

Updated status of European Lanner Falcon, *Falco biarmicus feldeggii* (Schlegel, 1843) (Aves Falconiformes): a taxon on the verge of extinction, with brief comments on the North African Lanner, *F. biarmicus erlangeri* (Kleinschmidt, 1901)

Andrea Corso

Via Camastra 10, 96100 Siracusa, Italy; email: zoologyep@gmail.com

ABSTRACT

Information on the breeding population size of European Lanner Falcon, *Falco biarmicus feldeggii* Schlegel, 1843 (Aves Falconiformes), up to the breeding season 2017 are here given, showing how this peculiar and distinctive taxon is now threatened. A brief overview of the most relevant past and recent information available for the main breeding strongholds is reported, with a more circumstanced status for Turkey and other countries for which the data so far published were either out of date or misleading. The general figure is at no more than ca. 200 breeding pairs worldwide, with slightly more known nesting territories so far remaining. Some comments for the North African subspecies *F. biarmicus erlangeri* (Schlegel, 1843) are also concisely reported, showing how also this taxon is steadily declining.

KEY WORDS

Fast decline; *feldeggii* Lanner; world population size.

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INTRODUCTION

The Lanner Falcon, *Falco biarmicus* Temminck 1825 (Aves Falconiformes), is a widely distributed raptor (Figs. 1–5), with various subspecies across Southern and Eastern Europe, the Caucasus, the Middle East and extensively in Africa (Leonardi, 2015). All its subspecies have good population sizes, while the unique and very distinctive subsp. *feldeggii* (Schlegel, 1843) is rather localized (Cramp & Simmons, 1980; Massa et al., 1991; Krueger et al., 1996; Corso 2000, 2001; Gustin et al., 2002; Andreotti & Leonardi, 2007; Allavena et al., 2015; Leonardi, 2015; Di Vittorio et al., 2017). In the 1800s and early 1900s, *F. biarmicus feldeggii* was still common, chiefly in Italy (Arrigoni degli Oddi, 1929; Martorelli, 1911; Mebs, 1959; Toschi, 1969). From January 1919 to February 1921, more

than 200 specimens of *F. biarmicus feldeggii* (most of them juveniles, but also adults) were collected in Puglia, Italy, alone (and sent to museums all over Italy, Europe and elsewhere in the world) (Arrigoni degli Oddi, 1929; Foschi et al., 1996; pers. obs.). Recent estimates of the world population of *F. biarmicus feldeggii* were of a maximum of ca. 400–900 pairs, including 123–172 breeding pairs in Italy (65+ in Sicily, the rest on the mainland) (Allavena et al., 2015; Leonardi, 2015). However, even the most updated monographies on Lanner, such as Allavena et al. (2015) and Leonardi (2015) for some countries report old and/or unverified data, such as that from Turkey and Greece (Kirwan et al., 2008a, b; Kirwan & Yoğurtcuoğlu pers. com.; pers. obs.). Indeed, more likely estimates from the core distribution range are nowadays much lower and therefore the status of *F. biarmicus feldeggii* need to be

revised. This short note updates the figure of the breeding population of this endangered taxon. As clearly shown here, *F. biarmicus feldeggii* is sadly on the verge of extinction. A figure for the whole *F. biarmicus feldeggii* breeding population is reported, with a discussion for the most relevant breeding areas. Comments about the possible negative population trend of the North African taxon, *F. biarmicus erlangeri* (Kleinschmidt, 1901), are also briefly discussed.

MATERIAL AND METHODS

This short note is the fruit of twenty years of intense personal field observations through most of the *F. biarmicus feldeggii* breeding range in Italy (Corso et al., 2017). A sample area of the core range in Turkey and Caucasus was also visited during the years 2009–2017 (combined). Sample areas of the known breeding range of *F. biarmicus erlangeri* in Tunisia and Morocco were visited during the years 1999–2014 and 2001–2016 respectively. Furthermore, potential suitable habitat in areas where the species could potentially breed were also visited. The breeding area covered (Central to Southern Tunisia, Central to Southern Morocco) was visited annually during the same period (January to the end of March–early April). A great part of the data discussed concisely here, however, was also gathered through correspondence with ornithologists from the GTR (Gruppo Tutela Rapaci), HOS (Hellenistic Ornithological Society), BRC (Batumi Raptors Count) and a large number of ornithologists who kindly shared their observations and studies (see acknowledgements). All the most relevant papers dealing with the Lanner Falcon of the subspecies *F. biarmicus feldeggii* and *F. biarmicus erlangeri* were thoroughly studied in order to acquire data that is as detailed and updated as possible. A partial list of the numerous scientific papers read is reported under many references.

RESULTS

Details regarding the breeding pairs of *F. biarmicus feldeggii* from the whole distribution range are given in Table 1. Figures reported in this table show the most up-to-date information mentioned by

the major works on the Lanner Falcon published in recent years. The total world breeding population of *F. biarmicus feldeggii* can be roughly estimated at 261–462 pairs for Andreotti & Leonardi (2007), 340–460 (max. range 572–960) for Leonardi (2015) and 408–815 for Allavena et al. (2015). These works, report unverified and, sometimes exaggerated estimates for certain countries, where data are either deficient or based upon incorrect statements from old literature. Indeed, Leonardi (2015) stresses the lack or the low quality of modern data for some breeding areas. The most relevant case is Turkey, while for many Eastern European countries, including Greece, the data still refer back to the 1980s and have never been updated since. The 5th column of Table 1 report the known breeding pairs of *F. biarmicus feldeggii* for the year 2017: these could be estimated as 119–171 pairs, with a maximum estimate of 257 nesting territories known. Thereafter, it is reported an overview primarily concerning the countries covering *F. biarmicus feldeggii*'s main core range.

ITALY. Massa et al. (1991), Krueger et al. (1996) and Gustin et al. (2002) estimate the Italian breeding population of *F. biarmicus feldeggii* at about 170–200+ pairs (80–90 of which being found in Sicily). Andreotti & Leonardi (2007) and Andreotti et al. (2008) updated the figure to 140–172 pairs (and 70–80 for Sicily). Leonardi (2015) repeated the same 140–172 pair figure while the number provided by Allavena et al. (2015) in an extensive region by region review provides a lower estimate of 123–152 pairs (and 65 in Sicily). In this work however, some odd data are reported, such as the one from Campania, for example with 3–4 breeding pairs monitored in the past in that region, none of which were actually ever observed at the nest in 2014–2015. Still, 3–4 breeding pairs are reported in the table summarising the Italian population, with the explanation that “surely some elusive pairs, not monitored, exist in the region”. Furthermore, in some regions, for example Abruzzo, the same number of breeding pairs from past works is reported (4–6 pairs) whereas in reality the number has already measurably declined since 2011–2012, as Corso (2013) had already reported the regional populations at 2–3 pairs (reduced to 1–2 in 2017; Antonucci, Carafa, Cappelli and Pulvirenti pers. com.; pers. obs.). In 2015–2017, the dramatic decline was finally acknowledged by Italian ornithologists.



Figure 1. World distribution range of Lanner Falcon *Falco biarmicus feldeggii* (Schlegel, 1843) as previously reported in recent works. The main stronghold, after this study - 1) blue squares population which strongly declined or for which the figure need to be updated; 2) blue circle, population almost eradicated; 3) green squares, mostly Saker Falcon *Falco cherrug* (Gray, 1834) found breeding in these areas in last decade; 4) red square, considered the Turkish stronghold, in recent years no or very few lanners observed in this area.

| COUNTRY | BREEDING PAIRS Andreotti & Leonardi (2007) | BREEDING PAIRS Leonardi (2015) | BREEDING PAIRS Allavena et al. (2015) | Updated estimate year 2017 | TREND |
|------------------------|---|-----------------------------------|---|----------------------------------|----------|
| Italy | 140-172 | 140-172 | 123-152 | 60-80 (106) | Negative |
| Turkey | 50-200 | 100-150 (300-600) | 200-500 | 20-30 (50) | Negative |
| Macedonia | >5 | 25-35 | 25-35 | 15-20 (30) | Stable? |
| Greece | 36-55 | 38-53 | 45-75 | 20 (35-40) | Negative |
| Montenegro | 2-5 | 8-12 | 2-5 | 1-5 | Negative |
| Georgia | 5 (tot. combined with Armenia and Azerbaijan) | 1-2 | 1-3 | 1-2 | Negative |
| Bosnia- Herzegovina | >5 | 12 | 1-5 | 1-2 | Negative |
| Croatia | 5-10 | 5 (10-20) | 1-4 | 1-4 | Negative |
| Serbia | 3-5 | 5-10 | 0-1 | 0-1 | Negative |
| Kosovo | ? | 2-3 | 0-2 | 0-1 | Negative |
| Bulgaria | >10 | 2-3 | 0-3 | 0-1 | ? |
| Armenia | Rif Georgia | 1-2 | 5-10 | ? (5) | ? |
| Azerbaijan | Rif Georgia | 1 | 5-20 | ? (5-10) | ? |
| Tot. | 261-462 | 340-460 (572-960) | 408-815 | 119-171 (257) | Negative |

Table 1. Numbers of estimated breeding pairs of Lanner Falcon *Falco biarmicus feldeggii* Schlegel, 1843 in the whole of its known distribution range according to the latest works on this taxon, compared to number of breeding pairs estimated in 2017. In brackets, the maximum estimated number of nesting territories.

thologists monitoring the species, with specific papers showing a decline at regional or national level for Regions such as Tuscany (Pezzo et al., 2016), Lazio (Brunelli & Sarrocco, 2017; Borlenghi et al., 2017), Abruzzo (Corsi, 2013), Molise and Central and Southern Italy (De Lisio et al., 2015; De Rosa et al., 2017). For Sicily, in recent years, several works provide contradictory figures. To quote just some examples, Sarà (2008) gives a total breeding population for Italy of 100–140 pairs and, amazingly, 120–125 pairs for Sicily alone. Similarly, Sarà (2014) reports 122 breeding territories during 2000–2009, 92 of which were regularly occupied. This data however, does not correspond to monitoring research undertaken by various Sicilian ornithologists (Di Vittorio and Ciaccio pers. com.; GTR database; pers. obs.). On the other hand, Di Vittorio et al. (2017) clearly demonstrate a negative trend in both the number of breeding pairs in Sicily, from 70–90 in the 1980s and 1990s to no more than 55–60 by 2016, and the productivity which has also diminished in the last 20 years. A further decline was recorded in Sicily in 2017 with an estimate of 56 nesting territories (but only 30 breeding pairs) and a very low rate of substitution of adults at the nest, showing a demography-related problem and high mortality (Di Vittorio, Ciaccio, Scuderi, Merlini pers. com., GTR; pers. obs.). Given that Sicily was always the main stronghold of *F. biarmicus feldeggii*, this decline is particularly worrying (Di Vittorio et al., 2015, 2017; pers. obs.). The general figure for the whole of Italy in the years 2016 and 2017 is of around 60–80 remaining breeding pairs, with a maximum count of 106 nesting territories holding pairs (not necessarily referring to breeding adults).

TURKEY. First breeding records reported by Kumerloeve & Niethammer (1935). Kumerloeve (1961, 1970, 1972) mention the species, considering Lanner a well distributed breeding species across the country though with scattered pairs. Beaman & Porter (1985) report “*status uncertain, probably a scarce breeding species*”. Kirwan (1997) did not find any specimens of Lanner preserved at the Robert's College collection, at Bebek (Istanbul). Kirwan (1995), Kirwan & Martins (1994), and Kirwan et al. (2003, 2008a) report only a few confirmed records of the species around the country. Meyburg & Meyburg (1987) estimate the Turkish population of Lanner at only 20 breeding pairs, a

figure also repeated by Grubac (1996). Kirwan et al. (2008b) mention very few well documented breeding records, with only a few well-known and studied nesting sites, reporting that the “*breeding status and distribution remain poorly understood and badly need further clarification*”. Allavena et al. (2015) and Leonardi (2015), on the contrary, mention, respectively, 200–500 and 100–150 pairs, both with an estimate of maximum 300–600 pairs. According to literature, the core breeding range should be found in Eastern Turkey, around the Van district/Eastern Anatolia and the Caucasus-Pontic Alps areas-Black Sea coastlands (Kirwan et al., 2008b; Leonardi, 2015). During the years 2011–2015, personal annual trips in late Spring-early Summer to these areas, did not produce any observation of Lanners, while a few Saker Falcons (*F. cherrug* Gray, 1834) were observed, as well as a few pale Peregrine Falcons (*F. peregrinus* Tunstall, 1771). Already Kasperek (1992) mentioned the possibility that many of the Turkish records of Lanner could actually refer to misidentified Saker or even Eleonora's Falcon (*F. eleonora* Gené, 1839), a possibility also repeated by Kirwan et al. (2008b). It is surely of interest in this context that Dixon et al. (2009) found most breeding pairs of Saker, during the years 2000–2008, in an area very much overlapping with the allegedly main distribution range of Lanner in Turkey. Turan (2005), during a raptor survey conducted in 2001–2002 across the country, reported only 2–5 records for Lanner (and Saker as well). Shurulinkov et al. (2008) reported only two adult birds observed in Eastern Turkey in 2005 and 2007 in the Agri and Sivas districts. Kirwan (pers.com.), reported that during studies across Turkey, he observed no more than 1 to 5 Lanners annually during decades of research in the country, considering several modern records referring to Lanner Falcon as pertaining to misidentified “Nordic” Peregrines (i.e. *F. calidus* Latham, 1790) and Sakers (as commonly happen in Italy and other countries too). Similarly, Yoğurtcuoğlu (pers.com.) reported only few of confirmed Lanners observed in the last ten years in the whole country. The real level of the breeding population of *feldeggii* in Turkey in recent years is therefore completely unknown. However, according to all the ornithologists contacted and cited, it is most likely estimated at about 20–30 breeding pairs (maximum 50) and by no means even close to the 150–600 pairs

reported by Leonardi (2015) and Allavena et al. (2015).

MACEDONIA. This country apparently holds one of the greatest population known to date, estimated at only 5+ pairs by Gustin et al. (2002) and Andreotti & Leonardi (2007), but reported to be 25–35 breeding pairs by both Allavena et al. (2015) and Leonardi (2015). Up to 2009, Grubač & Veleviski (2010) mentioned 14 verified breeding pairs with additional 11 probable nesting sites, reporting an estimate of 25–35 pairs in total. Recent observations in the country by several observers confirm the presence of 15–20 active breeding pairs.

GREECE. *F. biarmicus feldeggii* was mainly distributed in Central and northern Greece, with 36–55 breeding pairs reported in the 1980s (Handrinos & Demetropoulos, 1983; Handrinos & Akriotis, 1997). Gustin et al. (2002) thus report 36–55 breeding pairs, a number repeated in Andreotti & Leonardi (2007). Leonardi (2015) reports 38–53 pairs while Allavena et al. (2015) mention 45–75 pairs. All these data are based on research conducted in the 1980s and 1990s. Recent observations made by local/visiting ornithologists and birders in Greece refer to 20 active nests with a maximum estimate of 35–40 nesting territories. Future research, chiefly in the southern part of the country and all surrounding islands, are advisable.

CAUCASUS (SOUTHERN GEORGIA, SOUTHERN ARMENIA AND AZERBAIJAN). Abuladze et al. (1991) report 5 breeding pairs for the whole Caucasus area. Patrikeev (2004) consider Lanner as extirpated or an extremely rare breeder in Azerbaijan. Adamian & Klem (1999) consider *F. biarmicus feldeggii* a very rare breeding bird found primarily in Western Armenia at lower elevations. Leonardi (2015) report 3–5 pairs in total for Georgia, Armenia and Azerbaijan. On the other hand, Gustin et al. (2002) and Allavena et al. (2015) report a cumulative total of about 11–33 pairs. Abuladze (2012, 2013) report a remaining 1–3 pairs for Georgia. Recent correspondence with several ornithologists active in the area, reported an unknown number of pairs, since the species is considered almost eradicated from the area, with only one or two remaining pairs in Southern Georgia, an unknown population size for Armenia and Azerbaijan, where a possible estimate of, respectively, 5 and 5–10 nesting territories (A. Abuladze, A. Rukhaia and B. Verhelst pers. com.). Vasil

Ananian (pers. com.) reports that a confirmed and traditional breeding site is found at the Khosrov Forest State Reserve, where one nest is known since 1961, and breeding birds are observed there regularly. Summer records also exist from Mt Aragats (regularly), Ijevan Range (NE of the country), and Sevan Mountain Range (along the Eastern shore of the Lake Sevan). Adamian & Klem (1999) list other records, but some of them need verifications, e.g. summer records from Meghri area (extreme SE of Armenia) are probably erroneous, because here only the Peregrine breeds there. From personal study of several available photos from these countries and personal field observations, it seems that at least a proportion of the breeding pairs reported and/or Lanners observed in the field may actually refer to pale Saker Falcons (*Falco cherrug*). In this area (increasingly moving further east), some adult Sakers appear very similar to adult (mainly adult female) *F. biarmicus feldeggii*: generally bluish-grey upperparts, very well barred both above and below on flanks/belly, well barred remiges and tail, and rusty head/crown (Forsman, 2016; Corso, 2000, 2001; Corso et al., 2017).

BULGARIA. Gustin et al. (2002) report 10+ pairs, while both Allavena et al. (2015) and Leonardi (2015) mention 1–3 pairs. Nankinov et al. (2004) report a single verified breeding pair, while Golemanski et al. (2011) estimate 4–10 the breeding population for this country. Recent field studies report 0–1 pairs (Najankensko pers. com.), considering the single observations over the country as mostly pertaining to vagrants from nearby regions of Greece and Yugoslavia as already postulated by Boev & Dimitrov (1995). However, during raptor migration surveys in August–October 1979–2003 conducted at Bourgas by Michev et al. (2011), no Lanners were observed. For all the other countries where a few pairs are found, see Table 1.

NORTH AFRICA - *Falco biarmicus erlangeri*. Given the long direct field experience gained by me concerning the subspecies *erlangeri*, I report comments on what I have personally recorded in Morocco and Tunisia. Old information about North Africa in general is provided by Heim de Balsac & Mayaud (1962), where the authors considered the species widespread and abundant in the area, and most common in Morocco. Bergier (1987) reported a rough estimate of around 1000 breeding pairs in

the 1970s and 1980s for Morocco. Similarly, Thévenot et al. (1985) reported about 1000 pairs in the country, while Thévenot et al. (2003) considered the species as, at least modestly decreasing, and therefore with a smaller population size. However, data are highly deficient for the last two decades, and thus its real status and population size/trend are strongly in need of an update (Leonardi, 2015). M. Amezian (pers. com.) is of the same opinion, but following field observations over decades by his colleagues and him, it looks like, the species is definitely exhibiting a rather negative trend. Further studies are therefore necessary to understand the species' health in the main strongholds for *F. biarmicus erlangeri*. For Tunisia, Whitaker (1905) considered Lanners as the commonest large falcon over the country. Both Isenmann et al. (2005) and Leonardi (2015) report and estimate 350–400 breeding pairs for the 1990s and up to the middle of the first decade of the 21st century. However, Grubac (1996) and Meyburg & Meyburg (1987) consider a likely estimate of 200–250 pairs. Recent, updated, in depth research is lacking, and therefore little is known about the real population size and trend of this falcon in Tunisia. During numerous breeding seasons (see Material and Methods), Tunisia and Morocco were regularly visited with the finding of no less than 50 nesting territories (31 Tunisia, 19 Morocco - only 26 of which with actually breeding pairs and both adults at the nest). A stable number of nesting territories was recorded up until 2010, when no less than 10 sites appeared deserted (20%). In the years 2011–2013, only 24 nesting sites in total were apparently still occupied by at least one adult Lanner, and just 20 in 2014–2016 (a decline of 60%). Observing *F. biarmicus erlangeri* in the field in these two countries, outside of known nesting territories, was very easy on the 1990s and early 2000s but became increasingly difficult towards 2016. It would seem, therefore, that a similar negative trend as seen in *F. biarmicus feldeggii*, is also underway in *F. biarmicus erlangeri*, and a future focused study should be quickly organised. As far as the subspecies *tanypterus* Schlegel, 1843 in northeast Africa Arabia, Israel, and Iraq is concerned, not enough data about its population size is available. This subspecies is probably localized and with a discontinuous distribution, although the real figure is still rather unclear, chiefly concerning the situation in Libya and Cyrenaica (Leo-

nardi, 2015; Isenmann et al., 2016). In addition, the subspecies *erlangeri* may be considered a synonym of this taxon and therefore the total breeding population size may actually be considered rather large (Clark, 1999; Forsman, 2015; Corso et al. pers. data). However, further research should be conducted to ascertain the true breeding numbers and trend.

CONCLUSIONS

As a final figure, given the updated estimates mainly from Turkey and Italy, the two main strongholds, the world population of *F. biarmicus feldeggii* up to, and including 2017 can be estimated to be around 119–171 breeding pairs, with a maximum estimate of 257 nesting territories. Of course, the lack of ornithological coverage for a broad part of Turkey, the need for better and more extensive research in Greece, Bulgaria, and Macedonia, surely means that some further breeding pairs may be discovered in the future if greater efforts to obtain better knowledge of the population size of this vanishing taxon were to be undertaken. A better search also needs to be made in Croatia, Serbia, Bosnia and Herzegovina, Armenia, and Azerbaijan, where the real population size is unknown and could be higher than reported here, but where some of the potential breeding pairs may actually refers to pale Saker Falcons. Further studies are needed for Romania, Albania, Cyprus, and Crete. Although without doubt new breeding pairs of *feldeggii* might still be found indeed, it is evident the decline of these populations across Italy, the main world stronghold for this taxon. The reasons for such a quick decline are several, as theorized by many authors and in many different scientific papers, and they are derived from a range of many different factors (see References). One thing is clear and cannot ever be stressed enough: every possible solution needs to be examined and searched, and every possible action needs to be taken. At the same time, disturbance at the nest must be kept by everyone involved to a minimum (or not at all, for example that caused by bird photographers, but also certain ornithologists), and all environmental associations, together with the European Union, must co-operate to avoid further declines, and to prevent at least some of the most important threat factors.



Figure 2. European Lanner *Falco biarmicus feldeggii*, Southern Sicily, Italy, 01.IV.2014 (photo Stefania Merlino). A single adult female, not paired. Figure 3. European Lanner *F. biarmicus feldeggii*, Northern Sicily, 23.VII.2017 (photo Giuseppe Rannisi). A moulted adult during post-breeding season. Figure 4. Lanner *F. biarmicus tanypterus*, adult bird, Sde-boker, Northern Israel, June 2016 (photo Lior Kislev). Figure 5. Lanner *F. biarmicus tanypterus*, fresh juvenile, Sde-boker Northern Israel, June 2016 (photo Lior Kislev).

One of these is without any doubt, and by far one of the most relevant, the widespread and increasing practice of falconry, which appears to be completely out of control. As a first step, the simple detention of any *F. biarmicus feldeggii* must be declared illegal and it should not matter if it is said to originate from captive bred stock. It should not be possible to have *F. biarmicus feldeggii* in captivity, whatever its origin. Starting from this point, any illegal commerce could more easily be prevented. Bär (1997) and Dixon et al. (2009) report that falcon trapping in Turkey and Syria was very widespread in the 1970s and even more evident in the 1980s with around 300-600 big falcons being trapped in Turkey and a massive 700-1,200 annually in Syria. Binothman (2016), in a work about falconry in Saudi

Arabia, reported that there were approximately 100 trappers active in Turkey in 2014–2015, illegally trapping falcons (Lanners, Peregrines, Sakers, etc.). Trapping locations are typically located near the Armenian and Georgian borders, and therefore in the alleged strongholds of *F. biarmicus feldeggii* for this country. If this figure were to be confirmed, illegal trapping and falconry are seriously threatening the Turkish *F. biarmicus feldeggii* population and, as a consequence, the entire population of this endangered taxon. The same author (Binothman, 2016) reported a massive capture of wild falcons in North Africa and the Middle East that is hugely worrying for the Lanner population trend as a whole. According to his research, at least 2,544 adult and juvenile Lanner and Peregrine Falcons

were trapped and smuggled to the Middle East in the year 2015. In 2014, there were approximately 4,027 falcons trapped in the Middle East and North Africa (Libya 35.0%, Arabian Gulf 15.5%, Iran 11.1%, Turkey 9.9%, Egypt 8.6%, Yemen 8.1%, Sudan 7.9%, and Jordan 3.4%). In Libya alone, during 2014, 800 lanners were reportedly captured by people working for falconers, with as well as 300 lanners reported as captured in Egypt. There were more than 200 trappers illegally active in Libya in 2014–2015. The allegedly reported figure of captured Lanners (and falcons in general) in the mentioned work is probably, and hopefully, exaggerated, but the number of falcons illegally captured in the whole North Africa and Middle East is certainly massive. Therefore, it should not come as surprise if *F. biarmicus erlangeri*, *F. biarmicus tanypterus* and *F. biarmicus abyssinicus* (Neumann, 1904) (whenever or not all valid taxa) are all quickly declining and could become endangered in the near future.

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REFERENCES

- Adamian M.S. & Klem D. Jr., 1999. Handbook of the birds of Armenia. American University of Armenia, Okland, 220 pp.
- Andreotti A. & Leonardi G., 2007. Piano d'azione nazionale per il Lanario (*Falco biarmicus feldeggii*). Quaderni Conservazione Natura. Ministero Ambiente, 24: 1–109
- Andreotti A., Leonardi G., Sarà M., Brunelli M., De Lisio L., De Sanctis A., Magrini M., Nardi R., Perna P. & Sigismondi A., 2008. Landscape-scale spatial distribution of the Lanner Falcon (*Falco biarmicus feldeggii*) breeding population in Italy. *Ambio*, 37: 443–447.
- Allavena S., Andreotti A., Corsetti L. & Sigismondi A., (Eds.), 2015. Il Lanario in Italia: problemi e prospettive. Atti del convegno, Marsico Nuovo, 29/30 novembre 2014. Special issue of Edizioni Belvedere, Latina, Le Scienze, 72 pp.
- Abuladze A., Eligulashvili V. & Rostiasvili G., 1991. On status of Lanner in Soviet Union. Materials of the 10th All-Union Ornithological Conference Navuka itekhnika. Minsk, Belarus Part 2, Book 2: 26–28
- Abuladze A., 2012. A preliminary overview of raptor monitoring in Georgia. *Acrocephalus*, 33: 289–292.
- Abuladze A., 2013. Birds of Prey of Georgia (Materials towards a Fauna of Georgia Issue VI). Tbilisi, Printing House “Lasha Khvichia”, Tbilisi, 218 pp.
- Arrigoni degli Oddi E., 1929. *Ornitologia italiana*. Ulrico Hoepli, Milano, 1046 pp.
- Bär N., 1997. Falkenfang und Falkenhandel in der Arabischen Republik Syrien. *Mitt. Mitteilungen der Fränkischen Geographischen. Geography & Environmental Sciences*, 44: 191–223.
- Bergier P., 1987. Les Rapaces diurnes du Maroc. Statut, répartition et écologie. *Annales du Centre d'Etude sur les Ecosystèmes de Provence (C.E.E.P.) Aix en Provence*, 3: 160 pp.
- Beaman M. & Porter R.F., 1985. Status of birds of prey in Turkey. In: Chancellor R.D. & Meyburg B.-U., (Eds.), *World Working Group on Birds of Prey*, 2. Berlin, Germany and Paris, France
- Binothman Albara M., 2016. Current Status of Falcon Populations in Saudi Arabia. Theses and Dissertations, 976 pp. <http://openprairie.sdstate.edu/etd/976>
- Boev Z.N. & Dimitrov D.S., 1995. On the Lanner falcon (*Falco biarmicus* Temminck, 1825) in Bulgaria. *Acta zoologica bulgarica*, 48: 105–112.

- Borlenghi F., Brunelli M. & Sarrocco S., 2017. Rete regionale di monitoraggio dei rapaci diurni rupicoli di interesse unionale nidificanti del Lazio: resoconto 2014-2016. Fasano S.G. & Rubolini D. (Eds.), Riassunti del XIX CIO, Torino. Tichodroma 6: 29.
- Brunelli M. & Sarrocco S., 2017. Evoluzione delle popolazioni di lanario *Falco biarmicus* e falco Pellegrino *Falco peregrinus* nidificanti nel Lazio. Fasano S.G. & Rubolini D. (Eds.), Riassunti del XIX CIO, Torino. Tichodroma, 6: 25–26.
- Clark W.S., 1999. A field guide to the Raptors of Europe, the Middle East and North Africa. Oxford University Press.
- Corso A., 2000. Identification of European Lanner. Birding World, 13: 200–213.
- Corso A., 2001. Biologie, Verbreitung und Bestimmung des Lannerfalken *Falco biarmicus* in Europa. Limicola, 15: 1–41.
- Corso A., 2013. Il Lanario *Falco biarmicus feldeggii* nel parco Nazionale della Majella, Abruzzo. Resoconto per la redazione del Piano di gestione dei Siti Rete Natura 2000, ai sensi del programma di sviluppo rurale 2007/2013 - misura 323. Intervento al sottointervento a1.b. Punto A del Bando: Attività su *Falco biarmicus*, *Aquila chrysaetos*, *Pyrrhocorax pyrrhocorax*, *Falco peregrinus*.
- Corso A., Viganò M. & Starnini L., 2017. Sexing Lanner Falcon in the field. Dutch Birding, 39: 308–322.
- Cramp S. & Simmons K.E.L. (Eds.), 1980. The Birds of the Western Palearctic Volume II. Oxford University Press, Oxford, New York, 695 pp.
- De Lisio L., Corso A., Carafa M. & De Rosa D., 2015. Trend della popolazione nidificante di Lanario *Falco biarmicus feldeggii* e Pellegrino *Falco peregrinus brookei* in Molise e dati sulle interazioni interspecifiche. In: Tinarelli R., Andreotti A., Baccetti N., Mellea L., Roscelli F., Serra L. & Zenatello M. (Eds.), Atti XVI Convegno Italiano di Ornitologia. Cervia (RA), 22-25 settembre 2011. Scritti, Studi e Ricerche di Storia Naturale della Repubblica di San Marino, 345–347.
- De Rosa D., Di Febbraro M., De Lisio L., De Sanctis A. & Loy A., 2017. Il declino del Lanario *Falco biarmicus feldeggii* in Italia centro-meridionale: competizione o perdita di habitat? Fasano S.G. & Rubolini D. (Eds.), Riassunti del XIX CIO, Torino. Tichodroma, 6: 25.
- Dixon A., Ragyov D., Ayas Z., Deli M., Demerdzhiev D., Angelov I., Kmetova E. & Nedyalkov N., 2009. Population status of breeding Saker Falcons (*Falco cherrug*) in Turkey. Avian Biology Research, 2: 213–220. DOI: 10.3184/175815509X12570973331837
- Di Vittorio M.D., Ciaccio A., Greci S. & Luiselli L., 2015. Ecological Modelling of the distribution of the Lanner Falcon *Falco biarmicus feldeggii* in Sicily at two Spatial Scales. Ardeola, 62: 81–94.
- Di Vittorio M., Di Trapani E., Cacopardi S., Rannisi G., Falci A., Ciaccio A., Sarto A., Merlino S., Zafarana M., Greci G., Salvo M., Lo Valvo, Scuderi A., Murabito L., La Grua G., Cortone G., Patti N., Luiselli L. & López-López P., 2017. Population size and breeding performance of the Lanner Falcon *Falco biarmicus* in Sicily: conservation implications. Bird Study, 64: 339–343.
- Forsman D., 2016. Flight Identification of Raptors of Europe, North Africa and the Middle East. Christopher Helm, London & New York, 544 pp.
- Foschi U.F., Bulgarini F., Cignini B., Lipperi M., Melletti M., Pizzari T. & Visentin M., 1996. Catalogo della collezione ornitologica “Arrigoni degli Oddi” del Museo Civico di Zoologia di Roma. Ricerche di Biologia della Selvaggina, 97: 1–311.
- Golemanski V., Peev D., Chipev C., Beron P. & Biserkov V. (Eds.), 2011. Red data Book of the Republic of Bulgaria. Volume 2. Animals. IBEI - BAS & MOEW, Sofia.
- Grubac B., 1996. La Situation du Faucon lanier *Falco biarmicus* en Mediterranee et specialement dans le centre des Balkans. In: Muntaner J. & Mayol J. (Eds.), 1996. Biologia y Conservacion de las Rapaces Mediterraneas, 1994, Monografias, 4: 127–134.
- Grubač B. & Veleviski M., 2010. The Lanner Falcon *Falco biarmicus* in Macedonia. Falco, 35: 9–11.
- Gustin M., Palumbo G. & Corso A., 2002. International species action plan for the Lanner Falcon *Falco biarmicus*. BirdLife International. Council of Europe. T-PVS/Inf, 16, Strasbourg, 20 pp.
- Heim de Balsac H. & Mayaud N., 1962. Les Oiseaux du Nord-Ouest de l’Afrique. Distribution géographique, Ecologie, Migrations, Reproduction. Encyclopédie ornithologique X, Lechevalier, Paris, 487 pp.
- Handrinos G. & Demetropoulos A., 1983. The birds of prey of Greece. Efstathiadis Group, Athens, 199 pp.
- Handrinos G. & Akriotis T., 1997. The birds of Greece. Christopher Helm/A. & C. Black, London, 336 pp.
- Isenmann P., Gaultier T., El Hili A., Azafzaf H., Dlenis H. & Smart M., 2005. Oiseaux de Tunisie/Birds of Tunisia. Société d’Etudes Ornithologiques de France, Paris, 432 pp.
- Isenmann P., Hering J., Brehme S., Essghaier M., Etayeb K., Bourass E. & Azafzaf H., 2016. Oiseaux de Libye. Birds of Libya, Paris, 302 pp.
- Kasperek M., 1992. Die Vögel der Türkei eine Übersicht. Heidelberg, Max Kasperek Verlag, 128 pp.
- Krueger T.E. Jr., Leonardi G., Palumbo G., Rizzi V. & Siracusa M., 1996. Status of the Lanner Falcon (*Falco biarmicus feldeggii*) in Italy and the rest of its range. In: Pandolfi M. (Ed.), Abstracts of the 2nd International Conference on Raptors, Urbino, p. 72.
- Kirwan G.M., 1995. Recent records of rare birds in Turkey. Zoology in the Middle East, 11: 37–46.

- Kirwan G.M., 1997. A list of bird specimens held in the Robert's College, Bebek (Istanbul, Turkey) collection, with some comments on Mathey-Dupraz (1920–24). *Sandgrouse*, 19: 30–38.
- Kirwan G.M. & Martins R.P., 1994. Turkey Bird Report 1987–91. *Sandgrouse*, 16: 76–117.
- Kirwan G., Özen M., Kurt B. & Martins R., 2003. Turkey Bird Report 1997–2001. *Sandgrouse*, 25: 8–31.
- Kirwan G., Özen M. & Demirci B. 2008a. Turkey Bird Report 2002–2006. *Sandgrouse*, 30: 166–189.
- Kirwan G.M., Boyla K.A., Castell P., Demirci B., Özen M., Welch H. & Marlow T., 2008b. The birds of Turkey: a study in the distribution, taxonomy and breeding of Turkish birds. Christopher Helm, London, 512 pp.
- Kumerloeve H., 1961. Zur Kenntnis der Avifauna Kleinasiens. *Bonner zoologische Beiträge*, 1–318.
- Kumerloeve H., 1970. Zur Kenntnis der Avifauna Kleinasien und der europäischen Türkei. *Istanbul Üniversitesi Fen Fakültesi Mecmuası*, Ser. B, 35: 85–160.
- Kumerloeve H., 1972. Brutstatus der Greifvögel (Falconiformes) im vorderasiatischen Raum (Türkei Syrien, Libanesische Republik). *Tier und Umwelt*, 8: 10–22.
- Kumerloeve H. & Niethammer G., 1935. *Falco biarmicus feldeggii* Schleg. Brutvogel im nördlichen Kleinasien. *Ornithologische Monatsberichte*, 43: 94–95.
- Leonardi G., 2015. The Lanner falcon. Privately published.
- Massa B., Lo Valvo F., Siracusa M. & Ciaccio A., 1991. Il Lanario (*Falco biarmicus feldeggii* Schlegel) in Italia: status, biologia e tassonomia. *Il Naturalista siciliano*, 15: 27–63.
- Martorelli G., 1911. Il Lanario europeo (*Falco feldeggii*) e i suoi affini. *Atti Società Italiana Scienze Naturali*, 50: 246–282.
- Mebis T., 1959. Beitrag zur Biologie des Feldeggfalcken *Falco biarmicus feldeggii*. *Vogelwelt*, 80: 142–149.
- Meyburg B.-U. & Meyburg C., 1987. Present status of Diurnal Birds of Prey (Falconiformes) in various countries bordering the Mediterranean. In: Baccetti N. & Spagnesi M. (Eds.), *Rapaci Mediterranei*, III. Supplemento alle Ricerche di Biologia della Selvaggina, 12: 147–152.
- Michev T., Profirov L., Nyagolov K. & Dimitrov M., 2011. The autumn migration of soaring birds at Bourgas Bay, Bulgaria. *British Birds*, 104: 16–37.
- Nankinov D. (Ed.), 2004. Breeding Totals of the Ornithofauna in Bulgaria. *Green Balkans*, Plovdiv, 32 pp.
- Patrikeev M., 2004. The birds of Azerbaijan. Pensoft Publishers. Sofia-Moscow, Russian Nature Press, 380 pp.
- Pezzo F., Chiancianesi G., Cutini S., Fabbri F., Grilli G., Nardi R. & Paesani G., 2016. Rapporto sullo status del Lanario *Falco biarmicus feldeggii* in Toscana 2014–2016. *Picus*, 42: 132–136.
- Portolou D., Bourdakis S., Vlachos C., Kastritis T. & Dimalexis T. (Eds.), 2009. Important Bird Areas of Greece. Priority areas for biodiversity conservation. Hellenic Ornithological Society, Athens, 497 pp.
- Sarà M., 2008. Breeding abundance of threatened raptors as estimated from occurrence data. *Ibis*, 150: 766–778.
- Sarà M., 2014. Spatial analysis of lanner falcon habitat preferences: implications for agro-ecosystems management at landscape scale and raptor conservation. *Biological Conservation*, 178: 173–184.
- Shurulinkov P., Daskalova G., Hristov I., Ilieva M., Panikova R. & Day J., 2008. Contribution to the Knowledge on the Breeding Ornithofauna of Eastern Turkey. *Acta Zoologica Bulgarica*, 60: 125–133
- Thévenot M., Bergier P. & Beaubrun P., 1985. Present distribution and status of raptors in Morocco. In: Newton I. & Chancellor R.D. (Eds), *Conservation Studies on Raptors*. ICBP Technical Publications, 5: 83–101.
- Thévenot M., Vernon R. & Bergier P., 2003. The birds of Morocco. An annotated checklist. BOU Checklist 20. NHM, Tring
- Toschi A., 1969. *Avifauna italiana*. Ed. Olimpia, Firenze, 1031 pp.
- Turan L., 2005. The status of diurnal birds of prey in Turkey. *Journal of Raptor Research*, 39: 36–54.
- Whitaker J.I.S., 1905. The Birds of Tunisia. Being a History of the Birds Found in the Regency of Tunis. Vol. II. R.H. Porter, London, 412 pp.