



## The mammalian fauna of two protected areas in Adana Province: Akyatan Wildlife Development Area (Karataş) and Aleppo Pinery (Yumurtalık)

Ahmet Karataş\*, Mehmet Arslan

Department of Biology, Niğde Ö. H. University, Niğde-TURKEY

\*Corresponding email: [rousettus@hotmail.com](mailto:rousettus@hotmail.com); <https://orcid.org/0000-0002-5985-2094>

Received: 2 Sep. 2020 / Revised: 29 Sep. 2019 / Accepted: 4 Oct. 2020 / Published online: 28 Oct. 2020.

### Abstract

In the study, the mammalian fauna of the two protected areas (Akyatan Wildlife Development Area and Aleppo Pinery) in Adana Province were investigated. Some animals were directly observed or determined by indirect methods such as footprint, faeces, and burrow. Additionally, three photo-traps, set on 23 localities, were used to determine species composition and their activity time. Some specimens of small-sized mammals were captured by wire and Sherman traps. Several skulls were found from owl pellets. As a result of the study, it was determined that a total of 16 species, i.e., *Erinaceus concolor*, *Crocidura suaveolens*, *Lepus europaeus*, *Apodemus flavicollis*, *Mus macedonicus*, *Rattus rattus*, *Meriones tristrami*, *Hystrix indica*, *Canis aureus*, *Vulpes vulpes*, *Martes foina*, *Meles meles*, *Felis cf. silvestris*, *Felis chaus*, *Herpestes ichneumon*, and *Sus scrofa* which distributed naturally in the areas.

**Keywords:** Adana, Akyatan Nature Reserve, Aleppo Pinery, fauna, Mammalia

### Introduction

Ecological studies on mammals in Turkey has increased recently. These studies focused on large terrestrial mammals, including thesis conducted in Yenice forests in Karabük (Can, 2008), Çamlıdere-Çamkoru region in Ankara (Akbaba, 2010), Bartın (Ertürk, 2010), Datça-Bozburun Peninsula in Muğla (İlemin, 2010), and Northwest Anatolian forests (Soyumert, 2010). In Adana, where our work areas are located, more reporting studies such as action plans for large mammals are seen. According to previous studies, 65 mammal species were determined in Adana province (Anonymous, 2014). A study prepared between 2004 and 2007 in Akyatan WDA, 15 mammal species from 13 families of 5 orders were identified, including *Crocidura suaveolens*, *Lepus europaeus*, *Canis aureus*, *Herpestes ichneumon*, *Felis chaus*, *Meles meles*, *Meriones tristrami*, *Rattus norvegicus*, *R. rattus*, *Mus macedonicus*, *Nannospalax ehrenbergi*, *Sus scrofa*,



and *Cervus elaphus* (introduced) (WWF-Türkiye, 2008). 13 mammal species were recorded in the Akyatan and Tuzla Lagoons Management Plan (Anonymous, 2016).

These two protected areas in Adana province are located on the Mediterranean coast. The region has the characteristics of a typical Mediterranean climate, hot and humid summers (average relative humidity about 65%), and mild winters (MGM, 2016). The first of these, Akyatan Wildlife Development Area (WDA) (originally “*Akyatan Yaban Hayatı Geliştirme Sahası (YHGS)*” in Turkish) is located in Karataş district of Adana province (Fig. 1). Turkey's largest sand dunes are located in its parts between Akyatan Lagoon and the Mediterranean. These dunes has a length of 22 km and a width of up to 3-4 km (Oruç, 2013). Akyatan forest (2.018 ha.), which forms a border with sand dunes, was planted between 1972 and 1987 by the dunes afforestation project. Plantation trees in this area are *Pinus pinea* (Stone Pine), *P. brutia* (Turkish Pine), *P. halepensis* (Aleppo Pine), *Cupressus sempervirens* (Mediterranean Cypress), *Acacia saligna* (orange wattle, also known as Cypriot Acacia), *Robinia pseudoacacia* (False Acacia), and *Eucalyptus camaldulensis* (Eucalyptus). In 1987, it was declared as a Wildlife Protection and Breeding Area for *Francolinus francolinus* (Black Francolin) in the region by the General Directorate of Nature Conservation and National Parks. This status was transformed into a Wildlife Development Area in 2005 with the decision of the Council of Ministers (Oruç, 2013). Mainly watermelon, peanut, and wheat are grown in the fields on the border of the protected area. Partly livestock is also carried out. Transportation to the lagoon, fields, and forest areas is provided with dirt roads. There are different habitats such as the wide dune ecosystem, reedbeds, open water surfaces, fresh and salty marshes, ponds, and beaches in the area. The fact that the areas are protected areas has minimized the human impact. However, all activities that could damage the resource values of the fields are prohibited. Education, scientific studies, conservation activities, nature photography, and day trips are allowed (Anonymous, 2014).



**Figure 1:** Locations [A1-43] recorded in Akyatan WDA.



The second area, Aleppo Pinery (originally “*Halep Çamlığı*” in Turkish), is located in the Yumurtalık Lagoons in the south-west of Yumurtalık district of Adana (Fig. 2). The area is approximately 60 km from Adana, and it was taken under protection with a total area of 16,430 ha<sup>2</sup> (Anonymous, 2014). The protection statuses of the area are 1st Degree Natural Protected Area (1993), Nature Protection Area (1994), Ramsar Area (2005), and National Park (2009). Aleppo Pinery's primary vegetation naturally consists of *Pinus halepensis* (Aleppo Pine) and *P. brutia* (Turkish Pine) trees (Anonymous, 2014; DKMP, 2020).



**Figure 2:** Locations [H44-74] recorded in Aleppo Pinery.

The purpose of this article is to determine the fauna of mammals of Turkey's two crucial nature conservation areas, and changes in the composition of the fauna reveal according to their habitat differences and also to provide data to the plans will be made for these protected areas.

## Material and Methods

Direct and indirect observation, photo trap, live catch traps, and owl pellet analysis methods were used in the studies. Findings in indirect observation such as trace, faeces, sound, and burrow were identified according to Dobroruka (1989), Elbroch (2003), Çolak (2007), and Kütükçü (2016). Photo traps were placed by determining the burrows, feeding areas, paths, and drinking fountains detected in the field (Fig. 3, 4). They were operated in hybrid mode, and photo and video recordings were taken at each trigger. During the study, three photo traps were placed in 9 stations in Aleppo Pinery and 14 stations in Akyatan WDA at different times. The total working time was 93 days. The data obtained from them was used to determine the activity hours of mammalian species. For this purpose, the İstanbul time setting was used and was based on 24 hours. Additionally, a total of 102 live catch traps (42 Sherman and 60 wire traps) were used in two areas. Also 20 owl pellets were collected and analyzed in the laboratory. Kryštufek and





Vohralík (2001, 2009) and Yiğit et al. (2006)'s books were used to identify skulls obtained from pellets and animals caught with traps. Abbreviations for record types and localities used in the text are; *b*: burrow, *c-t*: camera-trap, *dig*: digging, *d*: droppings/faeces, *fp*: footprint, *lt*: live trapping, *owl*: owl pellet, *voice*: voice/sound, *w*: watching/observation; numbers of localities given in Fig. 1 and Fig. 2 for Akyatan WDA [A1-43] and Aleppo Pinery [H44-74].

## Results

As a result of the studies, 16 non-volant terrestrial mammal species were identified, 13 species in Akyatan WDA and 12 species in Aleppo Pinery. Nine species were common in these two areas.

## Activity Patterns

The mammal activity charts were prepared separately for Akyatan WDA (Table 1) and Aleppo Pinery (Table 2) by using the photo trap data obtained from field studies and given in the records. The activity times of 8 species in Akyatan and 7 species in Aleppo Pinery were determined. *Canis aureus* is the most active species in both areas. *Herpestes ichneumon*, *Felis chaus*, and *Sus scrofa* activities were also dense in Akyatan. Except for the diurnal *H. ichneumon*, the most intensive activity was between 20:00 and 24:00 in the evening and from 01:00 to 05:00 after midnight.

## Recorded Species

Ordo 1: EULIPOTYPHILA

Familia 1: ERINACEIDAE

***Erinaceus concolor* Martin, 1837**

**Locality and record:** Akyatan [A25], 5-14.iv.2015: 1 (c-t). Aleppo Pinery [H74], 17.v.2015: 1 (c-t).

**Ecologic remark:** The species was found in the ditch near the trail. The activated hours of the two hedgehogs displayed in the photo trap were 21:00 and 01:00.

Familia 2: SORICIDAE

***Crocidura suaveolens* (Pallas, 1811)**

**Locality and record:** Akyatan [A4], 17.ii.2015: 2 (owl), [A42], 16.ii.2015: 1 (lt). Aleppo Pinery [H61], 17.v.2015: 1 (lt); [H62], 16.v.2015: 2 (lt); [H66], 28.ii.2015: 1 (lt).

**Ecologic remark:** It was captured in three localities in Aleppo Pinery and the shore of Akyatan Lagoon. Skull remains parts of two individuals were identified from owl pellets in Akyatan.

Ordo 2: LAGOMORPHA

Familia 1: LEPORIDAE

***Lepus europaeus* L., 1758 (Fig. 3)**

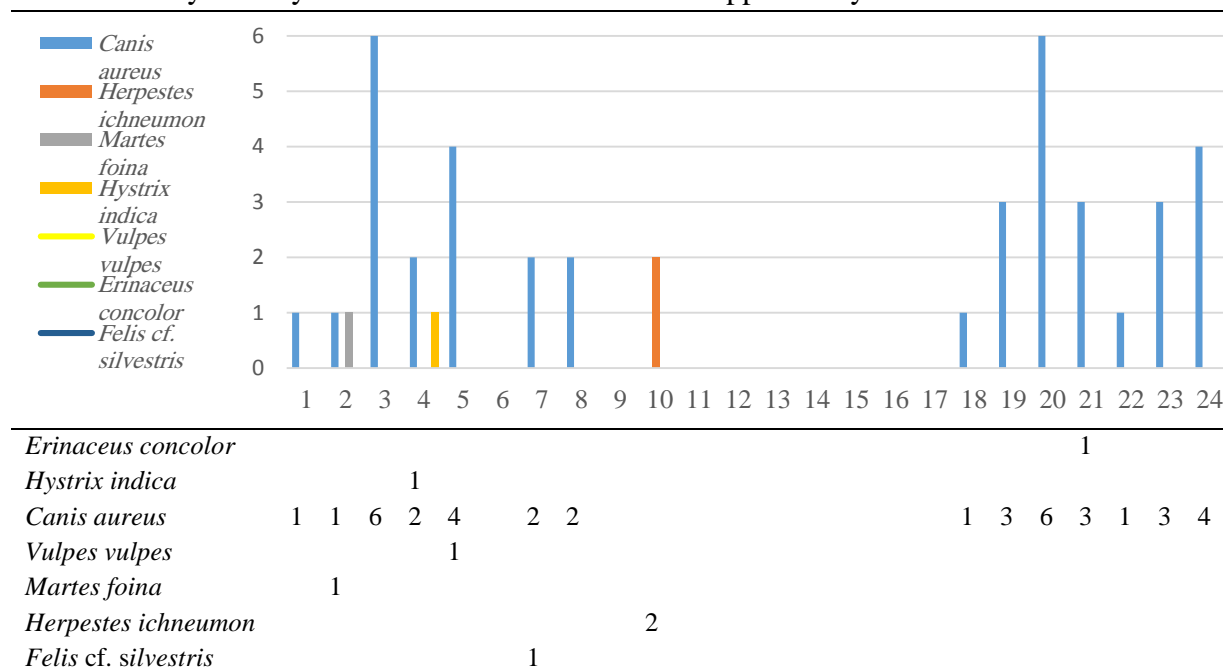
**Locality and record:** Akyatan [A16], 1-2.v.2015: 1 (c-t); [A24], 29.iv.2015: ? (d); [A25], 5-14.iv.2015: 2 (c-t); [A27], 3-16.i.2015: 1 (c-t); [A31], 21.ii.2015: 1 (w); [A36], 1.v.2015: 1 (w); [A7], 19.ii.2015: ? (d). Aleppo Pinery [H46], 16.v.2015: ? (d); [H49], 17.v.2015: ? (d); [H58], 18.v.2015: ? (d).

**Ecologic remark:** It was taken with photo-traps and observed directly in Akyatan WDA. Also, droppings and footprints were frequently seen in the openings in the forest, in the fields close to the lagoon and in the

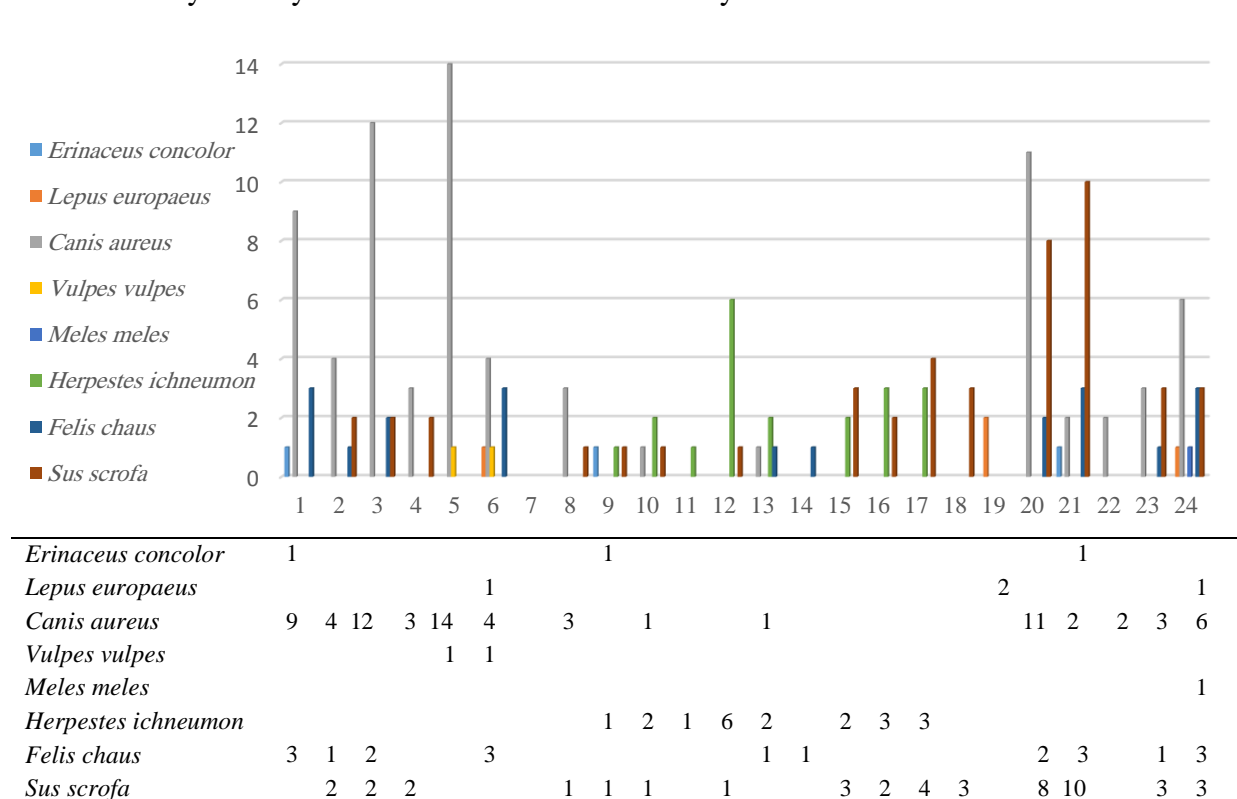


embryonic dune part in Akyatan and in the place with glassworts (sea beans) near the last part of the forest in the Aleppo Pinery.

**Table 1:** Daily activity hours for some mammals in Aleppo Pinery.



**Table 2:** Daily activity hours for some mammals in Akyatan WDA.





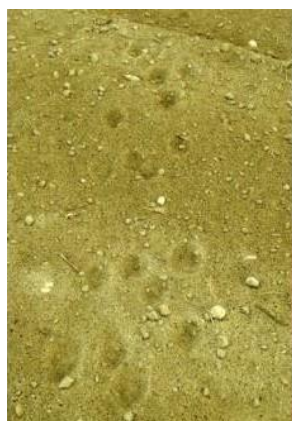
*Erinaceus concolor*



*Crocidura suaveolens*



*Lepus europaeus*



*Lepus europaeus* (fp)



*Hystrix indica*



*Hystrix indica* (fp)



*Canis aureus*



*Canis aureus* (fp)



*Meles meles*



*Felis chaus*



*Felis chaus* (d)



*Felis chaus* (fp)

**Figure 3:** Some mammal species and their footprint (fp) and faeces (d) taken in Akyatan WDA and Aleppo Pinery (photo by M. Arslan).





**Figure 4:** Some other mammal species and their burrow (b), footprint (fp) and faeces (d) taken in Akyatan WDA and Aleppo Pinery (photo by M. Arslan).



## Ordo 3: RODENTIA

## Familia 1: MURIDAE

***Apodemus flavicollis* (Melchior, 1834)**

**Locality and record:** Aleppo Pinery [H63], 17.v.2015: 1 (lt).

**Ecologic remark:** An individual was caught among the common myrtle (*Myrtus communis*) plants under the pine trees.

***Mus macedonicus* Petrov et Ruzîc, 1983**

**Locality and record:** Akyatan [A11], 29.iv.2015: 2 (lt); [A4], 17.ii.2015: 1 (owl).

**Ecologic remark:** It was trapped only from a sand dune in Akyatan WDA.

***Rattus rattus* (L., 1758)**

**Locality and record:** Akyatan [A4], 29.iv.-1.v.2015: 3 (lt); [A5], 29.iv.-1.v.2015: 12 (lt). Aleppo Pinery [H60], 30.iv.2015: 2 (lt); [H63], 16-18.v.2015: 10 (lt); [H63], 30.iv.2015: 1 (lt); [H65], 1.v.2015: 1 (lt); [H68], 28.ii.2015: 2 (lt).

**Ecologic remark:** This was the most caught rodent species in both conservation areas. Its main predator was determined as *F. chaus*.

***Meriones tristrami* Thomas, 1892 (Fig. 4)**

**Locality and record:** Akyatan [A11], 29.iv.-1.v.2015: 4 (lt); [A4], 17.ii.2015: 2 (owl).

**Ecologic remark:** It was captured only in fields, dunes, and grassy parts where forest cover is weak of Akyatan WDA. Burrow holes were seen under shrubs, at the base of acacia trees and in open areas. It was determined that it was used as food by owls.

## Familia 2: HYSTRICIDAE

***Hystrix indica* Kerr, 1792 (Fig. 3)**

**Locality and record:** Aleppo Pinery [H54], 1.iii.2015: ? (dig); [H69], 1.iii.2015: 1 (c-t).

**Ecologic remark:** It has been observed that the porcupine used orchards, maquis areas and forest openings. It was recorded in Aleppo Pinery with spine remains and photo trap images. It was hunted intensively by people in the region.

## Ordo 4: CARNIVORA

## Familia 1: CANIDAE

***Canis aureus* L., 1758 (Fig. 3)**

**Locality and record:** Akyatan [A3], 17-18.iv.2015: 1 (c-t); [A6], 17-18.ii.2015: 1 (c-t); [A8], 29.iv.2015: 1 (w); [A9], 2-3.v.2015: 1 (c-t); [A16], 1-2.v.2015: 1 (c-t); [A17], 1-2.v.2015: 1 (c-t); [A20], 19.viii.2013: 5 (voice); [A21], 1-2.v.2015: 2 (c-t); [A25], 5-14.iv.2015: 2 (c-t); [A26], 06-29.iv.2015: 1 (c-t); [A27], 03-16.i.2015: 1 (c-t); [A29], 22.iii.-5.iv.2015: 1 (c-t); [A32], 21.ii.2015: 1 (w); [A35], 1.v.2015: ? (d); [A38], 19.ii.2015: ? (d); [A39], 17.ii.2015: 1 (c-t); [A41], 17.ii.2015: 1 (c-t). Aleppo Pinery [H44], 16.v.2015: ? (d); [H45], 16-17.v.2015: 1 (c-t); [H47], 16-17.v.2015: 1 (c-t); [H50], 1.v.2015: ? (d); [H53], 28.ii.-





1.iii.2015: *I* (c-t); [H56], 28.ii.2015: ? (d); [H69], 1.iii.2015: *I* (c-t); [H70], 17-18.v.2015: *I* (c-t); [H72], 28.ii.-1.iii.2015: *I* (c-t); [H73], 18.v.2015: *I* (fp).

**Ecologic remark:** It was recorded that the jackal used almost the entire area including the sea shore, dune, acacia plantation, lagoon shore and forest as habitat. Howling sounds were heard frequently at night. It was seen in drinking fountain in Akyatan WDA. The food of the jackals consisted of dead animals stranded by the sea, sea turtle eggs and hatchlings, watermelons, fish and wild boars hunted by field keepers. It was observed that this species used the widest road in Akyatan, while it preferred small paths in Aleppo Pinery.

### ***Vulpes vulpes* (L., 1758)**

**Locality and record:** Akyatan [A25], 5-14.iv.2015: *I* (c-t). Aleppo Pinery [H51], 1.v.2015: ? (d); [H59], 28.ii.2015: ? (d); [H69], 1.iii.2015: *I* (c-t).

**Ecologic remark:** It has been found in woodlands and open fields. It seems to be denser in Aleppo Pinery. It was determined that Akyatan WDA.

### Familia 2: MUSTELIDAE

#### ***Martes foina* (Erxleben, 1777)**

**Locality and record:** Aleppo Pinery [H67], 18.v.2015: ? (d); [H69], 1.iii.2015: *I* (c-t).

**Ecologic remark:** It was found only in Aleppo Pinery.

#### ***Meles meles* (L., 1758) (Fig. 3)**

**Locality and record:** Akyatan [A25], 5-14.iv.2015: *I* (c-t); [A43], 19.viii.2013: *I* (c-t). Aleppo Pinery [H48], 28.ii.2015: ? (b, d).

**Ecologic remark:** It was determined from different parts of Aleppo Pinery and from the lagoon shore and near the field in Akyatan WDA.

### Familia 3: FELIDAE

#### ***Felis* cf. *silvestris* Schreber, 1777 (Fig. 4)**

**Locality and record:** Aleppo Pinery [H72], 1.iii.2015: *I* (c-t).

**Ecologic remark:** It was took by camera-trap in woodland.

#### ***Felis chaus* Schreber, 1777 (Fig. 3)**

**Locality and record:** Akyatan [A10], 18.ii.2015: *I* (w); [A12], 2.v.2015: *I* (w); [A13], 19.ii.2015: *I* (w); [A15], 2.v.2015: *I* (w); [A2], 29.iv.2015: ? (d); [A21], 1-2.v.2015: *I* (c-t); [A25], 5-14.iv.2015: *I* (c-t); [A26], 6-29.iv.2015: *I* (c-t); [A27], 3-16.i.2015: *I* (c-t); [A29], 22.iii.-5.iv.2015: *I* (c-t); [A3], 17-18.iv.2015: *I* (c-t); [A34], 1.v.2015: ? (fp); [A9], 2-3.v.2015: *I* (c-t).

**Ecologic remark:** It was determined that *F. chaus* preferred swamps, reeds and forest areas as habitat. Although it could not be found in Aleppo Pinery, it was recorded in almost the entire area of Akyatan WDA. External measurements of a jungle cat, which was exhibited as a museum material in the VIIth regional directorate of NCNP, obtained near Akyatan WDA on 12.x.2014 as follow: the head and body 690, tail 290, hindfoot 58, ear length 43, shoulder height 390, neck diameter 240 mm. The weight of this individual was 7300 grams.



## Familia 4: HERPESTIDAE

***Herpestes ichneumon* (L., 1758)** (Fig. 4)

**Locality and record:** Akyatan [A6], 17-18.ii.2015: 2 (c-t); [A14], 29.iv.2015: 1 (w); [A18], 30.iv.2015: 2 (w); [A19], 1.v.2015: ? (d, fp); [A21], 1-2.v.2015: 1 (c-t); [A25], 5-14.iv.2015: 2 (c-t); [A26], 6-29.iv.2015: 1 (c-t); [A27], 3-16.i.2015: 1 (c-t); [A29], 22.iii.-5.iv.2015: 1 (c-t); [A30], 1.v.2015: ? (fp); [A33], 1.v.2015: 1 (w). Aleppo Pinery [H45], 16-17.v.2015: 1 (c-t); [H52], 17.v.2015: ? (d); [H55], 17.v.2015: ? (fp); [H64], 1.v.2015: 1 (w); [H71], 28.ii.2015: 1 (w).

**Ecologic remark:** It is diurnal and widely observed in both protection areas, particularly in suitable vegetation to hide. An adult was found dead on Çukurova University campus in 21.v.2015. Its measurements as follow: Head and body 650, tail 1120, hindfoot 98, ear 18 mm; weight 2.352 grams.

## Ordo 5: CETARTIODACTYLA

## Familia 1: SUIDAE

***Sus scrofa* L., 1758** (Fig. 4)

**Locality and record:** Akyatan [A1], 1.v.2015: ? (dig); [A9], 2-3.v.2015: 1 (c-t); [A21], 1-2.v.2015: 2 (c-t); [A22], 30.iv.2015: 1 (w); [A23], 1.v.2015: ? (fp) [A25], 5-14.iv.2015: 1 (c-t); [A26], 6-29.iv.2015: 1 (c-t); [A27], 3-16.i.2015: 1 (c-t); [A28], 30.iv.2015: 1 (w); [A29], 22.iii.-5.iv.2015: 3 (c-t); [A37], 29.iv.2015: 1 (w); [A40], 21.ii.2015: 2 (w). Aleppo Pinery [H57], 16.v.2015: ? (d).

**Ecologic remark:** The species, which was densely found in Akyatan WDA, was observed seasonally in Aleppo Pinery during the winter months when human pressure was low. It was determined more in forest areas with dense vegetation. Individuals sleeping in muddy places such as reeds and swamps were observed at certain times of the day. It was established that wild boar ate corn and peanuts in the fields as well as sea turtle eggs and invertebrates near the shore.

**Discussion**

The lists of the mammalian fauna of two protected areas in Karataş and Yumurtalık districts of Adana province were updated by this study. Accordingly, a total of 16 species of non-volant terrestrial mammals were reported here (Table 3). Of these, 13 species were identified from Akyatan WDA and 12 species in Aleppo Pinery. The Brown Rat, *Rattus norvegicus*, and the Palestine Mole-rat, *Spalax ehrenbergi* could not be found in this study, although they were formerly recorded from the region (Oruç, 2013). Of the animals reported here, one species is included in the list of Appendix-II, three species in Appendix-III by Bern Convention (2020); while two species are included in Appendix-II of CITES (2020). Two species are listed in Annex-I, which includes species under protection by the Ministry of Agriculture and Forestry; five species are given in Annex -II, which determined as game animals allowed to hunt in a certain period of the year and are partially protected by MAK (Central Hunting Commission “Merkez Av Komisyonu”) (DKMP, 2020). The species identified during the studies and their conservation status (CITES, Bern Agreement and MAK) are given in Table 3. Since all species were listed in the Red List as Least Concern (LC), IUCN categories were not included in Table 3.

On the other hand, the activity hours of some mammal species in two conservation areas were indicated and compared with the literature below (Table 1, 2).





*E. concolor* was recorded with the photo trap once in two areas. *C. suaveolens* was more common in Aleppo Pinery, and it was found only on the lagoon shore in Akyatan WDA.

Considering its faeces, footprint and direct observation, *L. europaeus* was estimated to be more common in Akyatan WDA than Aleppo Pinery. The larger area and the more suitable habitat in Akyatan WDA may be effective in this difference. It has been stated that it is most active between 24:00 and 08:00 hours (Akbaba, 2010), 18:00 and 20:00 (İlemin, 2010) for this species. In this study, it was most active at 19:00.

**Table 3:** Mammal species recorded in Akyatan WDA and Aleppo Pinery, and with their conservation statuses.

Species name	Turkish name	English vernacular name	CITES	BERN	MAK	Akyatan WDA	Aleppo Pinery
<i>Erinaceus concolor</i>	Kirpi	White-breasted Hedgehog	-	-	-	+	+
<i>Crocidura suaveolens</i>	Beyazdırlı Böcekçil	Lesser White-toothed Shrew	-	III	-	+	+
<i>Lepus europaeus</i>	Yabani Tavşan	European Hare	-	-	II	+	+
<i>Apodemus flavicollis</i>	Sarıyakalı Ormanfaresi	Yellow-necked Mouse	-	-	-	+	-
<i>Mus macedonicus</i>	Sarı Evfaresi	Macedonian Mouse	-	-	-	+	-
<i>Rattus rattus</i>	Sıçan, Keme	Black Rat	-	-	-	+	+
<i>Meriones tristrami</i>	Anadolu Çölfaresi	Tristram's Jird	-	-	-	+	-
<i>Hystrix indica</i>	Oklukirpi	Indian Crested Porcupine	-	-	-	-	+
<i>Canis aureus</i>	Çakal	Golden Jackal	-	-	II	+	+
<i>Vulpes vulpes</i>	Tilki	Red Fox	-	-	II	+	+
<i>Martes foina</i>	Kaya Sansarı	Beech Marten	-	III	II	-	+
<i>Meles meles</i>	Porsuk	Eurasian Badger	-	III	I	+	+
<i>Felis silvestris</i>	Yabankedisi	European Wildcat	II	II	-	-	+
<i>Felis chaus</i>	Sazkedisi	Jungle Cat	II	-	-	+	-
<i>Herpestes ichneumon</i>	Kuyruksüren	Egyptian Mongoose	-	-	I	+	+
<i>Sus scrofa</i>	Yaban domuzu	Wild Boar	-	-	I	+	+

*A. flavicollis* was trapped only in Aleppo Pinery; on the contrary, *M. macedonicus* was captured only in Akyatan WDA. *R. rattus* was caught mostly (12 individuals) in a stone pine plantation and less (4 individuals) in acacia plantation. The species was determined as a food source for owls and jungle cat in the field. Habitat loss was observed for *M. tristrami* due to the continuation of the stone pine afforestation in Akyatan WDA.

*H. indica* and its spines were found in Aleppo Pinery. Although it was recorded on the coast of neighboring Ağyatan lagoon, it was determined in Akyatan WDA, probably because its number was lower here. While the most active time of this porcupine was reported as 20:00 to 22:00 (İlemin, 2010), it was determined that it was most active at 04:00 in this study.

*C. aureus* was the most frequently recorded carnivorous in both areas. While using wider ways of the area in Akyatan WDA; it seemed to be shy in Aleppo Pinery and used intermediate paths. In there, the jackal, which was active mostly at night, was rarely observed during the daytime. It showed activity for both day and night in Akyatan WDA. The most active time of the jackal was 18:00 and 08:00 hours in Aleppo Pinery, while it was 05:00 in Akyatan WDA. In a study, the most active hour of the day was given as 04:00



(Soyumert, 2010). According to her data, the activity hours were similar in Akyatan WDA and different in Aleppo Pinery.

According to our findings, *V. vulpes* was more common in Aleppo Pinery than Akyatan WDA. The habitat of Akyatan was very suitable for the red fox; it was thought to be affected by the red fox by human activities in Aleppo Pinery and by the pressure of dense the golden jackal population in Akyatan WDA. Akbaba (2010) noted that fox populations were most affected by competition with other canids, human impact, and habitat changes. The most active hours were between 22:00 and 24:00 (İlemin, 2010), 20:00-24:00 (Akbaba, 2010), and were given as 21:00 (Soyumert, 2010). In this study, it was determined that the most active time in both protection areas was 05:00.

The activity time of *M. foina* was given as the hours 22:00 to 24:00 by İlemin (2010) and also 04:00, 20:00, and 22:00 by Soyumert (2010). It was recorded at 02:00 in Aleppo Pinery in our study. *M. meles* were found to be denser in Aleppo Pinery than Akyatan WDA and it was more active at midnight (24:00). Similarly, Soyumert (2010) reported the peak activation hour as 01:00.

A cat taken by a photo-trap in Aleppo Pinery [H72] may be a feral domestic cat or a hybrid of wild x domestic cat, with the slender end of the tail, although it was suitable for the European wildcat in terms of pattern. Therefore it was identified as *Felis* cf. *silvestris*. Russian zoologist Nikola Formozov (in litt., 05.iii.2014), who worked on the wildcats, expressed his opinion that this individual was *Felis silvestris*. On the other hand, the most active time of the day is between 22:00 to 24:00 (İlemin, 2010) or 21:00 (Soyumert, 2010). In this study, the single individual was recorded at 07:00 in the morning.

During our studies, *F. chaus* was more active at night, and it was most active at the hours 21:00, 24:00, 01:00, and 06:00. Despite our works; it was not found on Aleppo Pinery. All our records were from Akyatan WDA. In studies conducted between 2010 and 2012, 38 jungle cats were identified in the first trimester and 44 in the second trimester. In each study, similar results were obtained in the same area. However, when the photos were analyzed, it was seen that only 11 cats were common among the jungle cats detected in three months. At the end of the field studies, 71 individuals of jungle cats were determined (Diker & Diker, 2012). Another study was carried out within the scope of Species Conservation Action Plan on Jungle cat (*Felis chaus*) for Adana Province (Oruç, 2013). Its density can be estimated about 0.8 individual/ha<sup>2</sup>. According to these data, Akyatan WDA seems to be one of the places where the species is densely found in the whole distribution area.

*H. ichneumon* was widely observed in both conservation areas. By looking at the frequency of the photo trap data, Akyatan WDA was thought to have higher areal density. For this diurnal species, the most active hour was determined as 10:00 and 13:00 in Aleppo Pinery WDA.

The most active time of *S. scrofa* is between 17:00 and 21:00 (Soyumert, 2010) or 20:00 to 22:00 (İlemin, 2010). In this study, although it was observed that the wild boar was active in the daytime in Akyatan WDA, it was recorded as 21:00 hours when it was most active.

In conclusion, intense human activity in both areas, especially in Aleppo Pinery, was detected to affect the numbers and hours of activity of the large mammals living there. In addition, it is necessary to carry out studies to reduce human activities such as fishing, animal husbandry, and forestry by-products in terms of wildlife. While Indian crested porcupine, beech marten, red fox, and Eurasian badger were recorded in small numbers, wild boar, golden jackal, and Egyptian mongoose were found relatively frequently. Since the systematic status of a single "wild" cat is unclear, molecular studies need to be done. The population of





jungle cat in Akyatan WDA was relatively good. This area is the most critical conservation area for this species in Turkey. Continuation of monitoring studies is important for the protection of the species. In addition, the beaches in both areas are important breeding areas for sea turtles. Sea turtles' eggs are effective in keeping the food chain balanced in these areas. The conservation status of the two protected areas should be continued since it is extremely important to protect the biological richness of Turkey.

## Acknowledgments

This article was produced from M. Arslan's master's thesis prepared under the supervision of A. Karataş who prepared for publication. We would like to thank Biologist Sercan Bilgin for their contribution and TR General Directorate of Nature Conservation and National Parks for the land permit.

## References

- Akbaba, B. 2010. Çamlıdere-Çamkoru Bölgesi'ndeki (Ankara) tilkilerin (*Vulpes vulpes* L. 1758) habitat kullanım ve beslenme davranışlarının incelenmesi. MSc thesis. Hacettepe Üniversitesi Fen Bilimleri Enstitüsü, Ankara 88 pp. (in Turkish).
- Anonymous 2014. Adana İli'nin karasal biyolojik çeşitlilik ve iç su ekosistemleri biyolojik çeşitlilik envanter ve izleme işi sonuç raporu. Doğa Araştırmaları Derneği (DAD), Ankara, pp. 672-705 (in Turkish).
- Anonymous 2016. Akyatan ve Tuzla Lagünleri Yönetim Planı (2013-2017). Doğa Araştırmaları Derneği (DAD), Ankara, 170 pp. (in Turkish).
- Bern Convention 2020. Bern Convention on the Conservation of European Wildlife and Natural Habitats, <https://www.coe.int/en/web/bern-convention/appendices>, accessed on 04.X.2020.
- Can, Ö. E. 2008. Camera trapping large mammals in Yenice forest habitats: A feasibility study for camera trapping large mammals in Yenice forests. PhD thesis. M.E.T.U., Institute of Science, Ankara, 118 pp.
- CITES 2020, Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendices I, II & III, <https://cites.org/eng/app/index.php>, accessed on 04.X.2020.
- Çolak, M. 2007. Kilis ve Şanlıurfa illerinden toplanan peletlerle, Peçeli Baykuş, *Tyto alba* (Scopoli, 1769) ve Kukumav, *Athene noctua* (Scopoli, 1769)'nın besin analizi. MSc thesis. Niğde Üniversitesi Fen Bilimleri Enstitüsü, Niğde, 45 pp. (in Turkish).
- Diker, H., Diker, E. 2012. Akyatan Yaban Hayatı Geliştirme Sahası (Adana) Saz kedisi (*Felis chaus*) popülasyonu araştırılması, izlenmesi ve korunması çalışması. WWF-Türkiye (Doğal Hayatı Koruma Vakfı), İstanbul. (in Turkish).
- DKMP 2020. Republic of Turkey Ministry of Agriculture and Forestry General Directorate of Nature Conservation and National Parks, <https://www.tarimorman.gov.tr/DKMP>, accessed on 04.X.2020.
- Dobroruka, L. J. 1989. A Field Guide Mammals. Hamlyn, London.
- Elbroch, M. 2003. Mammal Tracks & Sign. Stackpole Books, China.
- Ertürk, A. 2010. Bartın İli ve çevresinde *Canis lupus* L. 1758'in (Carnivora: Canidae) (kurt) CBS tabanlı habitat uygunluğu analizleri ve tür yayılımı modellenmesi. MSc thesis. Hacettepe Üniversitesi Fen Bilimleri Enstitüsü, Ankara, 78 pp. (in Turkish).
- IUCN 2020. The IUCN Red List of Threatened Species, <https://www.iucnredlist.org/>, accessed on 04.X.2020.



- İlemin, Y. 2010. Datça-Bozburun Yarımadası orta ve büyük memeli türlerinin vejetasyon tiplerine bağlı dağılımının belirlenmesi. MSc thesis. Hacettepe Üniversitesi Fen Bilimleri Enstitüsü, Ankara, 89 pp. (in Turkish).
- Kryštufek, B., Vohralík, V. 2001. Mammals of Turkey and Cyprus. Vol. I: Introduction, Checklist and Insectivora. Zložba Annales, Koper.
- Kryštufek, B., Vohralík, V. 2009. Mammals of Turkey and Cyprus. Rodentia II: Cricetinae, Muridae, Spalacidae, Calomyscidae, Capromyidae, Hystricidae, Castoridae. Zložba Annales, Koper.
- Kütükçü, A. E. 2016. Türkiye'deki Memeli Hayvanların İz Rehberi. WWF-Türkiye (Doğal Hayatı Koruma Vakfı), PrintWorld Matbaa San. Tic. A.Ş., İstanbul, 62 pp. (in Turkish).
- MGM 2016. Meteoroloji Genel Müdürlüğü, <http://www.mgm.gov.tr/genel/meteoroloji.aspx>, accessed on 10.III.2016.
- Oruç, A. 2013. Doğal Hayatı Koruma Vakfı, Adana İli Saz Kedisi (*Felis chaus*) Tür Koruma Eylem Planı. WWF-Türkiye (Doğal Hayatı Koruma Vakfı), İstanbul, 147 pp. (in Turkish).
- Soyumert, A. 2010. Kuzeybatı Anadolu ormanlarında fotokapan yöntemi ile büyük memeli türlerinin tespiti ve ekolojik özelliklerinin belirlenmesi. Doktora Tezi. Hacettepe Üniversitesi Fen Bilimleri Enstitüsü, Ankara, 141 pp. (in Turkish).
- WWF-Türkiye 2008. Akyatan'ın Yaban Yüzü, İstanbul, 64 pp. (in Turkish).
- Yiğit, N., Çolak, E., Sözen, M., Karataş, A. 2006. Rodents of Türkiye, Meteksan, Ankara.