Seasonal pattern of plumage colour in Yellow-legged Gulls at Bay of Biscay, Spain

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Large birds often pass through different plumage phases until they reach the mature, adult-like plumage. The identification of such plumages is crucial, because it allows us to determine the age correctly (Svensson 1992, Baker 1993, Jenni & Winkler 1994, Martinez et al. 2002), and this is fundamental when we want to model how a parameter (e.g., survival, dispersal distance, diet, etc.) varies according to the bird's age (e.g., Hake et al. 2001, Oro et al. 2013, Cresswell 2014). Plumage details also play an important role for the identification of many species, such as most gulls (Olson & Larsson 2004).

Yellow-legged Gull Larus michahellis is one of the most abundant large white-headed gulls in south-western Europe (mainly Iberia, southern Mediterranean France and the western Mediterranean islands), north-western Africa and the Macaronesian region (Olson & Larsson 2004). Two decades ago, the species colonized the English Channel and some other areas in central western Europe (Yelich 1991, Neubauer et al. 2010).

Two subspecies are recognized. nominate L. m. michaillii occurs in southern and western Black Sea coasts, Mediterranean, Iberia, western France, and is partially migratory; it winters in part in the Bay of Biscay. L. m. atlantis, of which the distribution range is under revision, is resident, considered to occur from the Azores to all of Macaronesia, or an even wider area including north-western Africa. A third population, breeding along the Atlantic region of Iberia, probably up to south-western Iberia (but with its distribution range also under revision), is also sedentary and has sometimes been recognized as a third subspecies L. m. atlantica (e.g., Olson & Larsson 2004) but is normally included in L. m. michaillii (Dickinson & Remsen 2013, Gill & Donsker 2019). These two (or three) subspecies show differences in body size, structure and plumage colour patterns (Minguez & Camniza 1993, Bosch 1996, Olson & Larsson 2004, Arizaga et al. 2008, Aguirre et al. 2009), voice (Geyssard 1984, timing of breeding (Arizaga et al. 2012, Bazlouf et al. 2014) and migratory behaviour (Murilla 1997, Arizaga et al. 2010, Galzacho et al. 2012).

As other related species, Yellow-legged Gull shows four age groups, reaching adult-like plumage when aged four, after a complete moult in the fourth year of life (Olson & Larsson 2004). Until then, immatures go through different plumage phases where the brown, juvenile coloration is progressively replaced by a higher amount of grey feathers in the wings, mantle and scapulars and white on the head, underparts and tail (Olson & Larsson 2004).

Yellow-legged Gull undergoes an annual complete moult before the winter, except in first-year birds, which conduct a partial moult involving head, body and some wing-covers (and a variable number of lesser, median and inner greater coverts, with high variation between individuals and populations. The post-juvenile moult lasts from July to even February (Brown 1998, Scherz 2003), usually up to October (Olson & Larsson 2004). Winter coloration of birds in their first year of life in the head and underparts is due to wear or bleaching. The replacement of body feathers or wing-covers in late winter or spring can be regarded as a small partial moult before summer or as first steps of a complete moult (Howard & Dunn 2007). Complete moults last from April to November, although the start and end dates again vary rather substantially between individuals and populations (Olson & Larsson 2004). For the particular case of the 'atlantica' Yellow-legged Gull population(s), the moult and timing between different plumage types have never been described in detail, as far as we know.

The aim of this paper is to describe in detail the seasonal sequence of the different plumages acquired by a resident 'atlantica' Yellow-legged Gull population at the Bay of Biscay in northern Spain.

Material and methods

Study area and data collection

Yellow-legged Gull chicks were ringed in four colonies in Gipuzkoa, Spain, in 2005-15. Ringing was carried out in late June, from 2005 to 2015. The number of chicks ringed per year ranged from 3% in 2005 to 35% in 2009. Overall, 2004 chicks were ringed (table 2). The chicks were ringed with both a metallic and a PVC colouning with an alphanumeric code, the latter allowing to identify the bird at distance.

Once these individuals leave the colonies, they are scattered around the coast or inland, in harbours, along rivers, at intertidal flats and damps, mostly within a radius of 30 km from their natal colonies (Arizaga et al. 2010). Our dataset consists of sightings of these ringed gulls, reported by birders or by us, compiled from 2006 to May 2016. Plumage was analysed by the authors, both in the field and, more frequently, based on photographs. For each bird, we annotated the date and the type of plumage, using the guide-code described in table 1. Examples of the plumages can be seen in figure 2. The decision to use this code was due to the relative subjectivity to assign the classic 'first', 'second'- or third summer or winter plumages normally considered in identification guides (e.g., Olson & Larsson 2004). We were especially interested in quantifying the amount (percentage) of grey in the dorsal and wing feathers, a variable that we wanted to record independently of the exact age of the bird. We also used this code since we found that in some ringed birds of known age, a mismatch occurred between known age and the age based on plumage characters if

<table>
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<th>Year</th>
<th>Olia</th>
<th>Santa Clara</th>
<th>Zarautz</th>
<th>Getaria</th>
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<td>73</td>
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<td>148</td>
<td>69</td>
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<td>2008</td>
<td>228</td>
<td>55</td>
<td>8</td>
<td>38</td>
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<td>2010</td>
<td>232</td>
<td>42</td>
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<td>0</td>
<td>65</td>
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<tr>
<td>2013</td>
<td>68</td>
<td>54</td>
<td>0</td>
<td>59</td>
</tr>
<tr>
<td>2014</td>
<td>151</td>
<td>59</td>
<td>0</td>
<td>51</td>
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<tr>
<td>2015</td>
<td>147</td>
<td>35</td>
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<tr>
<td>Total</td>
<td>1670</td>
<td>596</td>
<td>33</td>
<td>405</td>
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FIGURE 1 Location of sampling colonies of Yellow-legged Gull Larus michahellis in Gipuzkoa, Spain.
using the 'classic' criteria. Each bird was then also assigned to an approximate age, with July of the hatching year being the first time unit (month) in the study. In most cases, birds were aged when they were on the ground and, less frequently, in flight. This entails that primary covertts often remained unseen resulting in some gulls with signs of immaturity in these feathers being classified as category 8 (when they were actually category 7; table 1). We may thus have underestimated the proportion of birds in category 7.

Data analyses

Each individual was considered only once per time unit (month) in order to remove pseudo-replications. To test for the sequential replacement of the different plumage types, we used a Generalized Linear Mixed Model with the type of plumage as an object variable, date (month) as a factor, and individual as a random factor. We used a linear-link function with Gaussian errors distribution. Statistical analyses were conducted with R (R Development Core Team 2014).

Results

Overall, 725 records relating to 416 individuals were analyzed. The number of analyzed months in which plumage of individuals was classified varied between one (6.0% of all individuals) to 16 (one individual; 0.53%) (figure 3). Sample sizes of plumage categories differed between 8 (type 4) and 156 (type 8), with a mean of 68 individuals. Once controlled for the (potential) effect of each individual bird, plumage types succeeded sequentially without statistical overlap between them (F=324.28, P<0.001; figure 4). The juvenile plumage was only present during a period of c. four months from fledging, until October of the first calendar year. Type 2 plumage, however, was present for a period of 18 months, up to January of the third calendar year. Type 3 plumage was present also during a long period (21 months), from February of the second calendar-year to October of the third calendar-year. In contrast, type 4 plumage was present for only a very short time period, constrained to five months during the last part of the second calendar-year up to February of the third calendar-year. Type 5 and 6 plumages appeared during a period of 19 months: type 5 from October of the second calendar-year up to April of the fourth calendar-year and type 6 from March of the third calendar-year up to September of the fourth calendar-year. Type 7 plumage was present during a period of 24
months, from July of the third calendar-year to June of the fifth calendar-year. Finally, type 8 seemed to appear for the first time as early as at the age of 26 months (August of the third calendar-year), although it was generally not observed up to July-August of the fifth calendar-year (figure 5).

Discussion

This is the first study aiming to describe in detail the seasonal plumage sequence within a 'fusiform' population. We used a sample of 423 colour-ringed individuals (seen at 788 different occasions/months), i.e., birds of known age, and the sample size per each category of plumage was acceptable. Therefore, we consider that the sample used in this work was representative for the population and that the results are, in consequence, solid.

The first seven immature plumages appeared during the first five years of life, with adult plumage being observed generally not before mid-summer of the fifth calendar-year. Overall, such a time schedule fits with previous publications, although we detected some remarkable variations in relation to what has been published for the species (Camp & Simmons 1983; Olgen & Larsson 2004).

It is interesting to note that for the breeding period in the fifth year of life still a remarkable percentage (c. 20%) of the birds had a subadult plumage (classified as type 7), which in some birds was found to appear as early as the summer of the third year of life but in others remained up to the summer of the fifth year of life. This result contrasts with literature assuming that adult plumages would be fully acquired by the fourth year of life (Olgen & Larsson 2004). The long-term persistence of signs of immaturity fits with a slow life
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201 Yellow-legged Gull / Greepoorneus Larus michahellis, Ondarreta, País Vasco, Spain, 10 November 2017 (Aitor Aldai). Typical second-winter, with some grey feathers in mantle and wing-coverts (type 3 plumage). Bird BTW2 was ringed in nesting on 3 July 2016. 202 Yellow-legged Gull / Greepoorneus Larus michahellis, San Sebastián, País Vasco, Spain, 7 February 2016 (Juan Arizaga). Typical first-winter, assigned to plumage type 2, with juvenile feathers in wing-coverts. Bird BWG2 was ringed in nesting on 25 June 2015.

Acknowledgements
This research was funded by the Basque Government and the Gipuzkoa Administration. We are grateful to the people who provided us with photographs of ringed birds to increase our sample size, as well as to Peter Aldai, who reviewed the work and helped us to improve an earlier version.

References
Sulphur-bellied Warbler on Christiansø, Denmark, in May-June 2016

Sebastian Klein & Ibne B Ebirds

Christiania in the Baltic Sea is one of the best sites for rare birds in Denmark. Extensive territories such as Egyptian Nightjar Caprimulgus aegyptius, Swallow’s Thrush Catharulus rubetra, Rufous-tailed Robin Lanius amurensis, Siberian Rubythroat Calliope calliope and Siberian Accentor Prunella montanella have all been recorded on this small island in the last 15 years. On 30 May 2016, however, an even rarer bird was found here!

(Sebastian Klein) arrived by boat on Christiansø at 11:00 for my annual “I-need-to-find-rare-birds-or-I-will-surely-die-vacation”. It was quite a hot day with a stormy mist around the island. Already after a few hours I managed to locate a singing Blyth’s Reed Warbler Acrocephalus dumetorum at the south end close to "Stolte”. It was quite a good find and I immediately called Peter Lyngs who was also on the island. Shortly thereafter, I noticed a small bird calling with a peculiar deep - somewhat similar to a single call of a distantly related Reedling Pusio larinneus or the soft call of a Red-tailed Warbler Phylloscopus schwarzii. I turned to find a small Phylloscopus warbler in a small bush. The yellow supercilium and pale legs led me to believe it was just a Willow Warbler P trochilus and I quickly turned my attention to the singing Blyth’s Reed. Pl. soon appeared and the Phylloscopus called again. This time it flew past us into a nearby tree. “That’s a weird call for a Willow Warbler”, I said. “A Willow Warbler surely can’t call like that”, Pl. replied. We now noticed that the yellow supercilium seemed unusually longer than in Willow and was especially bright in front of the eye. The bird kept calling and left us utterly confused.

Both of us are familiar with pretty much all Western Palearctic species of Phylloscopus – but this bird did not match any of them! After a couple of minutes, it started singing. The song sounded a bit like that of Lesser Whitethroat Sylvia curruca or perhaps European Greenfinch Chloris chloris, which only added to our confusion... Lars Christian, Mari Ole Mathisen and Anders Mytten joined us but were equally baffled by the bird’s identification. Arctic Warbler P borealis and Red-rumped Warbler were discussed but easily ruled out. It did not take us long to realize that the bird might actually be something very, very rare. Too confident with our own birding skills – or perhaps because of lack of ambition – we had neglected to bring literature on the rarest Phylloscopus species. We tried to get some photographs and recordings of call and song. I got some decent shots of its head and sent them to other birders. Most of them had no idea what it was but were all eager to help distributing the images to other birders. Meanwhile, I desperately started checking Xeno-canto (www.xeno-canto.org) for pretty much every Asian warbler I could possibly think of. Ticket’s Leaf P. pullina, Yellow-streaked P. manchurica, Tytler’s Leaf P. tytleri and Rufe-armed Leaf Warbler P. jenissei were all checked but obviously wrong – and while struggling to remember the English names for all the different Phylloscopus species, decent help finally arrived.

My old friend Henrik Nielsen had seen my photographs and suggested the bird could be a Sulphur-bellied Warbler P. gorcevii. I remembered having seen species in India and that it actually shows a supercilium like our bird. A quick check of the call and song on Xeno-canto proved to be a perfect match! It was indeed a Sulphur-bellied and, although I kept thinking ‘it can’t be – it’s too bloody impossible’, there were no doubts about it. Luckily, the bird was quite confiding and kept singing frequently for the rest of the day. In the end, we even got some good photographs and decent recordings of the song.

The bird was nothing less than a Western Palearctic first – and thus by far the rarest bird ever recorded in Denmark! It remained until 3 June and was seen by at least 150 visiting twitchers from several or many countries.

Description
The description is based on field notes by SK, photographs by Eric Gronh-Andersen, SK, Christian Leitl, Pl. Sune Riis Sørensen and Thomas Vårto Nielsen (of Dutch Binding 3B: 323, plate 498, 2016) and sound-recordings by SK and SRS (www.xeno-canto.org/319537, 3456B, 345654-371).

SIZE & SHAPE: The Willow Warbler. Wing rather short; primary projection c 1/3 of length of longest remial. Bill relatively long and fine-tipped.