Notes on the breeding biology of Plain Swift *Apus unicolor* on Gran Canaria, Canary Islands

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Notes sur la biologie de reproduction du Martinet unicolore *Apus unicolor* à Gran Canaria, Îles Canaries. La biologie de reproduction du Martinet unicolore *Apus unicolor* a été étudiée de façon quantitative à Gran Canaria. En moyenne, la première ponte est déposée le 21 avril et la seconde le 24 juin (une troisième ponte a également été notée), prolongeant la période de nidification suspectée auparavant d'environ 1,5 mois. Les tailles moyennes des premières et deuxièmes pontes sont très semblables (1,97 œufs ±0.06 vs. 1,95 œufs). Le pourcentage des deuxièmes pontes est de 70% et la réussite moyenne des premières et deuxièmes pontes de 74,44±6,77 et 64,29±5,05 respectivement. Ces caractéristiques reflètent la position géographique et l'aspect océanique des Îles Canaries par rapport à la région tempérée septentrionale et l'Afrique tropicale.

Summary. The breeding biology of Plain Swift *Apus unicolor* was quantitatively studied on Gran Canaria. Mean laying date of the first clutch was 21 April and that for the second clutch 24 June (a third clutch was also recorded), extending the previously suspected breeding period by *c.*1.5 months. The mean sizes of the first and second clutches were very similar (1.97 eggs ±0.06 vs. 1.95 eggs). The percentage of second broods was 70% and the mean breeding success of first and second broods was 74.44±6.77 and 64.29±5.05 respectively. These intermediate life-history traits reflect the geographical location and oceanic aspect of the Canaries compared to the northern temperate region and tropical Africa.

Although Plain Swift *Apus unicolor* breeds regularly in the Canary Islands, its reproductive biology has never been documented quantitatively (García del Rey 2001, Martín & Lorenzo 2001). As the Canaries lie midway between the tropics and the temperate zone, it might be expected that Plain Swifts show life-history traits intermediate between those of swifts of the northern temperate region and those of tropical Africa. The abundance of insect life is thought to have a significant impact on the breeding biology of swifts, and may explain why breeding coincides with the wet season in the tropics and summer in the temperate zone (Chantler 1999). Weather, temperature, sunshine, wind velocity and precipitation all influence feeding conditions and prey abundance, hence affecting the breeding biology of many swifts (Lack 1973, Chantler 1999). The avian breeding season on the Canaries has been variably stated to extend from March to August (Bannerman 1963, Bannerman & Bannerman 1965, Cramp 1985, Chantler 1999) or April–September (Martín & Lorenzo 2001). I present here information on some aspects of the breeding biology of Plain Swift, in particular laying dates, clutch size, number of clutches and breeding success.

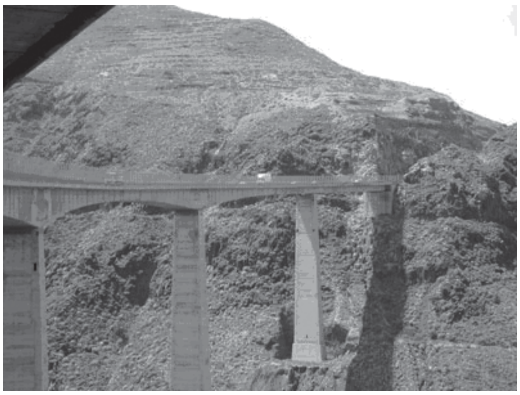

Figure 1. Study site at Puente Silva, Gran Canaria (Eduardo Garcia-del-Rey)

Site de l'étude à Puente Silva, Gran Canaria (Eduardo Garcia-del-Rey)

Methods

This study was undertaken during 2003 on Gran Canaria, Canary Islands (28º00'N 15º30'W). The climate on this oceanic archipelago is Mediterranean with cool, wet winters and hot, dry summers, and is influenced by the local north-east trade winds, the proximity of the Sahara on the

African continent and the high altitude of the central and westerly islands (Marzol-Jaén 1984). The study site was Puente Silva (Fig. 1.), a 400-m-long bridge with an internal cavity 2 m high and 10 m wide, near Agaete, in the north-west of the island. Swifts could access the interior of the bridge through narrow tubes and nested on the concrete floor, which was very convenient for nest inspection. Data were collected once a month from April to September during afternoon visits. The following assumptions were made in order to reconstruct the breeding phenology:

- Mean incubation period (measured from the laying to the hatching of the last egg) was assumed to be 20 days. Most swift species incubate for this length of time and incubation starts when the clutch is complete (Lack 1973).
- Laying was assumed to occur at an interval of two days (Lack 1973).
- Minimum nestling period was assumed to be 37 days (Cramp 1985). Nestling swifts are known to be able to slow down their growth in bad weather when food is scarce, thus saving energy for vital functions but thereby prolonging the nestling period considerably. Hence the nestling period can vary by up to three weeks (Lack 1973). It is assumed that the weight curve for a young swift does not vary greatly with season in the stable weather of Gran Canaria (see Marzol-Jaén 1984 for details of climate).

All eggs found were touched to check if incubation had started. Nests in which eggs were laid but not incubated were excluded from the study. In order to estimate the age of the nestlings, each chick was assigned to one of four categories: 1 = 1–7 days old (pink/naked chick); 2 = 8–15 days old (dark chick with very tiny or no pin feathers on wings); 3 = 16–30 days old (dark chick with pin feathers with brush-tipped feathers of several sizes); 4 = 31–37 or more days old (full-feathered chick with short to long tail ready to fledge). The assignment to categories was aided with photographs taken during the course of the study (Figs. 2–5). When a brood with chicks of different sizes was found, the age category assigned was based on the largest chick. Once the age of a nestling was estimated, the date on which the first egg in the clutch was laid was extrapolated.

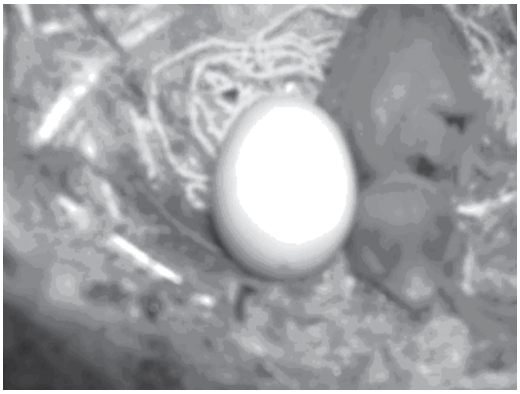

Figure 2. Nestling of category 1 = 1–7 days old, naked and pink (Eduardo Garcia-del-Rey)

Oisillon de la catégorie 1 = agé de 1–7 jours, nu et rose (Eduardo Garcia-del-Rey)

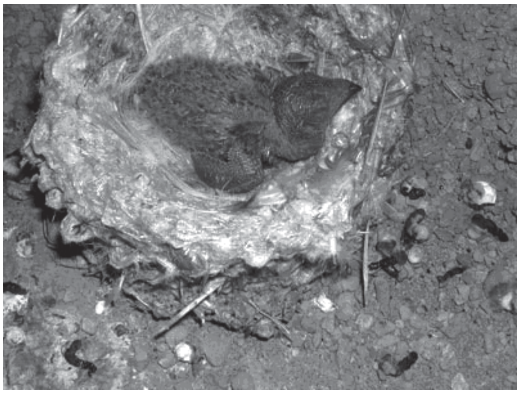

Figure 3. Nestling of category 2 = 8–15 days old, dark with very tiny or no pin feathers on wings (Eduardo Garcia-del-Rey)

Oisillon de la catégorie 2 = agé de 8–15 jours, foncé avec de très petites plumes ou sans plumes aux ailes (Eduardo Garcia-del-Rey)

For each nest the following parameters were determined: laying date (date of first egg), clutch size, breeding success, and occurrence of a second clutch (laid in same nest from which a first brood had fledged successfully). The percentage of second clutches was also calculated. As no birds were ringed, it has been assumed that all second (and third) clutches were laid in the same nest as the first. All statistical analyses were performed using SPSS 11.0 and results presented as mean ± standard error.

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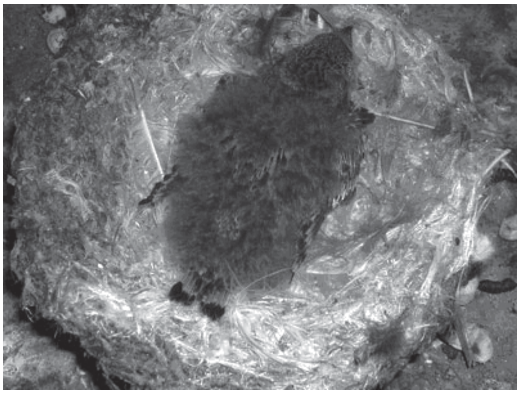

Figure 4. Nestling of category 3 = 16–30 days old, dark with brush-tipped feathers of several sizes (Eduardo Garcia-del-Rey)

Oisillon de la catégorie 3 = agé de 16–30 jours, foncé avec des plumes de plusieurs tailles (Eduardo Garcia-del-Rey)

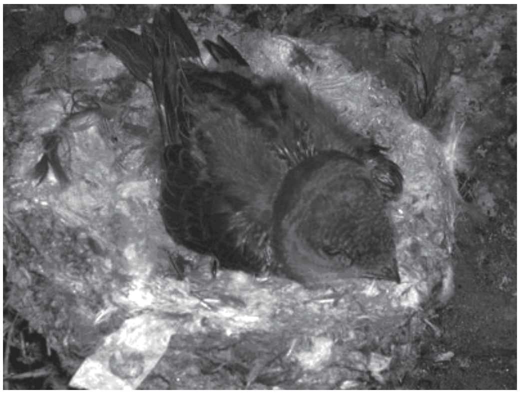

Figure 5. Nestling of category 4 = 31–37 or more days old, fully feathered with short to long tail, ready to fledge (Eduardo Garcia-del-Rey)

Oisillon de la catégorie 4 = agé de 31–37 jours ou plus, ayant toutes ses plumes avec queue courte ou longue, prêt à quitter le nid (Eduardo Garcia-del-Rey)

Table 1. Mean laying date (1=1 March), average clutch size and mean breeding success (±SE) of first, second and third clutches/broods. Sample size in parentheses.

Tableau 1. Date moyenne de ponte (1=1 mars), taille moyenne des pontes et réussite moyenne (±SE) des premières, deuxièmes et troisièmes pontes / nichées. Taille de l'échantillon entre parenthèses.

	First clutches/broods (*n*=30)	Second clutches/broods (*n*=21–22)	Third clutches/broods (*n*=1)
Laying date	21 April	24 June (*n*=22)	21 July
	51.57±5.22	115.91±4.32	143
Clutch size	1.97±0.06	1.95±0.05 (*n*=21)	1
Breeding success %	74.44±6.77	64.29±5.05 (*n*=21)	100

Results

The mean laying date of first clutches was 21 April (51.57±5.22; 1=1 March) and that for second clutches 24 June (115.91±4.32). One pair laid a third clutch on 21 July (see Table 1). Four pairs laid their first egg on the inspection day or the day before (assuming a laying interval of two days). This allowed checking the assumptions 1 and 3 (see Methods), and both were found to be correct.

The mean sizes of first and second clutches were very similar (1.97±0.06 for first clutches and 1.95±0.05 for second clutches) (Table 1), and no statistically significant differences were found between these (Student t-test: t=0.18, df=49, $P>0.05$). The number of second clutches was 70%.

Of the 30 pairs that laid a first clutch, the majority (19 pairs) raised all young (i.e. 100% breeding success), six pairs lost half the chicks (50% breeding success), one pair had a 33.3% breeding success and four pairs did not produce any offspring. Thus, mean breeding success of first broods was 74.44±6.77 (Table 1). Of the 21 pairs laying a second clutch, only six raised all young, whereas the majority (15 pairs) raised 50% of the chicks. The mean breeding success for second broods dropped to 64.29±5.05 but was not statistically significant (Mann-Whitney U-test: U=235.5, $P>0.05$). The causes of failure in the first half of the breeding season are unknown.

Discussion

The present study suggests that the breeding season of the Plain Swift in Gran Canaria commences in early March and ends in mid September, extending the previously suspected breeding period by *c.*1.5 months. However, mean laying dates presented here (Table 1) should be viewed with caution, as the precise date on which each pair in the colony laid their first egg is unknown. Any variation at the different stages of breeding will also affect the laying date, and *Apus* are known to have variable incubation and nestling periods

(Lack 1973). Daily visits to the colony during several years are needed to improve the data presented here (i.e. to establish the precise laying date and incubation and nestling periods of each nest, and to confirm the two-day laying interval). Most of the second clutches were laid immediately after the fledging of first clutches (i.e. *c.*1 day later). The nestling period of first broods could therefore not exceed *c.*37 days, which facilitated more accurate estimation of the laying date of the second clutch's first egg. Only three broods of second clutches had nestling periods longer than 37 days (45, 48 and 49 days, respectively). However, as the mean incubation period (20 days) and the minimum nestling period (37 days) were used to calculate the mean laying date in the colony, the extension of the breeding phenology found is this study is justified.

My results on clutch size (first clutch size = 1.97±0.06 eggs) agree with those of other authors (e.g. Cramp 1985, Chantler 1999), who also suggested that double broods (70% in this study) are frequent in Plain Swift. Clutch size in the genus *Apus* varies between one to three eggs (Lack 1973). Mean clutch for Common Swift *Apus apus* in northern Africa (Cramp 1985) is the same as that of Plain Swift in Gran Canaria. However, breeding success of first clutches in Plain Swift is higher than the mean reported for Common Swift (74.4% vs. 58–65%) (Chantler 1999). Life-history traits associated with breeding are assumed to be determined by natural selection to maximise the production of offspring (Baker 1938, Lack 1954). The pioneering work of Lack (1973) pointed out the highly adaptable breeding seasons in swifts. For example, Common Swift raises only one brood per year at Oxford, England, whereas Pallid Swift raises two successive broods in the Mediterranean region, and the Afrotropical White-rumped Swift *A. caffer* raises three broods each year (Lack 1973). The length of the warm-weather period has been suggested by Lack (1973) to explain this difference. Plain Swift in Gran Canaria seems to have adapted to the stable weather on the island, resulting in a high number of second clutches (occasionally even a third), low chick mortality and high breeding success. Both clutch size and number of breeding attempts per season seem to reflect the geographical location and oceanic aspect of these islands: clutch size is indeed lower than in the northern temperate region, whilst the number of breeding attempts is higher than in the north but lower than in Africa.

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