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Status and distribution of the Striped Hyaena, *Hyaena hyaena*, in Turkey: an updated assessment (Carnivora: Mammalia)

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Abstract: The Striped Hyaena, *Hyaena hyaena*, extends its distribution in the north into Turkey, where it has always been rare. In a status assessment conducted by Kasparek et al. in 2004, it was shown that the species is at the brink of extinction. We compiled information from different sources including a press survey and camera trapping in different parts of the country. The situation has even deteriorated since then. The population has strongly decreased, in particular, in the Marmara and Mediterranean regions, and presently the species survives in Western Anatolia only in some small relict populations in Manisa, İzmir, Muğla, and Bilecik provinces. The situation is different in southeastern Turkey, including the province of Hatay. The species could survive there and regular reports in the press (e.g., road kills) indicate that the species is still widespread and not extremely rare. Several animals were confirmed to live in a nature reserve established for the protection of Striped Hyaenas in the Hatay province. Altogether, the present-day distribution range of the Striped Hyaena in Turkey is split into two parts: a highly threatened relict populations in the west and a larger, slightly less threatened population in the southeast. This means that the species has lost about half of its distribution area in Turkey during the last three or four decades. If serious protective precaution measures are not taken, the Striped Hyaena population in western Anatolia will be completely lost in the near future.

Key words: Distribution, status assessment, camera trapping, conservation

1. Introduction

The Striped Hyaena, *Hyaena hyaena*, has a very large, albeit presently patchy distribution in Africa, Asia, and the Middle East. Its northern range extends into Turkey, where it occurs as far as Western Anatolia. The status and distribution of the striped hyena in Turkey was reviewed by Kasparek et al. (2004) more than a decade ago, who concluded that the species was on the verge of local extinction. They also noted that due to its secretive lifestyle, the species' status was difficult to assess and many occurrences may have been overlooked. Often, local people (e.g., herdsmen) were not aware of the presence of the species in their territory. Since the publication of Kasparek et al. (2004), new information has become available on the species' distribution and status in Turkey. Most of this information comes from the newspaper reports. İlemin and Gürkan (2010) performed a photo trap study in Muğla province, but could not obtain any Hyaena records. Akay et al. (2011) studied the distribution of the species in Hatay province, close to the border with Syria, where, in 2005, the Turkish government has established a "Wildlife Protection and Improvement Area" aimed primarily at the conservation of the Striped Hyaena. Meserve (2012) reviewed historical and cultural aspects of Striped Hyaena in detail. Akarsu (2014) prepared a species action plan for Şanlıurfa province in southeastern Turkey, and Çoğal et al. (2016, 2017) performed the first camera trapping study in the Kırıkhan region in Hatay province.

The purpose of this paper is to compile the scattered information on the occurrence of the Striped Hyaena in Turkey in order to update its status assessment since Kasparek et al. (2004). Additional information was gathered in course of the camera trapping study carried out in the Kırıkhan region of Hatay province, and in the Marmaris region of Muğla province.

2. Materials and methods

We reviewed the literature and available internet resources for any possible records of the Striped Hyaena. Internet sources were regarded as reliable only when

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the photographs were provided. Some information was additionally obtained from the interviews with local people in the Aegean region, as well as from anecdotal evidence provided by our colleagues.

In the Kırıkhan region of Hatay province, we placed 17 passive infrared cameras (Bushnell, Natureview, Overland Park, KS, USA) along a line between 36°25' N, 36°33' E and 36°48' N, 36°36' E. Camera trap locations were provided previously by Çoğal and Sözen (2017) in Figure 1 therein. Camera traps were placed on the 22nd of May 2016 according to the protocol of Sanderson (2004). We followed Silver et al. (2004) and Kelly and Holub (2008) methods for processing of the camera trap records. Most of the camera traps were collected in early October 2016, but CT4 was left in the same area. CT4 records were collected in the mid October 2017. The study area features two main habitat types: (i) the dry steppe with scattered vegetation and a few agricultural patches in the south, and (ii) the agriculture-free lava flow habitat (Leçelik), containing a few freshwater springs in the north. Eight camera traps were set in the steppe area, and nine in the lava flow area. The altitude of the study sites varies between 150 m and 410 m a.s.l.

The second camera trapping study, using the same methodology, was conducted from December 2014 to February 2017, with 29 camera traps in Köyceğiz and Marmaris area (İlemin, 2017). In this study, we recorded a total of 15,372 camera trap days (Figure 2).

All available records of Striped Hyaena were divided into two periods: pre-2004 (i.e. before the Kasparek et al. 2004 study) and post-2004 to assess the recent changes in the species status.

3. Results and discussion

3.1 Camera trapping studies

In Hatay province, the Striped Hyaena is known to survive in the Altınözü Hills (Akay et al., 2011), where a 358 km² protected area ("Important Natural Area") has been established for this species in 2005 (Official Newspaper [Resmi Gazete], 16.10.2005), following the local discovery of the species in early 2000s (Kasparek et al., 2004). In our camera trapping study there, we recorded a total of 890 photographs of wildlife over 1619 camera trap nights. The records of the Striped Hyaena were obtained from three stations in the steppe area (altitudes 175–226 m a.s.l.): We got 23 records from three cameras, including nine records

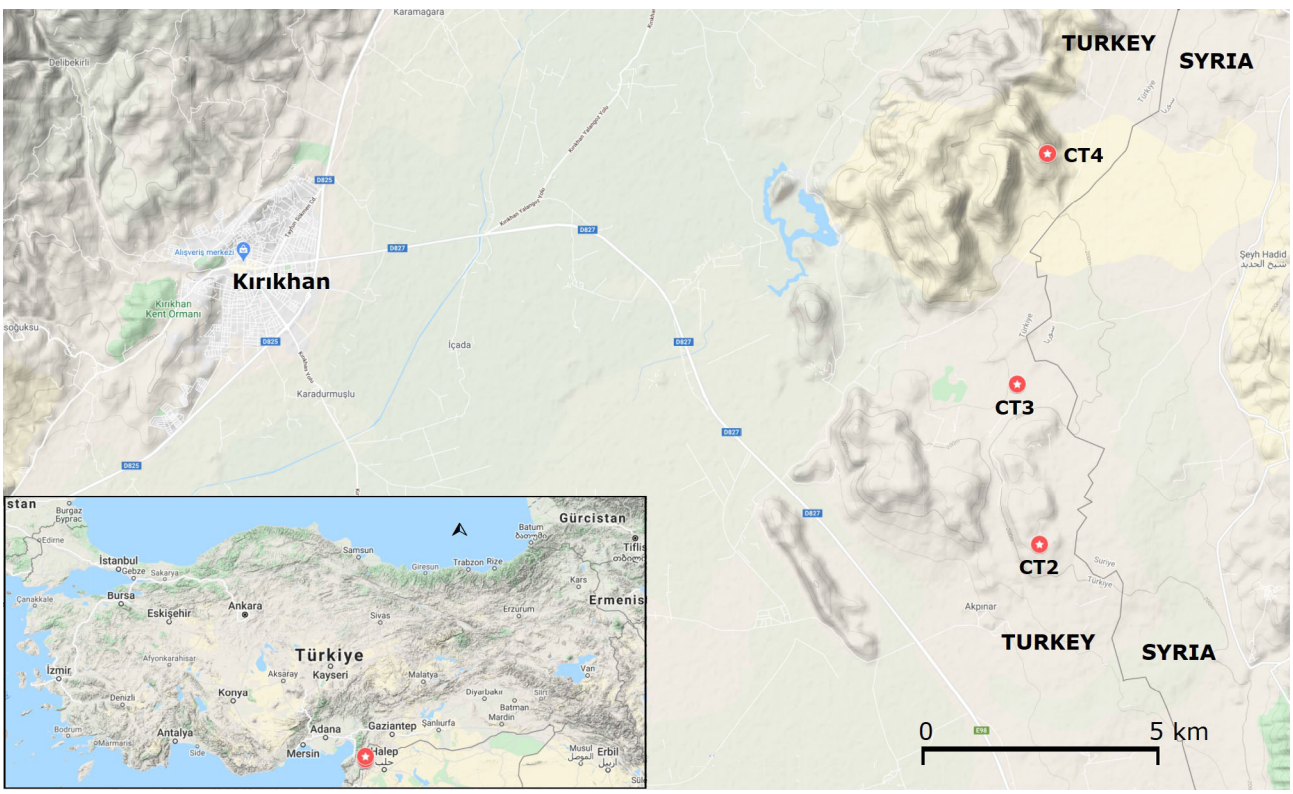


Figure 1. Striped Hyaena recorded camera trap locations in Hatay province.

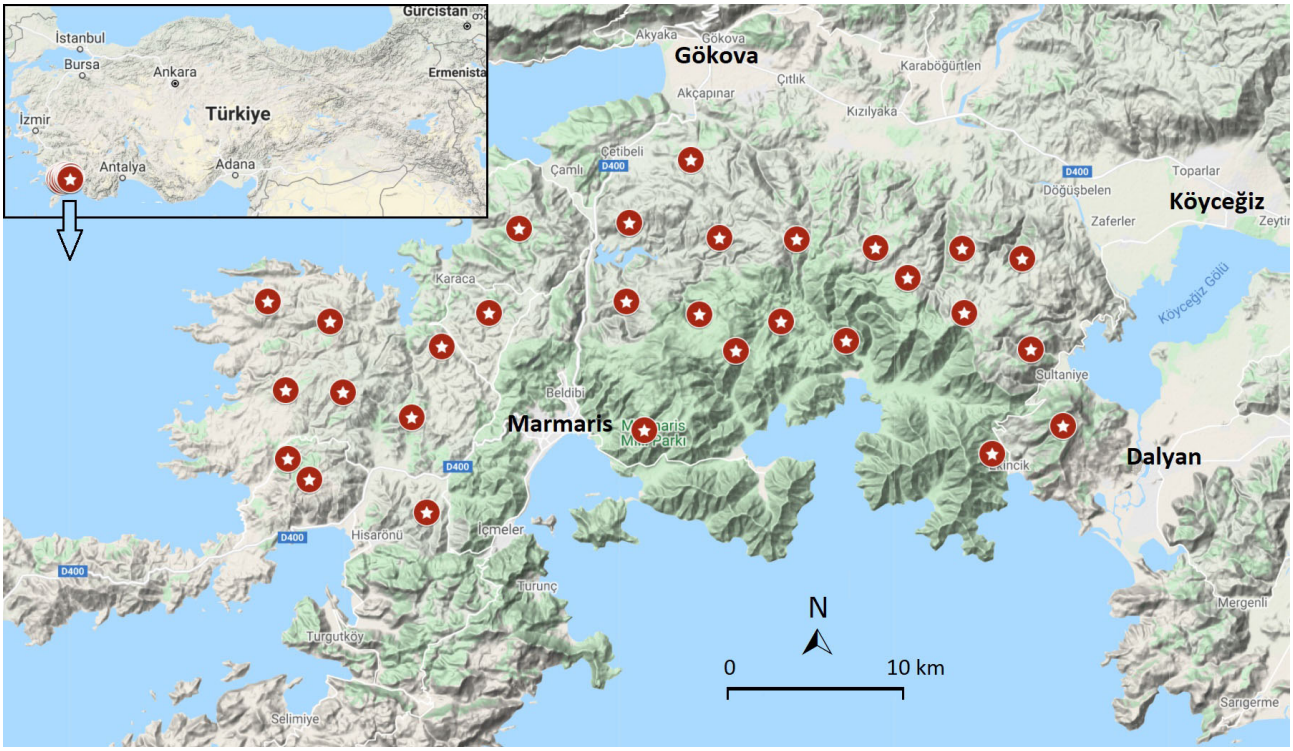


Figure 2. Camera trap locations in Muğla province.

from station CT 2 (37 S 280076E/ 4036142N) in 2016, one record from station CT 3 (37 S 279680E/ 4039578N) in 2016, five records and eight records from station CT 4 (37 S 280457E/ 4044498N) in 2016 in 2017, respectively (Figure 1). The detection rate for the Striped Hyaena obtained generally by trapping animals according to the total camera trapping days (CTD) was close to one (23 events, 1.42%) per 100 CTD. We did not obtain any Striped Hyaena records from the lava flow area. These findings show that the Striped Hyaena continues to survive in the Hatay region and prefers the steppe area.

In our second camera trap study in Marmaris, Köyceğiz, and Gökova area in Muğla province (Figure 2), from December 2014 to February 2017, no hyaena record was made despite 15,372 camera trap nights. In the previous study in nearby Datça and Bozburun Peninsulas (6863 camera trap nights logged between December 2007 and August 2008), no Striped Hyaena records were made as well (İlemin and Gürkan, 2010). We may conclude that the Striped Hyaena is now likely to be absent in this region. Anecdotal evidence exists that the Striped Hyaena was living in the area 10–20 years ago. In several other camera trap studies on the occurrence of large mammal conducted in the Marmara (Table), Aegean (Giannatos et al., 2006; Soyumert et al., 2010; Ilemin and Gürkan, 2010; Ilemin, 2014; İlemin, 2017), Central (Akbaba and Ayaş, 2012), and Mediterranean (Albayrak et al., 2012) regions, no Striped Hyaena was recorded.

3.2. Doubtful press news from western part of Turkey

In Western Anatolia, the limited anecdotal evidence on the occurrence of the Striped Hyaena may be considered doubtful. A local news article mentions a herdsman from Söke claiming that an odd animal had killed and ate his dogs and sheep (yeniasır/ 2012 in Table). The news also mentioned that a wildlife expert Dr. Can Bilgin from Middle East Technical University (Ankara) went there and performed a study to identify the hunter animal. Dr. Can Bilgin explained to us that he could not get enough data to identify the animal as Striped Hyaena. He also set some photo traps in the area and could not get any photos of Hyaena. The Söke record should therefore be considered unreliable. In one other news (milliyet/ 2013, Table) a herdsman from Burunköy village of Söke reported that a dead carnivore pup, possibly a Hyaena, was killed by his dogs. However, the genetic analysis identified this specimen as Golden Jackal and not a Hyaena (Dr. Can Bilgin, pers.comm.).

A more recent news came from the Marmaris (Table) region, mentioning a hunter who shared the photo of a Hyaena on the internet. However, the national park officers

informed us that the person came from south eastern Turkey, and the photo was taken there, so the record was not from the Aegean region of Turkey.

3.3. Reliable press news and interviews from western part of Turkey

In another news from the Bilecik region in Marmara region, (Table) the local villagers claimed that a strange animal killed about 20 of their dogs, and mentioned that these animals had a spotted coat pattern, unlike the striped pattern characteristic for the Striped Hyaena. However, when we showed the photograph of the Striped Hyaena to the locals, they could recognise the animal they have seen previously. The stripes on the Striped Hyaena coat are very definite, and may sometimes be described as spotted. In the interviews conducted by Dr. Can Bilgin in Selöz village of Bilecik, descriptions of the Striped Hyaena were clear, leading to his conclusion of the Striped Hyaena being present in the area (Dr. Can Bilgin, pers. comm). We therefore consider this record as reliable and include the Bilecik into a current distribition range of the species (Figure 3). On par with the historical record of Rigler (1852) from İznik, Bilecik could be the most northern district having the actual record of Striped Hyaena in Turkey.

A very interesting and unexpected distribution record was supplied from Sait Karaman, an officer in National Parks in Ankara. According to that record, the Striped Hyaena was hunted in 2013 around the Mihalıççık town of Eskişehir province in Central Anatolia. The specimen found and the photograph provided to us were identified undoubtedly as a Striped Hyaena. The officer Sait Karaman mentioned that the National Park officers found the hunter, and the punitive measures were applied. The records from Bilecik and Eskişehir imply that a population may survive between these two localities (Figure 4).

Finally, a local hunter, Mahmut Limnili, reported to us that he hunted a Striped Hyaena in 2011 around a ranger school in Foça, İzmir and skinned it. One of Mahmut Limnili's hunter mates mentioned that he also saw a Striped Hyaena in August 2017 around the Foça prison. Mahmut Limnili explained that his friend is able to identify the Striped Hyaena very well. These observations showed that Striped Hyaena might still survive around Foça, İzmir. The next record came from Alp Giray, who explained us that he saw a Striped Hyaena while walking in the north side of the Sandras Mountain in Köyceğiz, and his description clearly suggested a Striped Hyaena.

Interviews conducted in February 2017 with the local hunters, villagers, and farmers in Manisa and İzmir Provinces in the Aegean region revealed that a dog attack on a Striped Hyaena around Kemiklidere village in Manisa Province in 2016. The villagers showed us photographs of the animal and we able to clearly identify it as a Striped Hyaena. Villagers in Karaçam village of Soma town, Nuriye and Yeni Osmaniye villages of Saruhanlı town, Sakarkaya village of Akhisar town in Manisa Province, and Tokatbaşı village of Bayındır town in İzmir province mentioned that they have seen the Striped Hyaenas in recent years. The villagers explained that the species shelters in olive orchards, where they can remain undisturbed for most of the year, except for a short olive harvesting period.

3.4. Striped Hyaena records from southeastern Turkey mostly because of road kill events

No detailed study on Striped Hyaena has been conducted in south eastern Turkey. Most of the recent media reports from this region come from the area between Gaziantep and Şırnak, and refer to the road kill events (Figure 4). This situation implies that a reasonably common population of Striped Hyaena exists in the south eastern Turkey. The Species Protection Action Plan on Striped Hyaena was conducted in Şanlıurfa Province (Akarsu, 2014), and this plan also considers that the species is common in Şanlıurfa region.

3.5. Though some unreliable, some recent reliable records come from eastern Turkey

A recent press news reported a Striped Hyaena killed by a train in Divriği in Sivas province in Eastern Anatolia. The photographs showed that the animal was undoubtedly a Striped Hyaena, making it the only train hit record from Turkey. However, to understand and explain how a secret animal like Striped Hyaena can be killed by a train is not easy. On the other hand, most of the Striped Hyaena records from Turkey were coming from road kill events, and this situation would imply that, when this animal lives around railways, train kill events may also happen. Fortunately, railway lines are very rare in southeastern Turkey. We visited the National Park Office in Sivas to get data about the Striped Hyaena. The biologists Eray and Güray Şimşek from the National Park Office in Sivas mentioned that the point where the Striped Hyaena was hit by train was located between a river cliff, with very steep slopes in both directions. This difficult terrain had probably contributed to the animal's being hit, combined with the dazzling light from the approaching train. The fact that most of the Southeast Anatolian records are because of car hits suggests that the train hit event at Sivas may also be realistic. The National park officers mentioned that the local people have seen the Striped Hyaena in the area for decades. A population of the Striped Hyaena might therefore be native to the area, and the National park is planning a photo trap study to get more data about the Striped Hyaena in Sivas Province. Fortunately, railroads are rare in southeastern Turkey and so pose much lesser threat compared to the automobile roads.

Özgür Demircioğlu (pers. comm.) reported to us that he saw a Striped Hyaena near Akpınar Village of Hozat

Table. Records of the Striped Hyaena *Hyaena hyaena* from Turkey since the publication by Kasparek et al. (2004). CT: camera trap, RTr: radio telemetry record, Rk: road kill, Tk: train kill, Int: interview, Hnt: hunting, News: newspaper news

Locality	Record year	Record type	References/URL*
Marmara region			
Selöz village, Bilecik	2010	Int.	Posta [Online]. Website https://www.posta.com.tr/bilecikte-sirtlan-panigi-52702 [accessed 07.12.2010]. Can Bilgin pers. com.
Hamdibey village, Yenice, Çanakkale	1996	Int.	Önder Aslan and Sait Karaman
Aegean region			
Foça, İzmir	2011, 2017	Int.	Mahmut Limnili prs. com.
North slopes of Sandras Mountain, Köyceğiz, Muğla	2003	Int.	Alp Giray pers. com.
Karaçam village, Soma, Manisa	2016	Int.	This study
Eğnez village, Soma, Manisa	2016	Int.	This study
Yeni Osmaniye village, Saruhanlı, Manisa	2016	Int.	This study
Kemiklidere village, Saruhanlı, Manisa	2016	Int.	This study
Sakarkaya village, Akhisar Manisa	2016	Int.	This study
Tokatbaşı village, Bayındır, Izmir	2016	Int.	This study
Mediterranean region			
Akçakoyunlu village, Pazarcık, Kahramanmaraş	2020	CT	Hürriyet [Online]. Website https://www.hurriyet.com.tr/gundem/kahramanmarasta-cizgili-sirtlan-ve-porsuk-fotokapanla-goruntulendi-41499868 [accessed 21.04.2020]. The exact locality was taken from Sait Karaman (DKMP)
Zorkun plateau, Osmaniye	2017	CT	Hürriyet [Online]. Website https://www.hurriyet.com.tr/gundem/amanoslarda-ilk-kez-sirtlan-goruntulendi-40480931 [accessed 06.06.2017].
Akpınar village, Hatay	2016	CT	**Çoğal** et al. 2016; **Çoğal** et al. 2017; **Çoğal** and Sözen 2017; This study
Sucu village, Hatay	2016	CT	**Çoğal** et al. 2016; **Çoğal** et al. 2017; **Çoğal** and Sözen 2017; This study
Incirli village, Hatay	2016	CT	**Çoğal** et al. 2016; **Çoğal** and Sözen 2017; This study
Pazarcık, Kahramanmaraş	2014	RTr	İhlas Haber Ajansı [Online]. Website https://www.iha.com.tr/kahramanmaras-haberleri/yarali-cizgili-sirtlan-kurtarilamadi-850643/ [accessed 27.09.2014].
Uluyol village, Hatay	2012	Int.	Ali Tekbaş pers. com.
Antakya, Hatay	2008	Rk	CNNTürk [Online]. Website https://www.cnnturk.com/2008/yasam/diger/12/19/hatayda.olu.cizgili.sirtlan.bulundu/505445.0/index.html [accessed 19.12.2008].
Antakya, Hatay	2005	Rk	Haber7 [Online]. Website https://www.haber7.com/guncel/haber/101531-hatayda-bir-koyu-sirtlanlar-basti [accessed 08.07.2005].
Kırıkhan, Hatay	2019	CT	Cumhuriyet [Online]. Website https://www.cumhuriyet.com.tr/video/video/1426138/Hatay_dag_ [accessed 05.06.2019].
Around Mountain Gazelle reproduction centre, İncirli village, Hatay	2017	CT	This study
South-East Anatolia region			
Dandırmaz village, Adıyaman	2020	Hunt.	Haberler.com [Online]. Website https://www.haberler.com/cizgili-sirtlani-kopeklere-parcalatip-tufekle-13255869-haberi/ [accessed 24.05.2020].
Nemrut Mt., Kahta, Adıyaman	2020	CT	Haberler.com [Online]. Website https://www.haberler.com/cizgili-sirtlan-fotokapana-takildi-12811829-haberi/ [accessed 13.01.2020].

Table. (continued)

Locality	Record year	Record type	References/URL*
Kızılin village, Besni, Adıyaman	2020	News	İzmirGazetesi [Online]. Website https://www.izmirgazetesi.com.tr/cevre/cizgili-sirtlan-objektiflere-yakalandi-h9421.html [accessed 08.05.2020].
Şanlıurfa-Birecik way	2020	Rk	Urfanatik [Online]. Website https://www.urfanatik.com/haber/3593237/sanliurfada-cizgili-sirtlan-kazada-oldu [accessed 16.01.2020].
Takoran valley, Siverek, **Şanlıurfa**	2020	News	Başak [Online]. Website https://basakgazetesi.com/haber/cizgili-sirtlani-kurtarmak-icin-geceyarisi-seferber-oldular-90540.html [accessed 22.06.2020].
Aydınpınar village, Kahta, Adıyaman	2020	News	Habertürk [Online]. Website https://www.haberturk.com/adiyaman-haberleri/78848170-adiyamanda-coban-cizgili-sirtlani-fotografladi [accessed 20.06.2020].
Besni, Adıyaman	2020	News	Demirören Haber Ajansı [Online]. Website https://www.youtube.com/watch?v=a1XYqopcXRs [accessed 03.05.2020].
Kayseri village, Siverek, Şanlıurfa	2020	Rk	Gapgündemi [Online]. Website http://gapgundemi.com/haber-olu-cizgili-sirtlan-bulundu-51136.html [accessed 22.01.2020].
Karaköprü, **Şanlıurfa**	2019	News	Hürriyet [Online]. Website https://www.hurriyet.com.tr/gundem/sanliurfada-cizgili-sirtlan-yavrusutelef-oldu-41171192 [accessed 03.04.2019].
Kömürler village, Nurdağı, Gaziantep	2019	Rk	Habertürk [Online]. Website https://www.haberturk.com/gaziantep-haberleri/71810956-nurdaginda-aracin-carptigi-cizgili-sirtlan-telef-oldu [accessed 13.09.2019].
Araban, Gaziantep	2019	News	Twitter [Online]. Website https://twitter.com/GaziantepDkmp/status/1192512485816975361 [accessed 17.11.2019].
Batı Raman way, Batman	2018	Rk	Batman Yön Gazetesi [Online]. Website http://www.batmanyon.com/haber/20335/cizgili-sirtlan-olu-olarak-bulundu#.WxlEXBuTHNc.twitter [accessed 07.06.2018].
Demirbilek village, Batman	2018	Rk	Ilkha [Online]. Website https://ilkha.com/guncel/batmanda-bir-cizgili-sirtlan-daha-telef-oldu-78832 [accessed 01.07.2018].
Sivrice village, Midyat	2017	Int	Berivan Aslan pers. com.
Birecik, **Şanlıurfa**	2017	Rk	Hürriyet [Online]. Website https://www.hurriyet.com.tr/birecikte-cizgili-sirtlan-kazada-telef-oldu-40343363 [accessed 22.07.2017].
Akziyaret village, **Şanlıurfa**	2017	Rk	Habertürk [Online]. Website https://www.haberturk.com/yerel-haberler/haber/12260517-aracin-carptigi-cizgili-sirtlan-telef-oldu [accessed 15.06.2017].
Çifthisar village, Gerger, Adıyaman	2017	Rk	Milliyet [Online]. Website https://www.milliyet.com.tr/gundem/gergerde-telef-olmus-sirtlan-bulundu-2530396 [accessed 03.10.2017].
Besni, Adıyaman	2016	Rk	Yaman Haber [Online]. Website http://www.yamanhaber.com/haber/5749/servis-aracinin-carptigi-cizgili-asya-sirtlani-telef-oldu.html [accessed 01.08.2016].
Kahta, Adıyaman	2016	Rk	Milliyet [Online]. Website https://www.milliyet.com.tr/gundem/otomobilin-carptigi-cizgili-sirtlan-oldu-2194239 [accessed 14.02.2016].
Suçeken, Batman	2016	Rk	Ihlas Haber Ajansı [Online]. Website https://www.iha.com.tr/batman-haberleri/koruma-altindaki-cizgilisirtlan-trafik-kazasi-kurbani-oldu-1583229/ [accessed 29.12.2016].

Table. (continued)

Locality	Record year	Record type	References/URL*
Demirkuyu village, Silvan, Diyarbakır	2016	Rk	Diken [Online]. Website http://www.diken.com.tr/en-buyuk-zarar-yine-insandan-nesli-tukenmekte-olan-sirtlan-araba-carpmasi-sonucu-oldu/ [accessed 12.03.2016].
Battal village, Gaziantep	2016	Rk	Youtube [Online]. Website https://www.youtube.com/watch?v=FckNsJnqiII [accessed 20.06.2016].
Artuklu, Mardin	2015	Rk	Iletişim [Online]. Website https://www.mardiniletisimgazetesi.com.tr/cizgili-sirtlan-otomobil-carpmasi-sonucu-oldu/ [accessed 06.01.2015].
Türkmenören village, Bozova, Şanlıurfa	2015	Rk	Tramem [Online]. Website http://www.tramem.org/memelile r/?fsx=2fsdl22@d&sxc=1&id=989#.YE6EhpxR1PZ [accessed 15.01.2016].
Kahta, Adıyaman	2014	Rk	Ihlas Haber Ajansı [Online]. Website https://www.iha.com.tr/adiyaman-haberleri/yarali-cizgili-sirtlankurtarilamadi-850643/ [accessed 27.09.2014].
Subaşı köyü, Batman	2014	Rk	Milliyet [Online]. Website https://www.milliyet.com.tr/yerel-haberler/batman/nesli-tukenmekte-olan-cizgili-sirtlan-trafik-kurbani-oldu-ozel-haber-10488968 [accessed 24.11.2014].
Karkamış, Gaziantep	2014	CT	Akarsu 2014
Nizip, Gaziantep	2014	CT	Akarsu 2014
Birecik, Şanlıurfa	2014	CT	Akarsu 2014
Bağlarbaşı, Şanlıurfa	2014	CT	Akarsu 2014
Halfeti, Şanlıurfa	2014	CT	Akarsu 2014
Bozova, Şanlıurfa	2014	CT	Akarsu 2014
Kızıltepe, Mardin	2014	Rk	Haberler.com [Online]. Website https://www.haberler.com/koruma-altindaki-sirtlana-arac-carpti-6492028-haberi/ [accessed 17.09.2014].
Yeşilli, Mardin	2014	Rk	Hürseda Haber [Online]. Website https://hurseda.net/yerel/99175-mardinde-cobanlara-sirtlan-cezasi.html [accessed 16.01.2014].
Şanlıurfa	2013	CT	Haber7com [Online]. Website https://www.haber7.com/hayvanlar-alemi/haber/1014038-bu-sirtlan-bir-ilimizde-goruntulendi [accessed 14.04.2013].
Kahta, Adıyaman	2013	Rk	Milliyet [Online]. Website https://www.milliyet.com.tr/gundem/anadolu-sirtlani-trafik-kurbani-1701171 [accessed 30.04.2013].
Gercüş, Batman	2012	Rk	Haber7com [Online]. Website https://www.haber7.com/hayvanlar-alemi/haber/935809-batmanda-cizgili-sirtlanbulundu [accessed 03.10.2012].
Nizip, Gaziantep	2012	Hnt	Star [Online]. Website https://www.star.com.tr/guncel/gaziantepte-sok-eden-sirtlan-avi-haber-689004/ [accessed 14.09.2012].
Gölbaşı, Adıyaman	2011	Rk	Adıyamansonhaber [Online]. Website http://www.adiyamansonhaber.com/ [accessed 14.05.2011].
Araban, Gaziantep	2010	Rk	Internethaber [Online]. Website https://www.internethaber.com/gaziantepe-olu-sirtlan-bulundu-256612h.htm [accessed 30.05.2010].
Birecik, Şanlıurfa	2010	Rk	Sabah [Online]. Website https://www.sabah.com.tr/yasam/2010/10/24/kazada_olen_sirtlani_fotograflama_yarisi?paging=2 [accessed 24.10.2010].

Table. (continued)

Locality	Record year	Record type	References/URL*
Merkez, Adıyaman	2006	Rk	Internethaber [Online]. Website https://www.internethaber.com/canavar-sirtlan-cikti-34915h.htm [accessed 30.07.2006].
Suçeken village, Gercüş, Batman	2017	Rk	Ilkha [Online]. Website https://ilkha.com/guncel/batmanda-bir-cizgili-sirtlan-daha-telef-oldu-65300 [accessed 28.11.2017].
Demirbilek village, Baman	2018	Rk	Ilkha [Online]. Website https://ilkha.com/guncel/batmanda-bir-cizgili-sirtlan-daha-telef-oldu-78832 [accessed 01.07.2018].
Akziyaret village, Şanlıurfa	2017	Rk	CNNTürk [Online]. Website https://www.cnnturk.com/turkiye/sanliurfada-cizgili-sirtlan-kazada-oldu [accessed 15.06.2017].
Aydınpınar village, Kahta, Adıyaman	2016	Rk	Habertürk [Online]. Website https://www.haberturk.com/video/haber/izle/otomobilin-carptigi-cizgili- [accessed 14.02.2016].
Hilvan, Şanlıurfa	2017	Rk	Edessatv [Online]. Website http://www.edessatv.com/sanliurfa/sanliurfada-aracin-carptigi-cizgili-sirtlan-telef-oldu-h23402.html [accessed 15.06.2017].
Karagüveç village, Besni, Adıyaman	2019	Hnt	Sputniknews [Online]. Website https://tr.sputniknews.com/turkiye/201904161038780435-nesli-tukenme-tehlikesi-altindaki-cizgili-sirtlani-kopeklere-parcalatan-kisiler-arastiriliyor-/Inner/ [accessed 16.04.2019].
Inner Anatolia and East Anatolia regions			
Divriği, Sivas	2017	Tk	Milliyet [Online]. Website https://www.milliyet.com.tr/yerel-haberler/sivas/trenin-carptigi-cizgili-sirtlan-telef-oldu-11755488 [accessed 04.01.2017].
Mihalıççık, Eskişehir	2013	Hunt.	Photo and data were taken from Sait Karaman (DKMP)
Şırnak	2013	CT	AA [Online]. Website https://www.aa.com.tr/tr/yasam/sirnakta-cizgili-sirtlan-goruntulendi/205790 [accessed 08.11.2013].
Çukurca, Hakkari	2014	Rk	Yüksekovahaber [Online]. Website https://www.yuksekovahaber.com.tr/haber/koruma-altindaki-sirtlan-trafik-kurbani-138644.htm [accessed 16.09.2014].
Akpınar Köyü, Hozat, Tunceli	2001	Int.	Özgür Demircioğlu pers. com.
Records that are regarded as "not reliable" by us			
Söke, Aydın	2012	Youtube	Youtube [Online]. Website https://www.youtube.com/watch?v=IPlh2m6dTM4 [accessed 14.02.2012].
Söke, Aydın	2012	News	Yeniasır [Online]. Website https://www.yeniasir.com.tr/gundem/2012/02/02/soke-canavari-sirtlan-cikti [accessed 02.02.2012].
Undefinite, possible Jordan	2017	Youtube	Youtube [Online]. Website https://www.youtube.com/watch?v=KqB82N1Tyjg [accessed 01.03.2017].
Burunköy village, Söke, Aydın	2013	Youtube	Youtube [Online]. Website https://www.youtube.com/watch?v=p91eibvnqIQ [accessed 24.04.2013].
Söke, Aydın	2013	News	Milliyet [Online]. Website https://www.milliyet.com.tr/gundem/sokede-canavar-soylentisi-yine-alevlendi-1698983 [accessed 26.04.2013].

town in Tunceli province in 2001. Both locations are well outside the known distribution area. However, the latter record from Sivas is even from further, and could imply that the animal may indeed exists as a rare population between Sivas and Southeastern Anatolia (Figure 3).

3.6. Conclusion

The records and other evidence of the occurrence of the Striped Hyaena in Turkey compiled by Kasparek et al. (2004) are summarised in Table, and the new records covering the period after 2004 are presented in Table 1 and Supplementary Table. According to Kasparek et al. (2004), the Striped Hyaena is highly threatened in Turkey and on the verge of local extinction. The situation has even deteriorated since then. The distribution records for the period after 2004 imply that the population in the Marmara and Aegean regions have decreased considerably, and only some small relict populations seem to survive.

Kasparek et al. (2004) listed hyaena records from Erzurum and from the area between Trabzon and Gümüşhane as "not reliable", and another from Ankara as "doubtful" (Supplementary Table); therefore, they did not show these locations on their distribution map. However, the confirmed occurrence of Striped hyaena in Tunceli, Sivas, Bilecik, and Eskişehir provinces in the last two decades implies that the species may occasionally be found far from its core distribution range in Anatolia and/or may have larger distribution in Turkey than previously thought.

According to Kruuk (1976), the home range for a male Striped Hyaena is 44, for a female is 72 km². This data was obtained from Serengeti in south-central Africa and may be quite different for the size of the home range in Turkey. As such, these figures imply that Altınözü Wildlife Protection and Improvement Area may support no more than 5 or 6 individuals. It is clear that this area alone cannot be sufficient to protect the Striped Hyaena in Turkey. Additionally, our field observations and public survey results showed that the Striped Hyaena can approach human settlements and feed on communal and poultry farming garbage. Such behaviour also increases the rate of encounter between the animals and humans and so can pose danger to the animals. That is why, in addition to protected areas, it is important to increase public awareness of the Striped Hyaena, as well as to organise the designated crossing points along automobile roads.

Our observations show that the population of the Striped Hyaena has strongly decreased in most parts of Anatolian Marmara and Mediterranean Turkey, and survives in Western Anatolia today only in some small relict populations such as around Manisa and İzmir in the Aegean region (Figure 4). The situation is different in southeastern Turkey including the Hatay region. The species could survive there and regular reports in the press (e.g., road kills) indicate that the species is still widespread and not very rare there. Altogether, the distribution area of the Striped Hyaena is today split into two parts: a highly threatened relict population in the west and a larger,

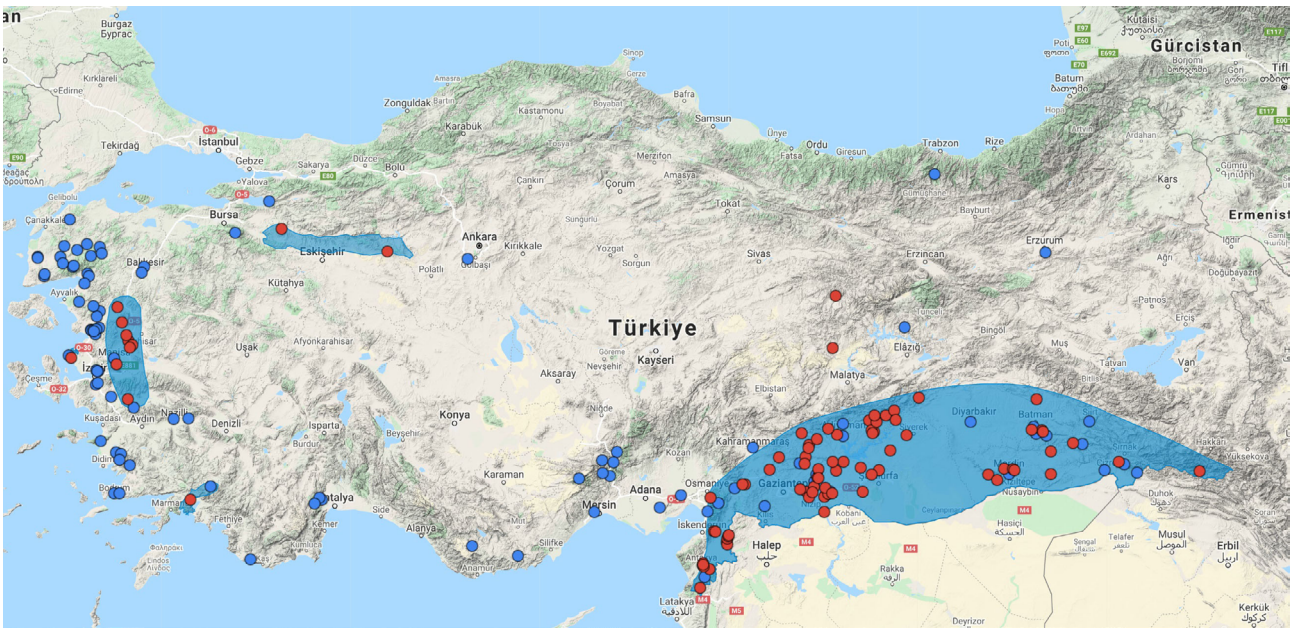


Figure 3. *Hyaena hyaena* records from Turkey recorded before 2004 (blue circles) and after 2004 (red circles), and the estimated current distribution areas in Turkey (blue filled areas).

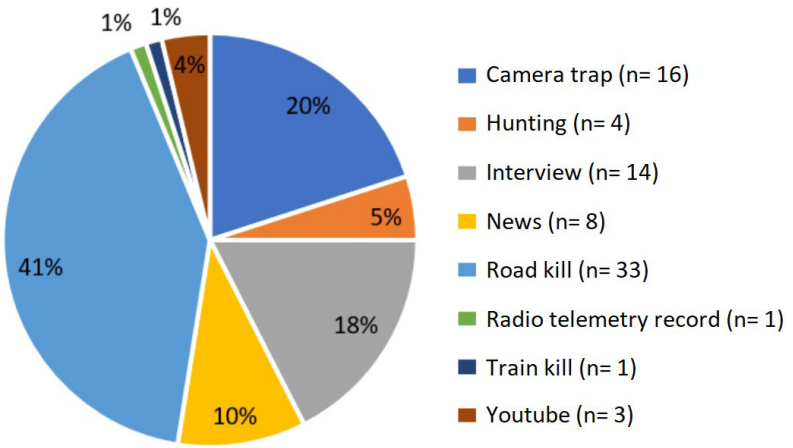


Figure 4. The proportions of Striped Hyaena records from Turkey.

slightly less threatened population in the southeast. This means that the species has lost about half of its distribution area in Turkey during the last three or four decades. Most of the records from Turkey, especially from southeastern Turkey came from rood kill events (Figure 4, Table). Road kill events seem to be the most important threat especially in southeastern Turkey where the Striped Hyaena is most common. Suitable motorway passes seem to be necessary in this region to reduce road kill events. The second serious threat is hunting. A special education programme and awareness activities for local people and hunters seem to be very important and necessary. Additionally, if serious protective measures are not taken, the Striped Hyaena population in western Anatolia, where the species is very rare, will be completely lost in the near future.

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Supplementary material

Table 1. *Hyaena hyaena* records given by Kasparek et al. (2004). The full references can be found in Kasparek et al. (2004).

Locality	Date	Source
Marmara region		
Kazdağı, Balıkesir	Before 1963	Huş (1974)
Edremit, Balıkesir	Before 1963	Huş (1974)
Balıkesir	Before 1963	Huş (1974)
Çanakkale	Before 1963	Huş (1974)
Ayvacık, Çanakkale	Before 1963	Huş (1974)
Ezine, Çanakkale	Before 1963	Huş (1974)
Terzialan, Çan, Çanakkale	Early 1980s	Beytullah Özkan, pers. comm. (2004)
Oğlanlanı Village, Yenice, Çanakkale	2002	Beytullah Özkan, pers. comm. (2004)
Yassıbağ, Çanakkale	2003	Interview by A.K. & M.K.
Bayramiç, Çanakkale	Until 2003	Interview by A.K. & M.K.
Bekirler(Gökçeşme), Çanakkale	Until 2003	Interview by A.K. & M.K.
İznik, Bursa	1852	Rigler (1852)
Uludağ, Bursa	1864	De Tchihatchef (1864)
Aegean region		
Yunuslar, Burhaniye, Balıkesir	Late 1960s or early 1970s	interview by A.K. & M.K.
Kaplan Köyü	In 1970s or early 1980s	interview by A.K. & M.K.
Hacıveliler, Balıkesir	1999	interview by A.K. & M.K.
İzmir	1877	Danford & Alston (1877)
İzmir	1905	Blackler (1905)
Kızıltepe, İzmir	1970	interview by A.K. & M.K.
Bozyerler, İzmir	Between 1965 and 1980	interview by A.K. & M.K.
Avunduk, İzmir	1960s or early 1970s	interview by A.K. & M.K.
Eğrigöl, İzmir	Until the early 1990s	interview by A.K. & M.K.
Zeytindağ, İzmir	1950s	interview by A.K. & M.K.
Zeytindağ, İzmir	2004	interview by A.K. & M.K.
Kozak yaylası, Bergama, İzmir	1980	interview by A.K. & M.K.
Bergama, İzmir	1960	interview by A.K. & M.K.
Bergama, İzmir	2004	interview by A.K. & M.K.
Koyuneli, İzmir	1960s and 1980s	interview by A.K. & M.K.

Koyuneli and Bozyerler (Second hand information)	2003, 2004	interview by A.K. & M.K.
Buca and Seydiköy in İzmir	1840–1860	Von Gonzenbach (1860)
Bodrum, Muğla	1970	Ullrich & Riffel (1993)
Samsun (Dilek) Dağı National Park	Mid 1980s	Kasparek (2004)
Selimiye, Muğla	1988	Kasparek (1988)
Manisa	1937	Kumerloeve (1967)
Bafa gölü, Aydın	1970s–mid 1980s	Kasparek (1988)
Bafa gölü, Aydın	1905	Wiegand (1985)
Ortaköy, Aydın	1877	Danford & Alston (1877)
Between Nazilli and Sarayköy	1877	Danford & Alston (1877)
Selimiye, Muğla	1986	Kasparek (1988)
Mediterranean region		
Dodurga, Antalya	1840	Fellows (1841)
Termosos, Beydağları, Antalya	1953	Turan (1969)
Güllük dağı, Antalya	1980	Masseti (1980)
Mersin	1906 and 1907	Walter Siehe (1907)
Gülnar, Mersin	1958	Kumerloeve (1967)
İnköy village, Tarsus	2004	interview by M.K.
Pozantı, Adana	2004	interview by M.K.
Kahramanmaraş	1940–1950	Kumerloeve (1967)
Yunushan Village, Altınözü, Hatay	2004	interview by A.K. & M.K.
Altınözü, Hatay	2002–2004	by the local hunter Mustafa Çeçen, Can and Lise (2004a,b), Atlas Dergisi (2004)
Dörtyol, Hatay	2003–2004	interview by M.K. 2003-2004
Antakya, Hatay	1900	Matschie (1900)
Ulukışla, Niğde	1985	Özkurt et al. (1998)
Southern Taurus	1902	Von Luschan
Çukurova, Adana	1855	Kotschy (1856)
Central Taurus Mountains	1843	Russegger (1843)
Central Taurus Mountains	1858	Kotschy (1858)
Pozantı and Çamalan, Adana	1917–1919	Koehler (1924)
Zincirli, Islahiye, Gaziantep	1900,1934	Matschie (1900), Pocock (1934)
Southeast Anatolia region		
Sof yaylası, Softa Dağı, Gaziantep	1918	Kumerloeve (1967)
Birecik	1880	Danford & Alston (1880)
Birecik	1972	Kumerloeve (1975)
Diyarbakır	1893	Naumann (1893)
Cizre, Şırnak	1952	Kumerloeve (1967)
Southeast Anatolia	2001	Can (2002) and Can and Lise (2004a)

Inner Anatolia, Black Sea, and East Anatolia regions		
Güdül, Ankara**	1897	Kannenberg (1897)
Erzurum*	1892	Cuinet (1892)
Between Trabzon and Gümüşhane*	1856	Sandwith (1856)

* These records were indicated by Kasparek as “not reliable” and not included in the map.

** This record was indicated by Kasparek as “doubtful”.