chronometer was stopped every time that a specimen was found and restarted when data collection was finished.

Relative abundance was estimated based on the number of snakes found per man-hour of searching (Campbell and Christman, 1982; May *et al.*, 1996; Oliveira and Martins, 2001).

## DESCRIPTION OF ISLA EL MUERTO

Isla El Muerto is a tiny island of 1.3 km<sup>2</sup> in area (figure 1) located in the Gulf of California about four kilometers off the shore of the middle portion of the upper segment of the peninsula of Baja California (Murphy *et al.*, 2002). Its highest elevation is 192 m (Murphy *et al.*, 2002), which is located near the mid-point along and across the island (fig. 2). The island is characterized by the presence of peaks, cliffs, mesas, canyons, and rocky beaches (fig. 3). As noted by Grismer (2002: 335), "the island is generally steep and extremely rocky. The volcanic rocks are angular, eroded, and very irregular in shape." The island is composed of materials dating to the middle and late Miocene and it probably separated from the mainland as a result of a geological block failure during the Pleistocene (Delgado-Argote, 2008).

The vegetation is desertic, as a consequence of limited rainfall and the shortage of available standing water. As noted by Lazcano *et al.*, (2011: 130), "the dominant plants [on] the island is [are] desert holly (*Atriplex hymenelytra*) and needlegrass (*Stipa* sp.). There is a small



number of cacti like [chollas] (*Cylindropuntia choya*) and cardons (*Pachycereus pringlei*). Other plants found in low proportion are desert thorn (*Lycium* sp.), glasswort (*Salicornia* sp.), jojoba (*Jojoba* sp.), and mesquite (*Prosopis* sp.).

The climate of Isla El Muerto is very dry with a mean annual temperature of 23°C and an annual precipitation fluctuating between 40 and 60 mm. The driest months are May and June. The highest average monthly temperatures (over 32°C) occur in July and August, whereas the minimum average monthly temperature (about 15°C) occurs in January (Minnich *et al.*, 2000; Cavazos, 2008).

The mammalian fauna of Isla El Muerto comprises only three species, including the California sea lion (*Zalophus californicus*), the California Myotis (*Myotis californicus*), and the Deer Mouse (*Peromyscus maniculatus*). These records are based on personal observations and the results of trapping efforts during our own field work in the island.

The most common birds that we observed on the island are brown pelicans (*Pelecanus occidentalis*), cormorants (*Phalacrocorax* sp.), frigate birds (*Fregata* sp.), herons (family Ardeidae), sea gulls (*Larus livens*), sea hawks (*Pandion haliaetus*), ravens (*Corvus corax*), and peregrine hawks (*Falco peregrinus*).

## THE HERPETOFAUNA OF ISLA EL MUERTO

Lazcano *et al.*, (2011) documented the herpetofauna of Isla El Muerto as consisting of eight species, including the five species listed by Grismer (2002). Four species each of lizards and snakes are recorded now from the island. The lizards are the iguanids *Dipsosaurus dorsalis* and *Petrosaurus mearnsi*, the phrynosomatid *Uta lowei*, and the phyllodactylid *Phyllodactylus xanti*. The snakes consist of the leptotyphlopoid *Rena humilis*, the colubrid *Trimorphodon lyrophanes*, the dipsadid *Hypsiglena torquata*, and the viperid *Crotalus pyrrhus*. Only the lizard *Uta lowei* is endemic to this island.

## HISTORICAL BACKDROP OF *CROTALUS PYRRHUS* KLAUBER, 1949

The population of *Crotalus pyrrhus* on Isla El Muerto was described originally as *C. mitchellii muertensis* by Klauber (1949), but subsequently was raised to species rank (*C. muertensis*) by Grismer (1999a). Klauber (1949) distinguished this taxon from other populations allocated to his concept of *C. mitchellii* by having "distinctive squamation and color patterns" and by

attaining "a smaller body size than other subspecies." "As more material from various populations of *C. mitchellii* accumulated, [however,] it became apparent that only the [last] characteristic is diagnostic, but Grismer (1999a) argued that this is sufficient to allocate full species status" (Campbell and Lamar, 2004: 561). Campbell and Lamar (2004) followed Klauber (1949) in considering the taxon *muertensis* as one of five subspecies of *C. mitchellii* they recognized. However; more recently Meik *et al.*, (2015) synonymized *C. muertensis* with *C. pyrrhus*.

## CHARACTERIZATION OF THE HABITAT OF *CROTALUS PYRRHUS* ON ISLA EL MUERTO

in order to identify the environmental heterogeneity of the island, the different Landscape Units were determined. For this, photointerpretation of images from the Google Earth Program was carried out, complemented with field verifications, obtaining a map of Landscape Units, which includes the ravines, beaches, plateaus, and slopes where we sampled for rattlesnakes (Figure 2).

A general analysis of the vegetation present on the island in the different Landscape Units was carried out. Some plants were photographed and with the use of a botanical press, samples of some plants present on the island were taken, which were later identified in the CIBNOR Botany Laboratory.

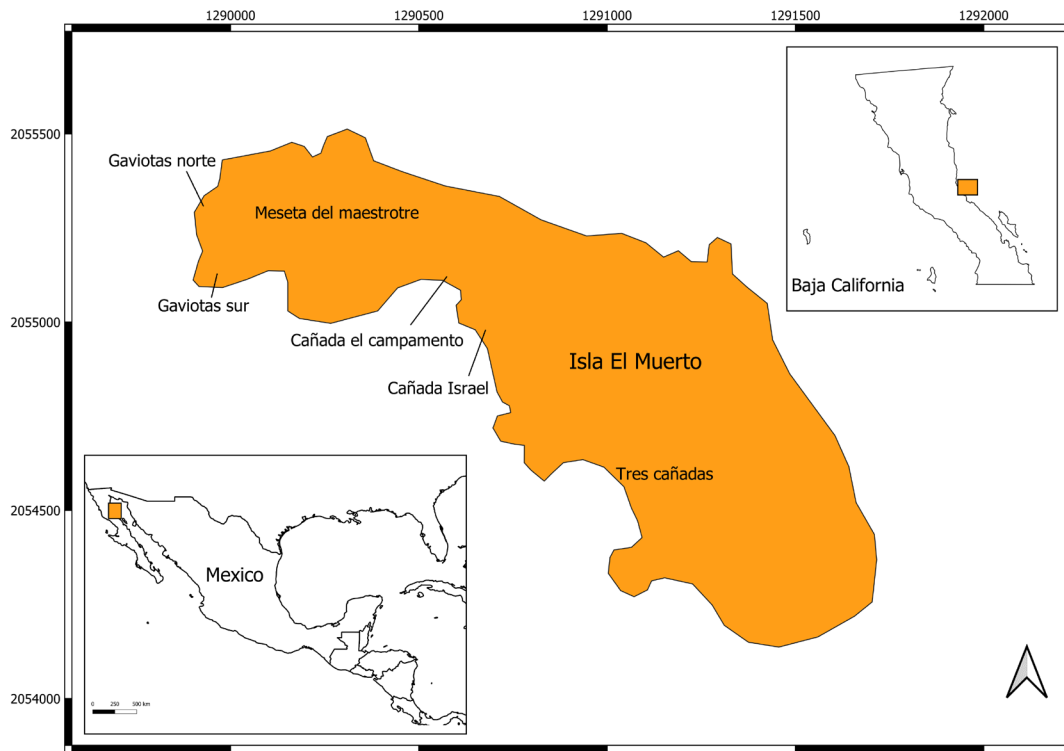
Some 100 m long Canfield lines were carried out in strategic locations on the island, recording the stoniness present according to different diameter categories that were previously established (Canfield, 1941). The Canfield lines measures 100 m of length and were made in the next places: "Cañada del Campamento", "Cañada de Israel", "Meseta del Maestrote", "Cañada derecho (Tres Cañadas) south of the island", "Plano passing Gaviotas Beach to the north" and "Table on one side of Gaviotas Beach to the south" (see figure 2).

The rocks were classified based on their size into type I rocks (up to 30 cm in diameter), type II rocks (31 to 60 cm in diameter) and type III rocks (more than 61 cm in diameter). The results per site of each of the categories (types of rocks, vegetation and naked soil are expressed in percentages.

## MICROHABITAT DISTRIBUTION OF *CROTALUS PYRRHUS*

*crotalus pyrrhus* occurs widely on this island (table 1, fig. 2). Collections were made over four days in May (4-7) and three days in June (16-18). Twenty-two individuals





**Figure 2.-** Map of Isla El Muerto indicating the locations of the inland and its study sites. Credit: Iván Villalobos-Juárez.



**Figure 3.-** Cañada del Campamento, illustrating the scarcity of vegetation on the beach and the rocky walls of the canyon. Photo by Elí García-Padilla.



were found over these seven days (table 1). Of 21 individuals that were sexed, 11 were males and 10 were females. Thus, the sex ratio was as close to 1:1 as is possible with an odd number of individuals.

Individuals of *C. pyrrhus* were encountered at seven different localities (Table 1) on the peninsular-facing side of the island (fig. 4) over a span of about 1.5 airline kilometers or about three-quarters of its length, and from the beach to the spine of the island.

The greatest number of individuals (nine) was found at the Cañada de Campamento locality (fig. 4). This place is the only one where we trapped *Peromyscus maniculatus*, one of the prey species known to be consumed by this rattlesnake. We also observed that *Uta lowei* congregates in large numbers at the bottom of this canyon to feed on mosquitoes, which attracts the rattlesnakes that prey on this lizard. We confirmed this association by finding a juvenile *C. pyrrhus* on the slope of Meseta el Maestrote that contained a *Uta lowei*. We also saw *Dipsosaurus dorsalis*,

*Petrosaurus mearnsi*, and *Phyllodactylus xanti* in this canyon. Klauber (1949) reported *Petrosaurus mearnsi* as prey of the rattlesnake and Grismer (2002) opined that it also probably feeds on *Phyllodactylus xanti*, which he indicated is common on the island. Grismer (pers. comm.) considered *D. dorsalis* to be a recent arrival on the island and we presume it also might serve as prey for the rattlesnake. At Playa Gaviotas, we observed individuals of *Crotalus pyrrhus* inactive under rocks during the day and active only during the night. At this site there is a community of *Salicornia* sp. that harbors chicks and nests with eggs of *Larus livens*. Presumably, the chicks also can be used as prey by *C. pyrrhus*.

### RELATIVE ABUNDANCE OF *CROTALUS PYRRHUS*

the total abundance of snakes found for the whole survey (May and June) = 3400 minutes of searching/60=56.66 hours of searching. A total of 13 snakes (9+4) were found. So then, the total relative abundance was: 13/56.66= 0.22 snakes/ hour.

**Table 1.**-Number of rattle snakes *Crotalus pyrrhus* found during the field work in Isla El Muerto, Gulf of California.

Snake	Date	Site	Sex	SVL
1	4/05/2009	Cañada del campamento	M	59.4
2	4/05/2009	Cañada del campamento	M	53.0
3	4/05/2009	Cañada del campamento	F	30.2
4	5/05/2009	Cañada del campamento	F	36.7
5	6/05/2009	Playa gaviotas	M	29.7
6	6/05/2009	Playa gaviotas	F	40.5
7	6/05/2009	Playa gaviotas	M	58.5
8	6/05/2009	Playa gaviotas	F	45.3
9	6/05/2009	Ladera de playa gaviotas-meseta del maestrote	F	41.7
10	6/05/2009	Playa gaviotas	M	48.5
11	6/05/2009	Cañada del compadre de Israel	M	36.5
12	6/05/2009	Cañada del compadre de Israel	M	43.7
13	7/05/2009	Ladera de la meseta del maestrote	F	27.5
14	7/05/2009	Ladera de la meseta del maestrote	M	69.0
15	7/05/2009	Ladera de la meseta del maestrote	M	61.6
16	16/06/2009	Cañada del campamento	F	49.5
17	16/06/2009	Cañada del campamento	F	49
18	16/06/2009	Cañada del campamento	-	-
19	17/06/2009	Playa gaviotas	F	32.0
20	18/06/2009	Playa del faro	M	50.0
21	18/06/2009	Playa del faro	F	31.1
22	18/06/2009	Cañada derecha de "3 cañadas"	M	35.5





**Figure 4.**-*Crotalus pyrrhus* from Isla El Muerto. Photo by Elí García-Padilla.

## CONSERVATION OF CROTALUS PYRRHUS IN ISLA EL MUERTO

the islands of the Gulf of California collectively constitute an important region of herpetofaunal diversity and endemism in Mexico (Peralta-García *et al.*, 2023; García-Padilla *et al.*, 2018). As noted by Lazcano *et al.*, (2011: 129), "the herpetofauna of the islands in the Gulf of California comprises more than 115 species, of which almost 50% are endemic." Rattlesnakes are frequent components of the Gulf of California insular herpetofauna. 14 species of rattlesnakes are recorded from the Gulf of California islands. Six of these species are insular endemics, each confined to a single gulf island (García-Padilla *et al.*, 2018; Peralta-García, *et al.*, 2023). The population of *C. pyrrhus* inhabits an island comprising 1.3 km<sup>2</sup>. Nonetheless, this rattlesnake is currently distributed in the southwestern United States and Baja California, Mexico (Peralta-García *et al.*, 2023).

*Crotalus pyrrhus* is not placed on the SEMARNAT list (SEMARNAT, 2010). Presuming this species ever appears on the SEMARNAT list, it should be considered as Endangered (P) since it is persecuted by humans for the illegal pet trade, it is killed by humans that use the island as a temporary camp and the species is evidently suffering the effects of climate change (Peralta-García *et al.*, 2023). The IUCN categorization for this rattlesnake is Least Concern. We find it difficult to understand how a rattlesnake species with this insular population to Isla El Muerto which is subject to outright killing and illegal collecting (see below)

possibly can be judged as of Least Concern. A much fairer assessment would categorize *Crotalus pyrrhus* as Endangered, if not Critically Endangered.

The evaluation provided by the application of the EVS measure tells a markedly different story. The value for *Crotalus pyrrhus* is 13, which places it in the upper portion of the medium vulnerability range (Wilson *et al.*, 2013). The species rates this value because it is limited to the vicinity of the type locality, occurs in a single vegetation formation, and is subject to human pressure (Peralta-García, *et al.*, 2023).

As well as, in their identification of priorities for the conservation of vipers, Maritz *et al.*, (2016) provided the following threat index (TI), ecological and evolutionary distinctiveness (EED), and combined (TI + EED) values for *C. muertensis*: TI = DD, EED = DD, TI+EED = DD. For *C. pyrrhus*: TI = 0.20, EED = DD, TI+EED = DD. And for *C. mitchellii*: TI = 0.30, EED = 0.49, TI+EED = 0.39. All these three values fall in the Least Concern category of the IUCN.

*Crotalus pyrrhus* is a rattlesnake species of significant conservation interest since some of its populations are confined in distribution to very small islands lying within easy reach of the mainland of the Peninsula of Baja California. According to Peralta-García *et al.*, (2023), the effects of climate change could present a severe threat to insular systems since amphibians and reptiles obviously cannot expand or modify their distributions to compensate for their effects. Among terrestrial



vertebrates on islands, reports show that amphibians and reptiles could be the most affected by climate change (Becerra-López *et al.*, 2022; Peralta-García *et al.*, 2023). Estimates indicate that many species could lose close to 50% of their distribution ranges (Ureta *et al.*, 2018). In addition to this factor, the rise in sea level due to the effects of climate change would affect many of the reptiles on islands (Bellard *et al.*, 2013; Pliego-Sánchez *et al.*, 2021).

Isla el Muerto is uninhabited by humans, but the island is visited sometimes by fishermen, who reported that individuals from the United States (“gringos”) regularly visit the island to search for this rattlesnake. (García-Padilla, 2010) and Mellink (1995) indicated that *C. pyrrhus* (cited as *C. muertensis*) is one of the species that inhabit the Peninsula of Baja California and its associated islands that is illegally collected and smuggled into the United States for sale in the pet trade black market. Mellink (op. cit.) stated that prices at the time ranged from \$150 for captive-born young to \$375 for a pair of adults. Given what we report here about the abundance and ease of encounter of individuals of this rattlesnake and the degree to which it is subject to illegal collection, we submit that this population should be monitored by authorities continuously to ensure its survival for perpetuity.

## SUMMARY AND CONCLUSIONS

**Distribution:** According to the literature, individuals of *C. pyrrhus* on Isla el Muerto can be found on beaches (Klauber, 1949) and on hills (Grismer, 2002). We also found that *C. pyrrhus* inhabits various other types of habitats, including rocky walls and canyons.

Klauber (1949) mentioned that the deer mouse (*Peromyscus* sp.) was found in the stomachs of *C. pyrrhus* on the island. We found that *Peromyscus maniculatus* inhabits Cañada del Campamento (see figure 2), so that we presume that this canyon is ideal for *C. pyrrhus* due to the presence of the only previously confirmed prey.

According to Grismer (2002), *Petrosaurus mearnsi* and *Phyllodactylus xanti* might be potential prey of *C. pyrrhus* on the island. We observed that *Dipsosaurus dorsalis*, a possible recent arrival on the island (Lazcano *et al.*, 2011) might also be a potential prey for *C. pyrrhus*. We assumed that these lizards and mice might have some influence on the presence and distribution of *C. pyrrhus* on Cañada del Campamento.

According to Grismer (2002), *Larus livens* might represent another prey of *C. pyrrhus* on the island. Although we did not find any evidence of predation, we observed

that in Playa Gaviotas there is a significant number of *C. pyrrhus*, and this might be related to the presence of *L. livens* chickens and eggs. Also, another important prey on this beach could be the lizard *Uta lowei*.

One of the places where we did not find any specimens of *C. pyrrhus* was Meseta del Maestrote. We noticed that deer mice and lizards are not present at this site, probably due to the lack of vegetation. Also, another observation was that the soil surface of this place can reach extremely high temperatures, due to direct incidence of sunlight, reducing very likely rattlesnake activity.

**Abundance:** The only evidence from the literature on how abundant is or was *C. pyrrhus* on the island is found on Klauber (1949). He mentioned that the collector (of the type series for *C. muertensis*) found nine animals in less than 20 feet. This means that nine *C. pyrrhus* were collected every 6.1 meters, or that 1.47 snakes were found every meter. The author did not mention the specific site of the island where this event took place, and we assumed that if the collector walked only six meters, he probably took only a couple of minutes to find the nine specimens.

We found that the relative abundance of *C. pyrrhus* on Isla El Muerto is 0.22 snakes/hour, which means that it is necessary to spend approximately five hours in order to find one specimen of *C. pyrrhus*.

When these data are compared to that on other insular and peninsular rattlesnake populations, we found that Avila-Villegas (2005) reported a relative abundance of 0.4 snakes/hour for *C. catalinensis* on Isla Santa Catalina. Additionally, Murillo-Quero (2009) mentioned a relative abundance of 0.75 snakes/hour for *C. ruber* on the Peninsula el Mogote, La Paz, Baja California Sur, and the relative abundance of *C. tortugensis* on Isla Tortuga was estimated as 0.45 snakes/hour (Arnaud-Franco, 2010, personal communication).

**Conservation:** Klauber (1949) mentioned that Isla El Muerto is one of the three islands on the Gulf of California where one collector can find a big number of snakes in a short period of time. Comparing the actual evidence and observations, we assume that the population of *C. pyrrhus* is decreasing drastically. The population of *C. pyrrhus* inhabiting a very small island remains vulnerable to pressures such as possible invasive species like feral cats and the indiscriminate killing and the illegal collecting for the pet trade (Mellink, 1995). Special regulations for its conservation status and protection need to be developed in order to achieve the preservation of this important rattlesnake population and its habitat for perpetuity.

**Table 3.- Relative abundance of snakes found during the month of June, 2009. The total abundance of snakes for this survey was: 0.12 snakes/hour.**

Site	Time of searching	Number of people	Number of snakes found	Abundance
Cañada del campamento	520min(8.666h)	5	0	0
Playa del faro	672min(11.2h)	5	3	0.267
Playa gaviotas	64min(1.06h)	5	1	0.943
Meseta del maestrote	29min(0.48h)	5	0	0
Cañada del compadre de Israel	670min(11.166h)	5	0	0

**Table 2.- Relative abundance of snakes found during the month of May, 2009. The total abundance of snakes for this survey was of 9 (snakes)/24.08 (hours)= 0.37 snakes/hour.**

Site	Time of searching	Number of people	Number of snakes found	Abundance
Cañada del campamento	575 min(9.583 h)	5	2	0.2 serp/hr.
Cañada de Israel	65 min	5	0	0
Playa gaviotas	425 min(7.083h)	5	5	0.7
Meseta del maestrote	380min(6.333h)	5	2	0.31



**Figure 5.-***Peromyscus maniculatus* from Isla El Muerto. Photo by Elí García-Padilla.





**Figure 6.**-*Uta lowei* from Isla El Muerto. Photo by Elí García-Padilla.



**Figure 7.**-*Petrosaurus mearnsi* from Isla El Muerto. Photo by Elí García-Padilla.



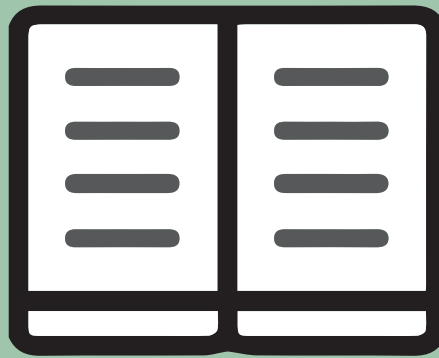


**Figure 8.**-*Dipsosaurus dorsalis* from Isla El Muerto. Photo by Elí García-Padilla.



**Figure 9.**-*Hysiglena torquata* from Isla El Muerto. Photo by Elí García-Padilla.





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