A new subspecies of Little Tern from the Levant and its distinction from 'European Little Tern' and Saunders's Tern

Yosef Kiat, Norman Deans van Swelm, Abdulla Alkaabi, Tereza Senfeld and J. Martin Collinson

Abstract In this paper, we describe a new subspecies of the Little Tern *Sternula albifrons*. We propose the name *S. a. levantinus,* the 'Levant Little Tern', reflecting the known breeding range of these birds. Levant Little Terns are, compared to Little Terns elsewhere in Europe ('European Little Terns') and Saunders's Terns *S. saundersi*, generally darker on the upperparts and with a tendency to show a grey rump and uppertail-coverts, concolorous with the back and mantle. Levant Little Terns are intermediate between European Little Terns and Saunders's Terns in biometrics and in some characteristics of the breeding plumage, such as the number of dark outer primaries. Genetic analysis shows that Levant Little Terns form a phylogenetic group with European Little Terns, distinct from Saunders's Terns and from Little Terns in Japan, Korea and Australasia (*S. a. sinensis*). Surprisingly, the genetic data also show that Little and Saunders's Terns are not each other's closest relatives; Saunders's Tern is a sister species to Least Tern *S. antillarum* of North America. The relationship between Levant Little Terns and the Little Terns breeding in the Persian Gulf requires further study.

Introduction

The genus *Sternula* includes the seven smallest species of tern, which are common in most parts of the world: the Least Tern *S. antillarum* in North America, the Yellow-billed Tern *S. superciliaris* and Peruvian Tern *S. lorata* in South America, the Little Tern *S. albifrons* across Eurasia and Africa, the Saunders's Tern *S. saundersi* in South Asia, the Damara Tern *S. balaenarum* in southern Africa, and the Fairy Tern *S. nereis* in Australia (del Hoyo *et al.* 2020). Two of these species – the Little Tern and the Saunders's Tern – breed in the Western Palearctic. The Little Tern is a common migrant breeder in Europe, North Africa and Arabia (Gochfeld *et al.* 2020a), while the Saunders's Tern breeds in the southeastern reaches of the Western Palearctic, in Egypt (Habib 2014) and Arabia (Gochfeld *et al.* 2020b), as well as in East Africa and south-west Asia east to Pakistan.

Distinguishing between these species can be a challenge, especially when dealing with individuals in non-breeding or immature plumage (Mullarney & Campbell 2022),

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though adults in breeding plumage can also be challenging (Malling Olsen & Larsson 1995a). In this paper, we describe the unique plumage characteristics and morphology of the Little Terns breeding in the Levant, Red Sea and northern Egypt (referred to from here on as 'Levant Little Terns'). We address the differences between the plumages of these birds compared to both Little Terns in Europe ('European Little Terns') and Saunders's Tern. In addition, we consider the possibility of misidentification between Levant Little Terns and extralimital records of both Saunders's Tern and Least Tern. We also suggest areas of future research for further clarifying the status of *Sternula* terns in the Western Palearctic.

Methods

The work presented in this paper is based primarily on a ringing project with Little Terns breeding in Israel. This project began in 2010 and has seen 1,895 birds ringed at a breeding colony in a series of artificial salt-pans near the town of Atlit, about 300 m from the Mediterranean coast (32.69°N 34.93°E). Free-flying Little Terns (adults and fledged young) were trapped using mist-nets during spring migration and the breeding season (April to August). Each tern was marked with a metal ring and a coded, plastic ring to enable individual recognition by researchers at a distance. Additional data collection was undertaken at the Natural History Museum in Tring and using the Cornell Lab of Ornithology's Macaulay Library (www.macaulaylibrary.org). Unpublished data on European Little Terns from the Baltic Sea and Northeast Atlantic regions were also obtained from ringing groups operating in these areas.

Results

Ringing

Most adults arrive at the breeding colony in Israel in late March and the first half of April. Ringing has shown that 34.3% of 216 individuals ringed as juveniles during 2010–20 returned to their natal colony during their first summer (2CY). This situation is different from that for populations breeding in northern Europe, where it is rare for first-summer birds to return to the breeding colony. Most of these first-summer individuals arrive at the breeding colony in Israel about a month later than the adults and acquire an adult-type breeding plumage, after which they cannot be separated from older birds by plumage alone. First-summer birds retaining a non-breeding plumage throughout the breeding season are uncommon in the colony in Israel, and such birds appear at the colony late in the season, mainly from July to mid August. Throughout this paper, we therefore use the term 'breeding plumage' to refer to the plumage of any bird not in juvenile, immature or non-breeding plumage, regardless of the age of the individual.

Two birds ringed at the breeding colony in Israel have been recovered on their wintering grounds in the southern hemisphere. Both were ringed as recently fledged juveniles (flight feathers still growing) in June/July 2012 and found in early March 2015 at Point Barra, Inhambane, Mozambique (23.78°S 35.52°E, a distance of 6,251 km). These two birds represent the southernmost recovery of any Little Tern; European Little Terns winter further north, in West Africa (Morocco, Mauritania, Senegal, The Gambia, Guinea-Bissau, Sierra Leone, Ivory Coast and Ghana), including individuals from populations breeding in relatively eastern parts of Europe, such as Poland, Lithuania and Belarus (Spina *et al.* 2022).

Plumage description of Little Terns breeding in the Levant

Birds breeding in the Levant, including Israel, are characterised by darker upperparts compared to Little Terns breeding in Europe and to Saunders's Terns. While lighter individuals in the Levant region can appear similar to birds in Europe, sometimes being only slightly darker above, other individuals can be strikingly dark in comparison (plate 143).

Back, rump and uppertail-coverts

The overall colour of the upperparts on Levant Little Terns is grey, similar to that of European Little Terns but usually a little darker, and always darker than Saunders's Tern (fig. 1). In European Little Terns, the rump and uppertail-coverts are white, contrasting with the bird's grey back (plate 144). Some Levant Little Terns are similar,

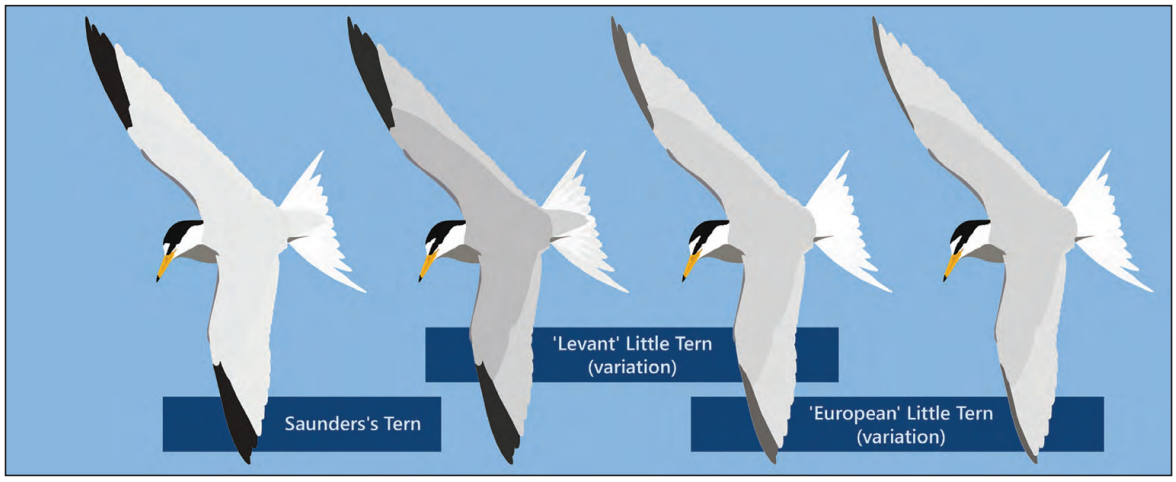

Fig. 1. Saunders's Tern *S. saundersi*, 'Levant Little Tern' *S. albifrons* subspecies nova and 'European Little Tern' *S. a. albifrons* showing differences in upperpart, rump and uppertail-covert coloration, and the colour and number of dark outer primaries.

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143. 'Levant Little Tern' *Sternula albifrons* subspecies nova, northern Israel, June 2018. This individual shows relatively dark grey upperparts, a grey rump, uppertail-coverts and tail feathers, and a restricted white patch on the forehead. Note also the pale, almost whitish peripheral uppertail-coverts, which frame the darker grey central uppertail-coverts.

with the rump and uppertail-coverts white or paler grey than the back but, in most individuals, the rump and uppertail-coverts are concolorous with the bird's back (plates 145 & 146). This pattern is extremely similar to that of Saunders's Tern, which also shows concolorous rump, uppertail-coverts and back, though this species has a pale, lighter-grey plumage, usually lighter than that of European Little Terns (Mullarney & Campbell 2022). The grey rump and uppertail-coverts in Levant Little Terns often contrast with the whitish undertail-coverts when viewed from the side and, in some individuals, with the marginal (outer) uppertail-coverts as well, which tend to be whitish (plates 143, 145–147). This pattern is different from Saunders's Tern, where the marginal uppertail-coverts are intermediate in tone between the grey central uppertail-coverts and the tail feathers and the white undertail-coverts, resulting in a gradual lightening and a less contrasting pattern, so that the darker grey uppertail-coverts appear less prominent (plates 148 & 149).

Outer primaries

As in many Laridae species, the outer primary feathers of *Sternula* terns are darker than the inner ones. The dark colour of these feathers is the result of moult strategy and abrasion (Chandler & Wilds 1994; Pyle *et al.* 2009; Thompson *et al.* 2020), of pigmentation by melanin, or a combination of both. The mechanisms that determine the outer-primary colour are not discussed further in this paper. Both the number of darker primaries and the degree of their darkness varies within the *Sternula* terns.

Marco Basso

Natural History Museum, Tring

144. European Little Tern *S. a. albifrons*, Italy, May. A white rump and uppertail-coverts is typical of European Little Terns. **145.** European Little Tern (left), Levant Little Tern (centre) and Saunders's Tern *S. saundersi* (right), showing differences in the coloration of the back, rump and uppertail-coverts.

Natural History Museum, Tring

Katya Rudnev

146. Saunders's Tern (top), Levant Little Tern (middle) and European Little Tern (bottom).
147. Adult Levant Little Tern, northern Israel, June 2017. This ringed bird is at least seven years old.

David Darrell-Lambert

David Darrell-Lambert

148. Saunders's Tern, Saudi Arabia, May 2021. Note the square and limited white forehead patch, paler grey upperparts, concolorous back, rump and central uppertail-coverts, and contrastingly dark primaries. **149.** Saunders's Tern, Bahrain, April 2021.

Jonathan Bull

150. European Little Tern, Gronant, Flintshire, May 2021.

European Little Terns have on average 1.9 dark primaries (range 1–3, n = 168), usually one to two (plate 150; fig. 2a). Additionally, the outer primaries of European Little Terns are typically dark grey, seldom blackish. Saunders's Terns have on average 3.0 dark primaries (range 2–5, n = 74). Most individuals have three dark outer primaries, and individuals with two are more common than individuals with four or five. In this species, the outer primaries are described as darker than in Little Tern, contrasting more strongly with the inner primaries (Mullarney & Campbell 2022; plates 148 & 149, fig. 2a).

The outer primaries of Levant Little Terns are usually blackish or dark grey, typically darker than in European Little Terns. Levant Little Terns show between one and four dark outer primaries (average 2.5, n = 37), with two or three dark primaries being the most common (fig. 2a). Individuals with four blackish primaries (plates 151 & 152) are more common than birds with only a single dark outer primary. Thus Levant Little Tern is intermediate between European Little Tern and Saunders's Tern in the colour and number of dark outer primaries.

Yosef Kiat

151. Adult Levant Little Tern, northern Israel, July 2016. Within our sample, a pattern of four dark outer primaries was found only in Levant Little Terns and never in European Little Terns.

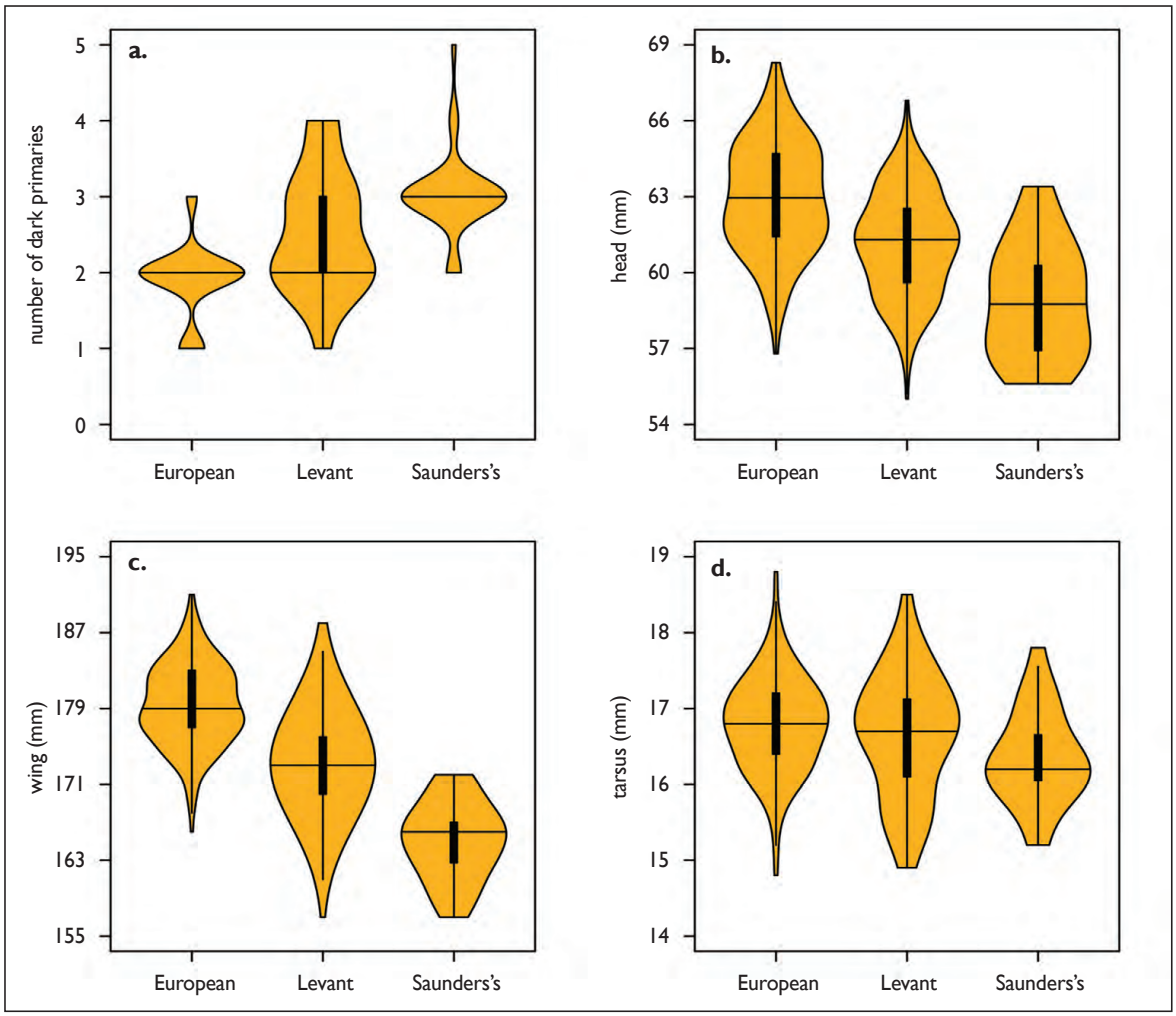

Fig. 2. **a.** Number of outer dark (dark grey or blackish) primary feathers, **b.** head length, **c.** wing length and **d.** tarsus length in European Little Tern, Levant Little Tern and Saunders's Tern. The width of each yellow patch represents frequency while the vertical bar represents the 95% confidence interval and the horizonal bar represents the median value.

Shimon Shiff

152. Adult Levant Little Tern, Eilat, Israel, June.

Forehead pattern

European Little Terns have a head pattern that includes a black cap and lores and a white forehead patch that extends to above or behind the eye, creating a rounded border between white and black on the forehead when viewed from above (plates 153 & 154). In contrast, Saunders's Tern has a white forehead but lacks the white extension over the eye (plates 148 & 149); the resulting pattern is a squarer border to the forehead relative to European Little Terns (Mullarney & Campbell 2022). Levant Little Terns are intermediate in this characteristic, with a white forehead that typically has a shorter extension of white over the eye, less than in European Little Terns, though there is considerable variability (see, e.g., plates 155–157). In many individuals, this extension of white reaches in line with the eye, while a few individuals show no

extension of white at all, resulting in a square forehead patch similar to Saunders's Tern (plate 156). That said, the white forehead patch of Levant Little Terns is rarely as restricted as in Saunders's Terns, though it may look similar when viewed from certain angles (e.g. the bird in plate 157).

Simon Colenutt

Yuri Mukhin

Ofer Brill

Yosef Kiat

Ofer Brill

153. top Adult European Little Tern, Pennington Marshes, Hampshire, May. The rounded white forehead patch is typical in this taxon.

154. upper middle Adult European Little Tern, Arabat Spit, Ukraine, July.

155. lower middle Adult Levant Little Tern, northern Israel, July 2021. This bird is at least 13 years old.

156. bottom left Square white forehead patch in Levant Little Tern, adult (>2CY), northern Israel, July 2016.

157. bottom right Adult Levant Little Tern, northern Israel, July.

Size

Fig. 2b–d summarises the size differences between European Little Terns, Levant Little Terns and Saunders's Terns. The results of the comparisons show that the Little Terns breeding in the Levant have an intermediate body size between the larger European Little Terns and the smaller Saunders's Terns, although the overlap between the three is considerable.

Genetics

A genetic analysis was undertaken to resolve the status of Levant Little Terns with respect to Little Terns from elsewhere in the range and with respect to Saunders's Tern. Feather samples were obtained from four Levant Little Terns from Atlit, Israel (32.69°N 34.93°E), and four from Port Said, Egypt (31.35°N 32.05°E). Feathers from one Little and one Saunders's Tern were obtained from Bahrain (26.26°N 50.47°E). DNA was extracted from all samples and the COI gene amplified and sequenced using published barcoding technology (Hebert *et al.* 2004). Sequences were aligned with available GenBank sequences from Little Terns from the rest of the range, representing European, Middle Eastern, Asian and Australasian breeding populations, and also with sequences from Least, Fairy and Yellow-billed Terns. No sequences are currently available for Damara and Peruvian Terns. A maximum likelihood tree was drawn to illustrate the relationships between the taxa based on this mitochondrial gene (fig. 3). It showed with high confidence that the sequences from Levant Little Tern fall within a clade that includes Little Terns from Europe and western Russia. It is therefore unlikely that Levant Little Terns have had a long period of genetic isolation from other Little Terns. The tree also shows that Saunders's Tern is not closely related to Little Tern, perhaps surprisingly it is a sister species to Least Tern – a relationship that perhaps makes sense on the basis of plumage details but suggests an unusual biogeographic history. Little Terns from Japan, Korea and Australasia form their own well-supported genetic clade and it is likely they merit species status.

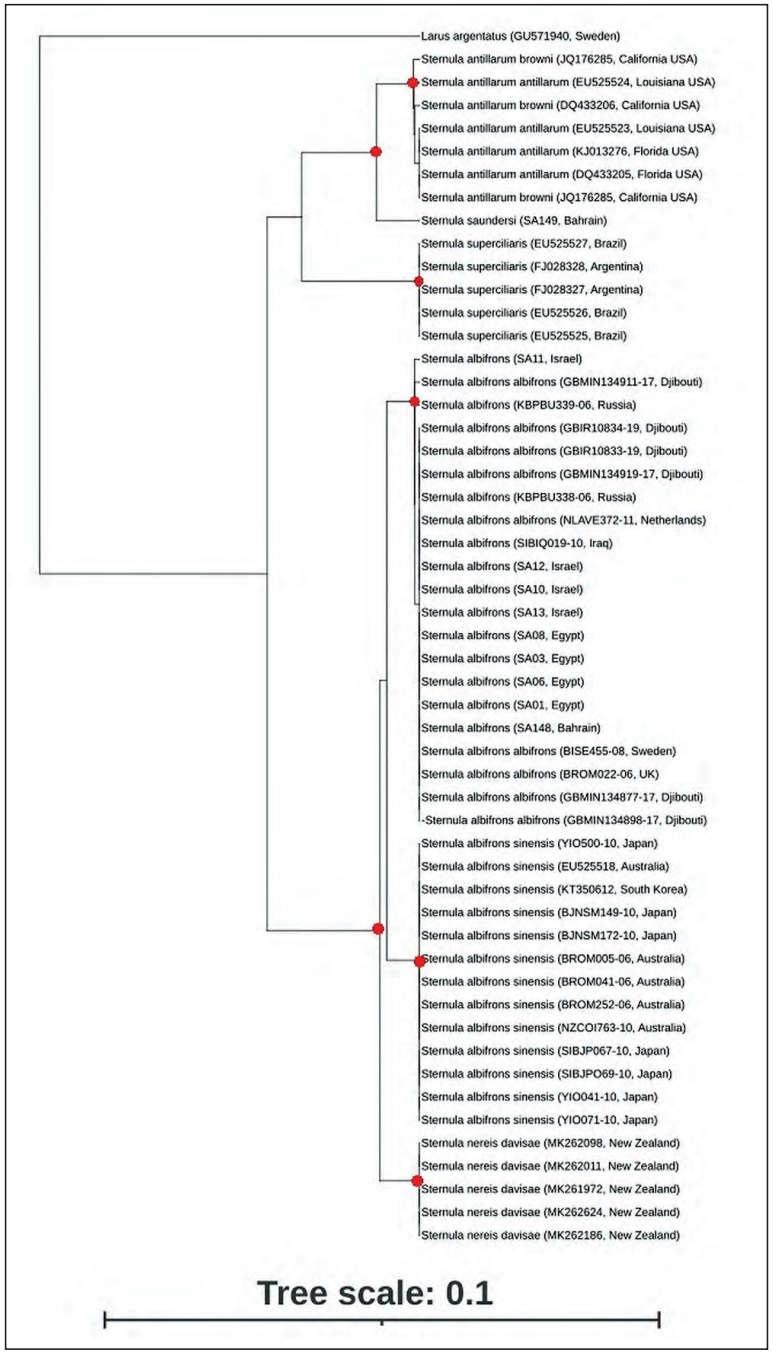

Fig. 3. *Sternula* tern COI gene phylogeny. Maximum Likelihood tree of COI of *Sternula* terns, including published sequences and new birds sampled for this study. The red dots highlight nodes with >99% bootstrap support.

Taxonomic proposal

Based on the morphological characteristics described above, we propose a new subspecies of Little Tern.

Sternula albifrons levantinus,
subspecies nova

Holotype

AV-18679: male (skin) from Hula Valley, northern Israel, collected on 11th July 1957 by A. Dani (Ussishkin House Zoological Collection), currently held in the Steinhardt Museum of Natural History, Tel Aviv University, Israel.

Paratypes

1924-3-20-160: male (skin) from Tigris River, Karadah, Baghdad, 'Mesopotamia' (Iraq), collected on 24th July 1921 by P. Z. Cox and R. E. Cheesman, currently held in the avian collection at the Natural History Museum, Tring.

1907-12-21-655: female (skin) from Gök, Turkey, collected on 1st July 1905 by R. B. Woosnam (A. C. Bailward Collection), currently held in the avian collection at the Natural History Museum, Tring.

1965-M-4216: female (skin) from Antioch Lake, Amik Valley, southern Turkey (formerly Syria), collected on 17th May 1933 (R. Meinertzhagen Collection), currently held at the avian collection of the Natural History Museum, Tring.

Etymology

The English name – Levant Little Tern – and scientific name – *levantinus* – proposed here reflect the known breeding distribution of the subspecies, which occurs mainly in the Levant.

Discussion

The Levant Little Tern is distinct by its darker plumage compared to both the European Little Tern and the Saunders's Tern, although some characteristics are intermediate between European Little Tern and Saunders's Tern (fig. 2). The Levant Little Tern has been documented breeding on the Red Sea coast of Saudi Arabia and the Mediterranean coast of Israel and Syria. Additionally, Levant Little Terns have been found breeding locally at Port Said on Egypt's Mediterranean coast (Habib 2016). This led to the terns there being casually named as 'Malaka's Little Tern' *S. a. 'habibi'* (Deans van Swelm 2016), though no formal description was published and no type specimen was designated.

Further research is needed to map the breeding distribution of Levant Little Tern. Specimens that fit the morphological description of this newly described subspecies have been collected from southeast Turkey, Iran, Iraq and Oman (specimens in the Natural History Museum, Tring), but it is not clear if these represent birds from local breeding populations.

Furthermore, the relationship between European and Levant Little Terns and *S. a.* '*innominata*' from the Persian Gulf should be investigated; *innominata* is currently synonymised with the nominate race of Little Tern by both IOC and HBW/BirdLife (Gill *et al.* 2023; editor's note in Gochfeld *et al.* 2020a). A description given by Baker (1928) of *S. a. 'praetermissa'* from the Persian Gulf, considered to be a junior synonym of *innominata*, states that birds there have 'rump, upper tail-coverts and tail grey, but distinctly paler than the back. Shafts of both first and second primaries dark brown.'

Cramp (1985) noted the occurrence of birds intermediate between Saunders's Tern and Little Tern in the northern Indian Ocean, and interpreted this as suggesting intergradation, but they may in fact have been Levant Little Terns.

The darker plumage of the Levant Little Tern, compared to European birds, may reflect Gloger's rule (Gloger 1833), whereby southern populations living in warm and more humid environments show a darker phenotype than those living in cooler, less humid environments. In addition, the phylogenetic difference between Levant Little Tern and Saunders's Tern may indicate that their common characteristics are the result of selection pressures due to the similar environmental conditions they both encounter.

Alternatively, the plumage similarities of Levant Little Tern with Saunders's Tern may have arisen through hybridisation; however, a more detailed genomic analysis would be needed to confirm this.

Although both European and Levant Little Terns cluster together phylogenetically according to analysis of the COI gene, reciprocal monophyly is not a requirement for subspecies designation. The genetic results presented here suggest recent or ongoing gene flow.

Extralimital records of Saunders's and Least Terns

The information presented here regarding the plumage of Levant Little Terns has reopened discussions regarding historical records of Saunders's Terns from outside their regular breeding areas. Saunders's Tern has been reported as a vagrant in Israel (six observations from Eilat between 1988 and 2006). Although a record of Saunders's Tern in the northern Red Sea (Gulf of Aqaba) is plausible, documentation of these past records appears insufficient to exclude Levant Little Tern. Most claims of Saunders's Tern in Israel have focused on the presence of three black outer primaries, a squared-off forehead and, particularly, a grey rump and uppertail-coverts (e.g. Shirihai 1999). These characteristics are all shown by Levant Little Tern and, indeed, the last feature fits Levant Little Tern better than Saunders's Tern, which shows a considerably lighter grey rump and uppertail-coverts (Mullarney & Campbell 2022). Even the smaller body size of Levant Little Tern compared to European Little Terns may be misleading in a comparative observation of resting individuals.

The colour of the bare parts (e.g. leg colour and bill colour, which are not discussed in this paper) may also be misleading, since they tend to change rapidly after the breeding season is over and vary among non-breeding summering birds (even those in almost-complete breeding plumage). Leg colour – orange-yellow in Little Tern and dusky yellow-olive in Saunders's Tern (Chandler & Wilds 1994; Gochfeld *et al.* 2020a,b) – is relevant only in birds in complete breeding plumage that also show a bright yellow bill; among Little Terns with an ill-defined border between the yellow and black on the bill, which may indicate a transition away from breeding colours, a variety of leg colours is possible (including dusky yellow-olive or green-brown). The legs of birds that have successfully bred that season are already black by the second half of July or during August, as early as June in failed breeders.

When photos of Levant Little Terns were shown to observers who had previously claimed to have found a Saunders's Tern in Israel, the observers identified these terns incorrectly as Saunders's Tern (YK unpublished information). This test emphasised the risk of confusion between the two taxa and led to several of the observers withdrawing their records of Saunders's Terns in Israel. No historical record of Saunders's Tern in Israel was photographed, and thus reassessment of the remaining records was not possible. The Israel Rarities and Distribution Committee (IRDC) therefore found all remaining, previously accepted records of Saunders's Tern in Israel to be not proven, and the species was removed from the Israeli List (Perlman *et al.* 2019). Future claims of extralimital Saunders's Terns will require critical evaluation in light of the information presented in this paper and in Mullarney & Campbell (2022).

In addition to its similarity to Saunders's Tern, Levant Little Tern shows a number of characteristics that are similar to those of Least Tern, such as the concolorous grey back, rump and central uppertail-coverts (Malling Olsen & Larsson 1995b; Pyle *et al.* 2009; Thompson *et al.* 2020; plates 158 & 159). These features are currently considered diagnostic of Least Tern with respect to its separation from Little Tern, and have thus been used to identify extralimital birds in Europe. Records of vagrant Least Terns that are based on morphological characteristics alone will likely require re-examination in light of the new information described in this paper for Levant Little Tern.

Although Least Tern was not systematically studied, the result of the genetic analysis shows that this species is a sister species to Saunders's Tern (fig. 2), a relationship which may play some part in the similarities in, for example, rump coloration.

The morphological description of Levant Little Terns presented here will, we hope, improve knowledge on the identification of this proposed subspecies and lead to further clarification in their distribution and variation in their plumage.

Daniel Irons

Daniel Irons

158. Least Tern *Sternula antillarum*, Cape May, New Jersey, United States, July. With its grey rump and uppertail-coverts, limited white forehead and contrastingly dark primaries, this species is perhaps most likely to be confused with a Levant Little Tern in the Western Palearctic.

159. Least Tern, Cape May, New Jersey, United States, July.

In this paper, we have addressed adult breeding plumage only. Further research is necessary to understand the differences between Levant Little Terns and both European Little Terns and Saunders's Terns in immature and non-breeding plumage (though see Mullarney & Campbell 2022).

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