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Status and size of Pied Avocet *Recurvirostra avosetta* populations in East Africa, with a first coastal breeding record

Raphaël Nussbaumer, Améline Nussbaumer, Don Turner and Colin Jackson

Summary

Several populations of Pied Avocet are understood to overlap in East Africa, yet the specific movements and size of each of them remains largely unclear. A review of current literature, combined with waterbird counts and recent citizen science data, suggests that potentially three populations occur in the region (Palaearctic, southern origin, and resident), and that the resident population is substantially smaller than previous estimates suggested. A new breeding record at the Kenyan coast, which only constitutes the fourth confirmed breeding location of Pied Avocet in Kenya and the first for the East African coast, demonstrates a potential overlap of Palaearctic migrants and East African residents, which may breed opportunistically along the coast. More resources are needed to carry out standardized and regular national monitoring counts in order to further elucidate the origin, movement, and numbers of Pied Avocets in East Africa.

Keywords: Avocet, migration, breeding, East Africa, bird populations

Introduction

The Pied Avocet *Recurvirostra avosetta* is a monotypic wader with a global conservation status of Least Concern (BirdLife International 2016), and an extensive breeding range from western Europe to Central Asia, and from the middle East to southern Africa (Pierce *et al.* 2020). While the origin of wintering birds in Western Africa has been researched extensively (Chambon *et al.* 2018, Hötker 2002) and has been confirmed from ringing recoveries as being western Europe (Blomert *et al.* 1990, Salvig 1995), the status of Pied Avocets in East Africa remains complex. Three populations have been suggested as overlapping in this area, though with little research to allow any validation of the different hypotheses (Delany *et al.* 2009).

First, an annual increase in the number of Pied Avocets occurring in the East African Rift Valley and Tanzania during the Palaearctic winter (Oct–Mar), but without evidence of breeding, has been attributed to the influx of Palaearctic migrants (Baker 1996, Britton 1980, Lewis & Pomeroy 1989). The Palaearctic origin is consistent with the general increase in occurrence and abundance across all eastern regions of Africa during these months. The successive increase in abundance in Israel first, followed by Northern Africa and then later East Africa suggests a post-breeding southward movement of Palaearctic birds (Appendix 1). However, to date there is no concrete evidence (such as ring recoveries) that Palaearctic birds reach East Africa and the ex-

act breeding location of these migrants remains unknown, with possibilities ranging from Eastern Europe to Asia.

Second, it has been suggested that large flocks of non-breeding birds counted from June to early August (e.g., 200 at Lake Nakuru, 800 at Lake Rukwa and 500 or more at Lake Magadi in early August 1969) could originate from southern Africa (Britton 1980). However, it was also hypothesized that the South African population might be resident (Tree 1997), breeding there from July to November (Tarboton 2001, Tree 1997). Recent citizen science data, however, show a lower reporting rate of Pied Avocets from February to July in southern Africa (Brooks & Ryan 2020, eBird 2020, Appendix 1), which could be explained by either seasonal movement to less extensively surveyed regions of sub-Saharan Africa (e.g., further north in Namibia; Dodman, 2014), or the aggregation of birds into more concentrated and widely separated groups, or both. Possible movement further north into East Africa is aligned with observations in southwest Tanzania (Baker & Baker 2020), such as a group of 800 in June at Lake Rukwa in the 1950s (Vesey-Fitzgerald & Beesley 1960).

Third, regular breeding records in the southern parts of the Kenya Rift Valley at Lake Magadi and at Lake Manyara in northern Tanzania attest to the presence of a small resident breeding population (Brown & Britton 1980, Fuggles-Couchman & Elliott 1946, Morgan-Davies 1960). This population breeds mostly after the main wet season (June–July) and occasionally after the short rains (January–February; Brown & Britton 1980). This is also confirmed by citizen science data (App. 1) as Pied Avocets are recorded throughout the year, even in June–July when no birds are reported in Israel and Northern East Africa. Beyond this, little is known about this population's movement and size, but opportunistic rain-related movement can be expected to be similar to the population in southern Africa (Delany *et al.* 2009, Tree 1997). For instance, Baker (1996) hypothesized that the large flocks gathering in June–August might be explained by birds waiting for ideal breeding conditions before spreading out in temporary waterholes created by rain.

The aim of this paper is to review the status and size of Pied Avocet populations in East Africa. To this end, we review existing literature and combine it with an analysis of the national waterbird counts of Tanzania and Kenya, and provide an updated estimate of the non-breeding and breeding populations. Finally, we report the first breeding record on the East African coast and discuss the possible origin of these birds.

Results and discussion

Estimation of the non-breeding population size

Combined with the difficulty of assigning any count of Pied Avocet (hereafter, just Avocet) to a specific origin, the variable breeding dates and unpredictable movements linked to rainfall patterns have presented a challenge in accurately estimating the size of the three populations in East Africa. This is further compounded by the fact that standardized counts are restricted to larger lakes, while breeding might be spread out in smaller temporary waterholes (e.g., Baker 1996, Lewis 1989). The size of the resident population in East Africa was recently revised from 25 000–100 000 (Delany *et al.* 2009, Stroud *et al*. 2004) to 20 000–50 000 (Dodman 2014). The initial estimate is mainly based on the mention of "45 000 or more on some Kenyan lakes" by Hayman (1986), yet as such a record cannot be verified, it is treated with caution here in the light of other historical counts (see below).

In Tanzania, Fuggles-Couchman & Elliott (1946) reported that numbers on Lake Manyara reached a peak of several thousand in the 1940s. January waterbird counts in Tanzania produced a total of 8323 Avocets in 1995 (Baker 1996), but only 2247 in 2005 (N. Baker pers. comm.). In Kenya, besides a count of 3200 at Lake Turkana in January 1986 (Taylor 1996), there are just a few records of numbers greater than around a thousand birds (e.g., Davis 2019, Pearson 1983, Turner 1992). The annual January waterbird counts in Kenya (Fig. 1) detected a mean of 2387 (s.e. 370) birds annually from 1991–2020. Ninety-three percent of all Avocets counted during those years are concentrated in three main sites (Fig. 3): Lake Elementeita (mean: 1194, s.e. 255; max: 4631), Lake Magadi (mean: 841, s.e. 212; max: 5264) and Lake Nakuru (mean: 373, s.e. 146; max: 2934). The count data reveal high annual variability in the total number of Avocets at these sites (ranging between 340 in 2015 and 7477 in 2009) without any clear trend. In addition, while some sites have seen their occupancy levels decrease (e.g., Lake Elementeita: mean of 1570 in 1991–2010 to 253 in 2011–2020), others saw an increase (Lake Magadi: mean of 597 in 1991–2010 to 1276 in 2011–2020). This suggests that Avocets winter in different lakes each year, most probably linked to water-level conditions. We can assume that Avocets from Tanzanian lakes (e.g., Lake Natron) do the same. Therefore, estimates of the number of Avocets in East Africa based on summing the maxima of each site across the years run the risk of double-counting individuals.

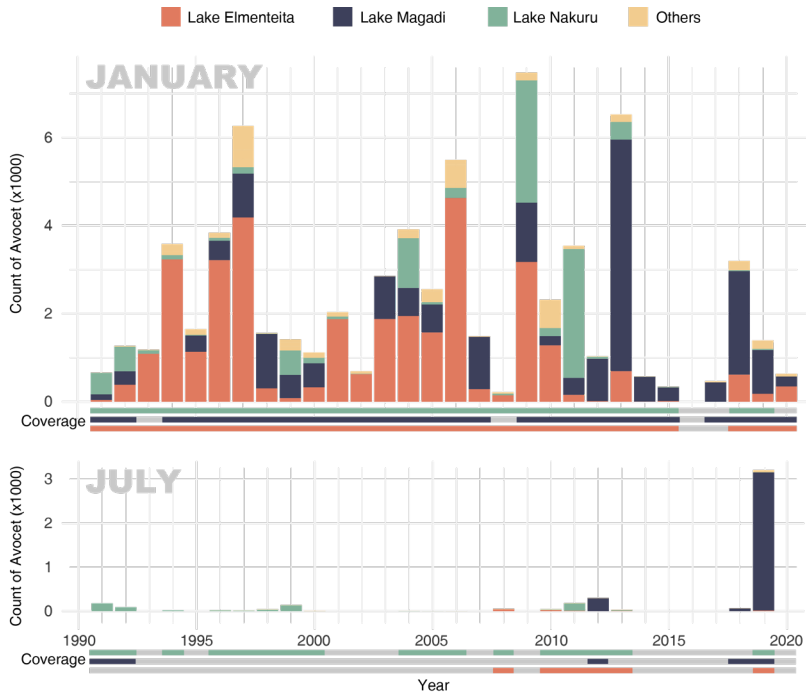

Figure 1. Number of Pied Avocets recorded during national waterbird counts in Kenya for January and July counts. The coverage lines illustrate whether counts were performed at each of the three lakes (coloured) or not (grey).

Based on data from 1995, Baker (1996) extrapolated a total non-breeding population of 12 000–15 000 for Tanzania, though with a caveat that the estimate might be too high. Thus, adding the Tanzanian and Kenyan counts, we can reach an estimate of 10 000–20 000 for non-breeding birds in East Africa. However, these counts include Palaearctic migrants, and as such cannot be used to estimate the size of the East African resident population.

Estimation of the breeding population size

An estimation of the resident breeding East African population is fraught with difficulty. While it might be assumed that a July count would exclude Palaearctic birds, it is possible that first-year Palaearctic migrants may remain on the non-breeding grounds (i.e., over-summering) as has been shown to be a common occurrence in other wader species (e.g., see McNeil *et al.* 1994). Furthermore, July would be the time of year that southern African migrants might be in the region and thus augment the resident population.

In Kenya, the only estimate of breeding birds is of "a small number" at Lake Magadi (Britton 1980, Lewis & Pomeroy 1989), while in Tanzania, Baker (1996) estimated that "a few thousand pairs" should be breeding based on the 1995 January waterbird count, acknowledging the large uncertainty due to the multiple potential breeding sites available. Meanwhile, Morgan-Davies (1960) reported only 14 breeding pairs at Manyara in 1959. Fewer waterbird counts were carried out in July than in January (Fig. 1), with 18 at Lake Nakuru (mean: 41, max: 173), six at Lake Elementeita (mean: 18, max: 43) and only three at Lake Magadi (296 in 2012, 61 in 2018 and 3135 in 2019). The exceptional count of 2019 is likely to have been caused by the flooding of Lake Natron in northern Tanzania, and ensuing population displacement.

Overall, based on these counts and field experience, we tentatively estimate there to be an East African breeding population of maximum 750 pairs in Kenya and Tanzania combined.

First coastal breeding record

On 23 January 2020, as part of the annual international waterbird counts, 68 Pied Avocets were observed at Krystalline Salt Works Ltd. in Gongoni, coastal Kenya (3°02′18″ S, 40°08′51″ E), on a pan with shallow saline water. The presence of at least four chicks confirmed that some had bred recently at the site. Given the size of the chicks, they were likely to have been only two to three weeks old (Fig. 2).

Avocets had been recorded on the salt pans for three consecutive years of waterbird counts in January: 101 were counted in 2018, 72 in 2019 and 68 in 2020 (Nussbaumer *et al.* 2021). A follow-up visit to Krystalline Salt Works was conducted on 5 June 2020, during which 133 individuals were counted but no indication of breeding was observed.

Known and accepted Kenyan breeding records are confined to an old sighting at Lake Nakuru (Jackson 1938), "annual nesting of small numbers" at Lake Magadi (Brown & Britton 1980), and a record from Amboseli (Lewis 1989). Large numbers of breeding Avocets reported from Nyeri freshwater marshes (Mackworth-Praed & Grant 1952) are considered a doubtful record (Lewis 1989, Lewis & Pomeroy 1989). In Tanzania, nesting has been recorded in several locations in the north of the country but never near the coast (Baker 1996).

Figure 2. Pied Avocet adult and chicks at Gongoni, central Kenya coast, on 23 January 2020 (Photo: M. Adamjee).

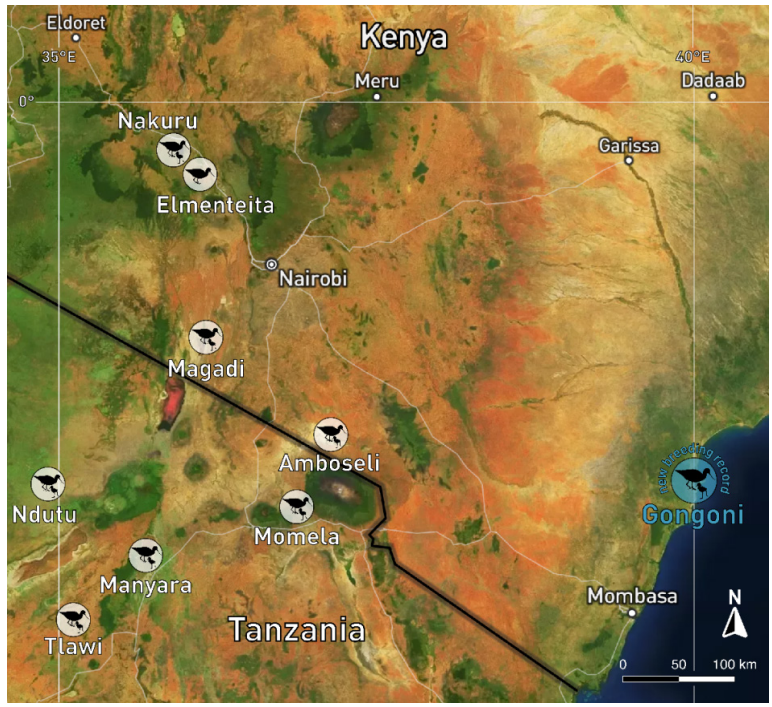

Figure 3. Map of known breeding sites for Pied Avocet in Kenya and Tanzania (Source: Mapbox, OpenStreetMap).

All the existing breeding records in East Africa were in shallow saline-alkaline lakes, which resemble the shallow saltwater pans where this breeding event was observed. Saltpans constitute a favourable nesting habitat for this species in other areas of its distribution (e.g., Chokri & Selmi 2011, Hötker & West 2005, Lei *et al*. 2021, Pierce *et al*. 2020).

The timing of this breeding record falls within the short rains, which is typically a secondary breeding season for the species (see Introduction). Indeed, as is the case for many species in regions with bimodal rainfall regimes, peak breeding for Avocets occurs in June–July in East Africa, at the end of the long rains (Brown & Britton 1980, Lewis & Pomeroy 1989). However, breeding after the short rains has also been recorded in northern Tanzania in January (Baker 1996) and in Kenya in February (Brown & Britton 1980). The timing of the breeding described here matches these other East African breeding records and might be further explained by the extreme positive Inverse Ocean Dipole event in 2019 which caused extended short rains and high water levels (Lu & Ren 2020, Nussbaumer *et al.* 2020).

Origin of Avocets on the coast

The counts at the Sabaki River mouth, the only monitored site where Avocets are regularly sighted in coastal Kenya (Nussbaumer *et al.* 2021), suggest that most birds occurring there belong to the migratory Palaearctic population. Indeed, Avocets are mainly present from October to March with peak numbers in early December (Fig. 4). Further south along the coast, around Dar es Salaam, a similar seasonal pattern is observed with birds present from September to April (Baker & Baker 2020).

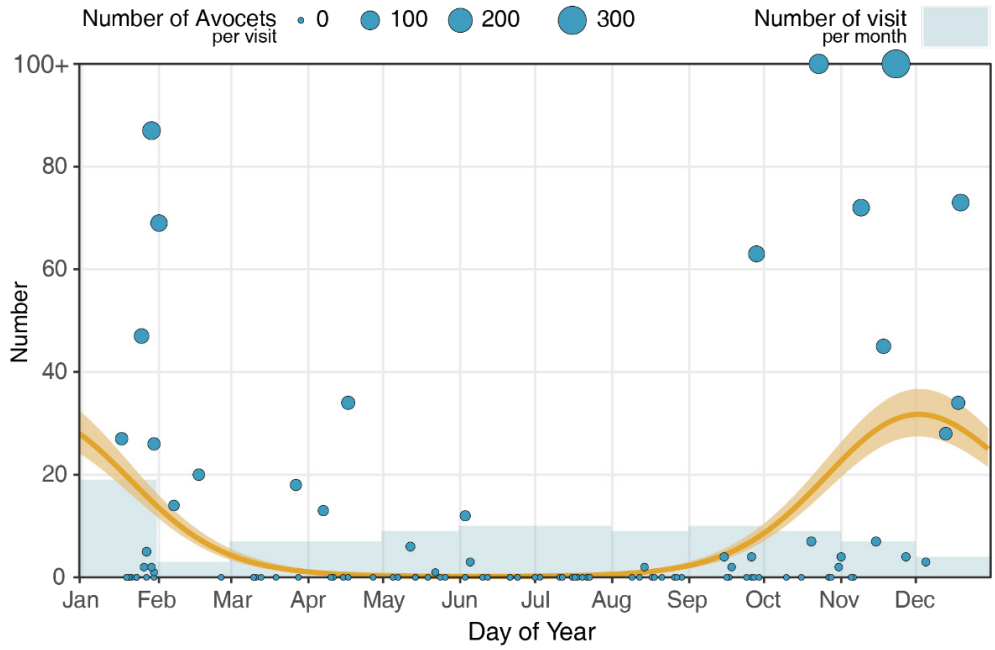

Figure 4. Counts of Pied Avocet at the Sabaki River Mouth (3°10′05″ S, 40°08′42″ E), located 18 km south of Gongoni, where monthly waterbird counts are conducted by A Rocha Kenya (1998–2020). The yellow line represents the smoothing of the counts using a generalized additive model with its uncertainty.

However, this new breeding record suggests that there is an overlap of occurrence between East African and Palaearctic populations on the coast and dispels the assumption that avocets on the coast are exclusively migratory. This is further confirmed by the later count of 133 birds at the salt pans in June 2020. Yet the lack

of prior breeding records, the small number of chicks observed, and the absence of Avocets on nests suggest that opportunistic breeding at Gongoni only occurs when conditions are suitable, with birds arriving there from the population in the Rift Valley. Similarly, the small flocks observed at Sabaki in June (Fig. 4) could be attributable to local movements of the resident East African population based on rainfall patterns and the water level of the Sabaki River. However, in the absence of ringing or satellite tracking data, the interchange of birds between these two regions remains unconfirmed.

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Data Accessibility

All the data and codes used for this study can be found at https://github.com/A-Rocha-Kenya/Pied-Avocet-Breeding-And-Review.

References

Baker, N.E. 1996. Tanzania Waterbird Count: The First Coordinated Count on the Major Wetlands of Tanzania, January 1995. BirdLife International.

Baker, N.E., & Baker, L. 2020. Tanzania Bird Atlas Preliminary Map. http://tanzaniabirdatlas.net/.

BirdLife International. 2016. *Recurvirostra avosett*a. The IUCN Red List of Threatened Species 2016.

Blomert, A.M., Engelmoer, M. & Ntiamoa-Baidu, Y. 1990. The Banc d'Arguin, Mauritania, as a meeting point for avocets during spring migration. *Ardea* 78(1–2): 185–192.

Britton, P.L. (ed.) 1980. *Birds of East Africa: their habitat, status and distribution*. Nairobi: East Africa Natural History Society.

Brooks, M. & Ryan, P. 2020. Southern African Bird Atlas Project 2. Animal Demography Unit, Department of Zoology, University of Cape Town.

Brown, L.H. & Britton, P.L.1980. *The breeding seasons of East African birds*. Nairobi: East Africa Natural History Society. https://doi.org/10.5962/bhl.title.114419.

Chambon, R., Dugravot, S., Paillisson, J.M., Lemesle, J.C., Ysnel, F. & Gélinaud, G. 2018. Partial migration in inexperienced pied avocets *Recurvirostra avosetta*: distribution pattern and correlates. *Journal of Avian Biology* 49(6). https://doi.org/10.1111/jav.01549.

Chokri, M.A. & Selmi, S. 2011. Nesting ecology of pied avocet *Recurvirostra avosetta* in Sfax salina, Tunisia. *Ostrich* 82(1): 11–16.

Davis, T. 2019. eBird Checklist: https://ebird.org/checklist/S62436006. In eBird: An online database of bird distribution and abundance [web application]. https://ebird.org/checklist/S62436006.

Delany, S., Scott, D., Dodman, T. & Stroud, D. 2009. *An atlas of wader populations in Africa and Western Eurasia*. Wageningen: Wetlands International.

Dodman, T. 2014. Status, *Estimates and Trends of Waterbird Populations in Africa: AEWA-listed African populations*.150. Wageningen: Wetlands International.

eBird. 2020. eBird: An online database of bird distribution and abundance [web application]. Ithaca, New York: EBird, Cornell Lab of Ornithology. http://www.ebird.org.

Fuggles-Couchman, N.R. & Elliott, H.F.I. 1946. Some records and field-notes from North-Eastern Tanganyika Territory. *Ibis* 88(3): 327–347.

Hayman, P., Marchant, J. & Prater, T. 1986. *Shorebirds: an Identification Guide to Waders of the World*. London: Croom Helm.

Hötker, H. 2002. Arrival of pied avocets *Recurvirostra avosetta* at the breeding site: effects of winter quarters and consequences for reproductive success. *Ardea* 90(3): 379–387.

Hötker, H. & West, R. 2005. Population size, population development and habitat use by Avocets in Western Europe at the end of the 20th century. *Bulletin-Wader Study Group* 107: 57–112.

Lewis, A.D. (1989). A new Kenyan breeding site for the Avocet *Recurvirostra avosetta*. *Scopus* 13(2): 121–122.

Lei, W., Wu, Y., Wu, F., Piersma, T., Zhang, Z., & Masero, J.A. 2021. Artificial Wetlands as Breeding Habitats for Shorebirds: A Case Study on Pied Avocets in China's Largest Saltpan Complex. *Frontiers in Ecology and Evolution*, 9:622756. doi: 10.3389/fevo.2021.622756.

Lewis, A. & Pomeroy, D. 1989. *A Bird Atlas of Kenya.* Rotterdam: A. A. Balkema.

Lu, B. & Ren, H.L. 2020. What Caused the Extreme Indian Ocean Dipole Event in 2019? *Geophysical Research Letters* 47(11): 0–2.

Mackworth-Praed, C.W. & Grant, C.H.B. 1952. *Birds of eastern and north eastern Africa* Vol. 1. London: Longmans, Green.

McNeil, R., Diaz, M.T. & Villeneuve, A. 1994. The mystery of shorebird over-summering—a new hypothesis. *Ardea* 82(1): 143–151.

Morgan-Davies, A.M. 1960. A Nesting Colony of Avocets at Lake Manyara Tanganyika. *Journal of the East Africa Natural History Society* 23(6): 241–243.

Njoroge, P. & Brooks, M. 2020. Kenya Birdmap (Full protocol records). Kenya BirdMap, National Museums of Kenya.

Nussbaumer, R., Lennox, K., Baya, A., Gijsbertsen, J., Kinzer, A. & Jackson, C.H.W. 2021. Waterbird Counts at Sabaki River Mouth and Mida Creek. A Rocha Kenya.

Nussbaumer, R., Lennox, K. & Jackson, C. 2020. National Waterbird Counts Report Kenya, Coast (Issue May).

Pearson, D.J. 1983. East African Bird Report 1981. *Scopus* 5(5): 131–153.

Pierce, R.J., Kirwan, G.M. & Boesman, P.F.D. 2020. Pied Avocet (*Recurvirostra avosetta*), in del Hoyo, J., Elliott, A., Sargatal, J., Christie, D. & de Juana, E. (eds). *Birds of the World*. Ithaca, New York: Cornell Lab of Ornithology.https://doi.org/10.2173/bow.pieavo1.01.

Salvig, J.C. 1995. Migratory movements and mortality of Danish Avocets *Recurvirostra avosetta*. *Ringing and Migration* 16(2): 79–90.

Stroud, D.A., Davidson, N.C., West, R., Scott, D.A., Haanstra, L., Thorup, O., Ganter, B. & Delany, S. 2004. Status of migratory wader populations in Africa and Western Eurasia in the 1990s. *International Wader Studies* 15: 1–259.

Tarboton, W. 2001. *A guide to the nests and eggs of southern African birds*. South Africa: Struik.

Taylor, B. 1996. Resident and migrant waterbirds at Lake Turkana. In L. A. Bennun & M. Fasola (eds). *Quaderni della Civica Stazione Idrobiological di Milano* (Vol. 21, pp: 7–62).

Tree, A.J. 1997. Avocet (pp. 434-435), in Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds). *The Atlas of Southern African Birds*. Johannesburg: BirdLife South Africa.

Turner, D.A. 1992. East African Bird Report 1990. *Scopus* 14(3): 130–158.

Urban, E.K., Fry, C.H. & Keith, S. 1986. *The birds of Africa.* Vol. 2. London & New York: Academic Press.

Vesey-Fitzgerald, D.F. & Beesley, J.S.S. 1960. An annotated list of the birds of the Rukwa Valley. Tanganyika. *Tanganyika Notes and Records* 54: 91–110.

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Appendix 1

In this appendix we aggregate citizen science data of Pied Avocet across multiple regions from South Africa to Israel to show the spatial and temporal change in occurrence. These data can help in elucidating the movement and overlap of the three populations of Pied Avocet overlapping in East Africa.

We downloaded barchart data from eBird (e.g. https://ebird.org/barchart?r=ZA,ZW,NA,MZ,BW&bmo=1&emo=12&byr=1900&eyr=2021&spp=pieavo1) (eBird, 2020) which provided frequency (i.e., percentage of complete checklists reporting a Pied Avocet) and abundance (i.e., average number of Pied Avocets reported). We aggregated data in five regions (Table 1) based on similarity of frequency and abundance data, as well as providing a sufficient number of checklists. We also downloaded the 'full protocol card' data from the African Bird Atlas Project (ABAP) (http://www.birdmap.africa/species/269) and extracted the reporting rate (percentage of cards reporting Pied Avocets) for Southern Africa and Kenya (Brooks & Ryan 2020, Njoroge & Brooks 2020).

Table 1. Description of regions used in Figure 5. Sample refers to checklists for eBird and cards for African Bird Atlas Project (ABAP). Countries providing a large proportion of the data for the region are marked with an asterisk.

Name of region	Countries	Number of samples	Source
Southern Africa	Zambia, Zimbabwe, Namibia, Mozambique, Botswana and South Africa*	108 005	eBird
		271 236	ABAP
East Africa	Kenya, Tanzania and Uganda	60 046	eBird
		8 221	ABAP
Northern East Africa	Ethiopia*, Eritrea, Djibouti, Soudan	10 373	eBird
Israel	Israel*, Egypt and Jordan	74 998	eBird
Gulf countries	United Arab Emirates, Qatar, Kuwait	37 577	eBird

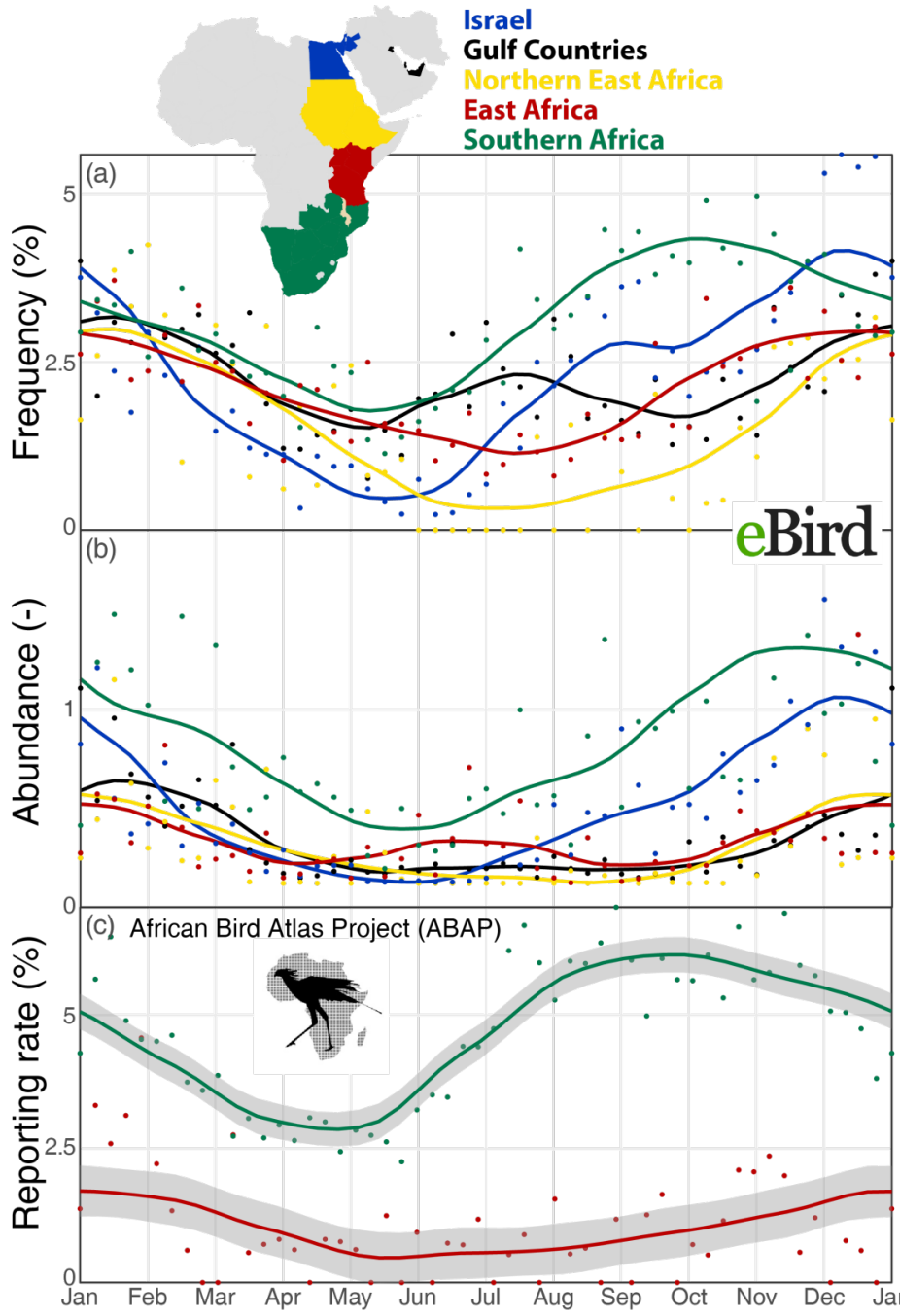

Figure 5. Phenology of Pied Avocet occurrence from South Africa to Israel from citizen science data: (a) percentage of complete checklists reporting Pied Avocet in the eBird dataset, (b) average number of Pied Avocets reported in checklists in the eBird dataset, and (c) reporting rate of Pied Avocets in cards for African Bird Atlas Project (ABAP). The coloured lines represent the same coloured region in the map.