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ANNUAL ACTIVITY CYCLE OF THE JAVELIN SAND
BOA *ERYX JACULUS* (LINNAEUS, 1758) IN SICILY

SUMMARY

The Javelin sand Boa *Eryx jaculus* is a snake little known from an eco-ethological point of view. Here, some aspects of its phenology are described for the first time. 229 observations were collected in Sicily, with the aim of describing the annual activity of this population. The activity of adult males and juveniles presents a similar trend, with a sharp peak between May and July. Juveniles sharply declined in the following months. Adult females have three peaks of activity of similar amplitude. The activity cycle of the Javelin sand Boa could be modulated by some aspects of his trophic behaviour. In fact, juveniles and adult males prefer prey types highly available only during their maximum activity period. Adult females exploit prey with more constant availability over time and this could cause smaller fluctuations in the activity. Juveniles' observations had a peak in the first half of their annual activity cycle, contrary to what might be expected in a species that gives birth mainly in late summer. This could indicate that the newborns have extremely elusive habits in the first months of life or, alternatively, the occurrence of births in spring has been rarely observed in other studies.

Key words: Phenology, mobility, adults and young.

RIASSUNTO

Attività annuale del Boa delle sabbie Eryx jaculus (Linnaeus, 1758) in Sicilia. Il Boa delle sabbie *Eryx jaculus* è un ofide poco conosciuto dal punto di vista eco etologico. In questo contributo vengono descritti per la prima volta alcuni aspetti della sua fenologia. Sono state raccolte 229 osservazioni in Sicilia, con lo scopo di descrivere l'attività annuale di questa popolazione. L'attività di maschi adulti e giovani presenta un andamento sovrapponibile, con un prominente picco fra maggio e luglio. I giovani hanno subito un brusco decremento nei mesi successivi. Le femmine adulte presentano invece tre picchi di attività di ampiezza paragonabile. Il ciclo di attività del Boa delle sabbie potrebbe essere modulato da alcuni aspetti del suo comportamento trofico. È noto che giovani

e maschi adulti sfruttano soprattutto prede disponibili principalmente durante il loro periodo di massima attività. Le femmine adulte sfruttano prede con disponibilità più costante nel tempo, questo potrebbe contribuire a un ciclo di attività con oscillazioni meno ampie. Le osservazioni di giovani hanno un picco nella prima metà del ciclo annuale di attività, al contrario di quanto ci si possa aspettare in una specie con nascite prevalentemente tardo estive. Questo potrebbe indicare che i nuovi nati abbiano delle abitudini estremamente elusive nei primi mesi di vita o, in alternativa, la prevalenza di nascite primaverili, come già rilevato altrove in singoli casi.

Parole chiave: Fenologia, mobilità, adulti e giovani.

INTRODUCTION

The Javelin sand Boa *Eryx jaculus* (Linnaeus, 1758) is a snake belonging to the Erycidae family, is found in North Africa, Middle East and in the southern Balkans (SINDACO *et al.*, 2013). Recently, the presence of this species has been confirmed in a small area of southern Sicily, in Italy (INSACCO *et al.*, 2015; FARAONE *et al.*, 2017a). The origin of the Italian population of Javelin sand Boa is not yet clear due to the absence of genetic studies, currently it is hypothesized that it can be attributed to an ancient introduction (INSACCO *et al.*, 2015). FARAONE *et al.* (2019) found a phenotypic resemblance between the Sicilian sand Boas and those of North Africa, attributable to the nominal subspecies (TOKAR, 1991).

Knowledge of the Javelin sand Boa in Sicily is currently limited to the feeding habits (FARAONE *et al.*, 2017b, 2021), morphology (FARAONE *et al.*, 2019) and population's distribution (INSACCO *et al.*, 2015; FARAONE *et al.*, 2017a). *E. jaculus* is known as a difficult species to observe in the field due to its nocturnal and fossorial habits (TOKAR & OBST, 1993; GHERGHEL *et al.*, 2009); for this reason the knowledge on its biology is overall poor and fragmentary (TOKAR & OBST, 1993; GHERGHEL *et al.*, 2009; CATTANEO, 1984, 2005, 2010).

This paper describes for the first time the annual activity cycle of *E. jaculus* in Sicily and some eco-ethological traits of this species.

MATERIALS AND METHODS

Sampling was carried out within the geographic range of the Javelin sand Boa in South Central Sicily, within an area between Palma di Montechiaro (province of Agrigento) and Butera (province of Caltanissetta) (INSACCO *et al.*, 2015; FARAONE *et al.*, 2017a).

The snakes were collected during active searches at night, both by car and on foot. Some observations outside the sampling sessions were also considered, such as the snakes rescued from two small abandoned cisterns checked daily during the period of activity of the Javelin sand boas. The data

were collected between August 2014 and February 2021. The samplings were carried out regularly, on an almost daily basis, between April 2018 and October 2020. During this period, we got 93.4% of the observations. A total of 229 individuals (80 males, 67 females, 82 juveniles) were examined, 78 of which (28 males, 28 females, 22 juveniles) were roadkilled.

Sex was determined by examination of external sexual features (spurs, tail shape), by cloacal popping and by cloacal probing (FARAONE *et al.*, 2019). Snout to vent length (SVL) was measured with a mm ruler on all live juveniles, and freshly dead and little damaged individuals. *E. jaculus* with a snout-vent length < 270 mm were considered as juveniles (see FARAONE *et al.*, 2019)". All the snakes examined, after the measurements, has been released at the point where they were found.

The activity rate of *E. jaculus* was expressed separately for juveniles and adult males and females as a percentage of the total observations of each category. Two monthly values were calculated, from the 1st to the 15th and from the 16th to the end of the month. The mean, standard error (SE), minimum and maximum (min-max) values were calculated on SVL.

RESULTS

During the sampling period, snakes were found in activity in the range between the beginning of March and the end of October (Fig. 1). A peak of activity was observed in June for all categories. During this month, the activity seems to have a prominent increase in adult males and juveniles with, respectively, 44.3% and 35.0% of the total observations. For adult females, in June the peak of observations appears to be of lesser amplitude, thus females have two other peaks of comparable amplitude in the first half of August and in the second half of September, during which the observations of adult males and juveniles drop dramatically.

Figure 2 shows the variation in the mean size (SVL) of juveniles over time. There is a general increase in the size of this category, with minimum values in May and June and a sharp increase (18.8%) between June and July. In August and September, the number of juvenile records collapses.

DISCUSSION

The observations trend indicates possible differences between sexes and ages. The activity rates of adult males and juveniles tend to be comparable, with a prevailing peak between May and July, in which there are

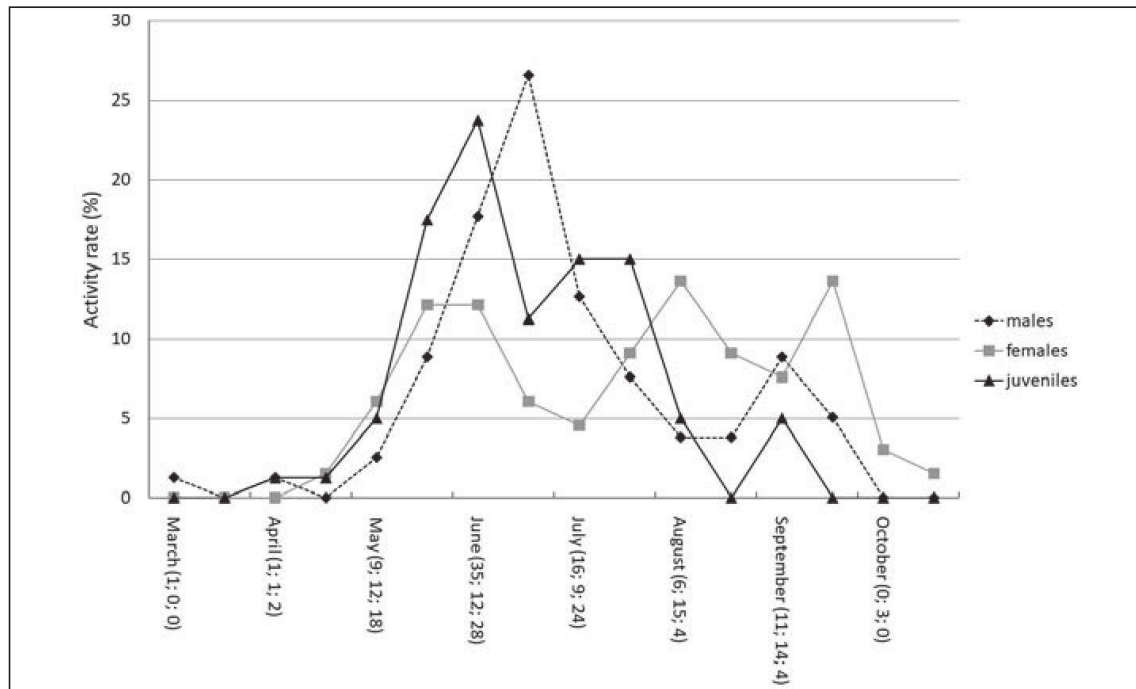


Fig. 1 — Annual variation in the activity rate of adults (males and females) and juveniles of *E. jaculus* in Sicily. In brackets, the number of monthly observations of males, females and juveniles is indicated in order.

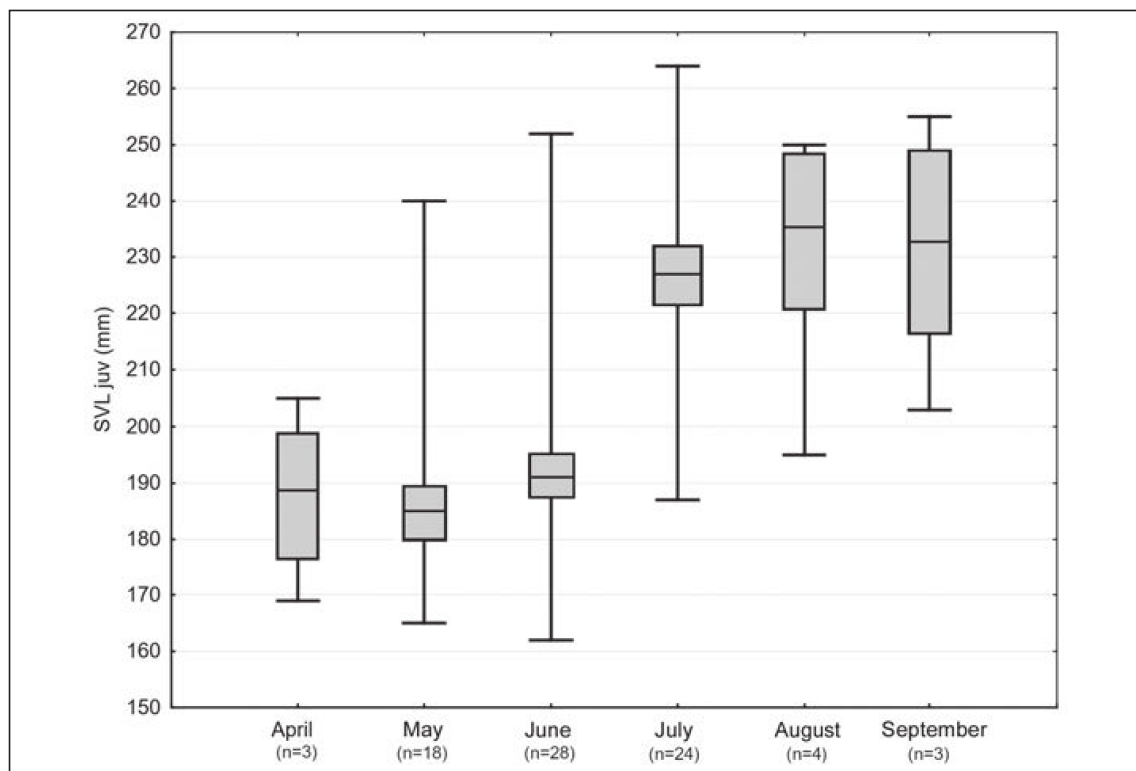


Fig. 2 — Annual variation of the body size, expressed as SVL, of the juveniles. Box = Mean \pm SE; Whisker = min-max.

respectively 75.9% and 87.5% of the observations. In both classes a similar trophic behavior is observed, with the dominant or consistent exploitation of saurian eggs (FARAONE *et al.*, 2021), a resource mainly available in late spring and early summer (CORTI & LO CASCIO, 1999). The peak of observations in this case appears to be actually associated with that of maximum feeding activity recorded for the same area in juveniles and adult males (FARAONE *et al.*, 2021). The increasing activity of adult males could also be associated with greater mobility during the breeding period, which is known for this species in spring (TOKAR & OBST, 1993). The annual activity of males and juveniles seems to have a tendentially unimodal pattern, very similar to that observed for another Mediterranean species with crepuscular and nocturnal habits such as *Coronella girondica* (AGRIMI & LUISELLI, 1994). The activity of adult females, on the other hand, has three almost equivalent seasonal peaks and less pronounced amplitude intervals than those observed in the other two classes. This trend could be also linked to trophic reasons: the main prey exploited by females are micromammals (FARAONE *et al.*, 2021), that presumably have a more constant availability over time than the prey exploited by adult males and juveniles. The late summer/autumn peak in females appears wider than that observed in males and juveniles. Also in this case, the increase in observations appears to be simultaneous with an increase in feeding activity (FARAONE *et al.*, 2021). As reported for several viviparous snakes, females often enhance their food activity after juveniles to increase body reserves before hibernation (ZUFFI *et al.*, 1999; BRITO, 2004; SANTOS *et al.*, 2007).

According to the little information available on *E. jaculus*, the mating period takes place mainly in spring and births in late summer (TOKAR & OBST, 1993). Our results indicate a peak in the number of juvenile observations and smaller body sizes in spring compared to subsequent months, contrary to what might be expected in a species with late summer births (Fig. 2). These results could be influenced by the extremely secretive behavior of the offspring before winter latency, which for this reason could have a very low detectability in the first months of life. Alternatively, this population could have a different reproductive phenology from that dominant elsewhere, with spring births, as in the case described by CATTANEO (1984) for the island of Antiparos (central Cyclades). Unfortunately, mating activity and females in the final stages of pregnancy have not yet been observed in Sicily, and this does not allow to accurately describe the reproductive phenology of this population.

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