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Inter-annual constancy in the laying period of Cory's Shearwater *Calonectris diomedea diomedea* on Lavezzi Island (Corsica)

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Some migrant species of petrels have a laying period that is short, constant and with little inter-colony variation (*e.g. Puffinus tenuirostris*: Serventy 1963). But this is not a general rule, other migrant species showing some variation between both years and colonies (Warham 1990). In Cory's Shearwater (*Calonectris d. diomedea*), the laying period lasts less than three weeks throughout its distribution area (Massa and Lo Valvo 1986), even though the Mediterranean populations breed one week earlier than the Atlantic population (Selvagem Is.: Zino *et al.* 1987, Berlinga I.: Granadeiro 1991). Moreover, the Mediterranean population is mainly migrant, leaving in October via Gibraltar (Telleria 1980) to winter in the South Atlantic (Mougin *et al.* 1988), while Atlantic populations are totally migrant (Mougin *et al.* 1988).

Previous studies on the laying period of Cory's Shearwater in the Mediterranean did not compare data among several breeding seasons (Aegean Is.: Wink *et al.* 1982, Corsica: Thibault 1985, Linosa I.: Massa and Lo Valvo 1986, Malta I.: Cachia Zammit and Borg 1986-87, Zembra I.: Gaultier 1981). The aim of this note is to study the inter-annual constancy in the laying date of the Cory's sh earwater at a single colony in the Mediterranean.

The study was carried out on a monospecific colony of 255-400 pairs of Cory's Shearwater on Lavezzi Island (41°20'N, 09°15'E), a 66-ha nature reserve situated between Corsica and Sardinia in the Western Mediterranean. The island is mainly flat, but there are several discrete blocks of granite rocks, isolated from each other, which rise to a height of 40 m above sea level. Shearwaters occupy different blocks, forming distinct subcolonies.

In order to know the laying dates, samples of respectively 67, 57 and 51 occupied breeding sites were selected in 1982, 1992 and 1993 before the pre-laying exodus. Breeding sites were selected on the basis of good visibility of the birds in their nests. Laying occurs in the hours following the return of the female, after an exodus of several days (Gaultier 1981, pers. obs.); before laying, nest-sites are generally empty during the day: males visit them regularly, but mainly at night (pers. obs.). To obtain laying dates, breeding sites were monitored every morning in May and June in 1982 (from 20 May to 2 June) and 1992 (from 16 May to 12 June); in 1993, burrows were checked at the beginning and at the end of the laying period (22-23 May, 28-30 May and 6 th June). For the three years, dates were transformed into days of the civil year because of leap year 1992. We assumed that we always observed birds on the first day when they laid. Differences between the tempored distribution of egg laying during the different breeding seasons and among subcolonies were tested with a non-parametric test (Kolmogorov-Smirnov) and differences between the three years in the proportion of eggs laid at different times during the period with a contingency table.

Length of the laying period

In 1992, the first egg was laid on the 139th day (May 18), and the last on the 152th day (May 31). Moreover, most eggs (80.6%) were laid in seven days (Table 1). No differences appeared in the proportions of eggs laid at different times during the overall period for the three years (χ^2=1.43, 2 d.f. n.s.). Mean laying dates corresponded to the 147th day in 1982 and to the 146th day in 1992.

Annual variation in the laying period

Data for the three years are presented in Table 2. No differences appear between distribution of egg-laying periods expressed in accumulated clutches for the years 1982 and 1992 (Kolmogorov-Smirnov test, D=0.07, n.s.), nor when comparing the beginning and the end of the 1992 and 1993 egg-laying periods (Kolmogorov-Smirnov test, D=0.10, n.s).

Table 1 - Comparison between the three years in the proportion of eggs laid between the 143th and the 149th day.

Years	Number of eggs laid during the 143th and the 149th day	%	Number of eggs laid before the 143th and after the 149th day
1982	57	85.1	10
1992	44	77.2	13
1993	40	78.4	11

Variation in laying period between subcolonies

Data obtained in 1982 and 1992 are presented on Table 3. No difference was detected in the laying period among the two main subcolonies for 1982 (Kolmogorov-Smirnov test, D=0.10, n.s.) and 1992 (Kolmogorov-Smirnov test, D=0.04, n.s.).

These results show that there were no differences in the range of laying dates within and between subcolonies. They also confirm the high synchrony among breeding localities in the western Mediterranean, with a mean laying date corresponding to 26-28 May (Massa and Lo Valvo 1986). The two other petrels breeding in the Mediterranean, the Storm Petrel (*Hydrobates pelagicus*) and the Mediterranean Shearwater (*Puffinus yelkouan*), show a very different pattern. The Storm Petrel's laying period occurs from the end of April to mid June on Corsica (Guyot and Thibault 1985, Bretagnolle and Thibault 1990), and from the end of April up to mid -July on Malta (Sultana and Gauci 1982) and Sicily (Massa and Catalisano 1986). The mean laying-period of the Mediterranean Shearwater occurs from mid-March to the beginning of April on Hyéres Is., France (Vidal 1985), mainly in mid-March in the Balearics (Aguilar 1991) and from the first half of March on Malta (Galea 1990-91). So, at least in the Western Mediterranean, the Storm Petrel has a laying-period spread over more than two months, whereas the Mediterranean Shearwater shows variations according to breeding locality. In contrast, Cory's Shearwater has a short and regular laying-period with no difference between breeding localities. We suggest that these different patterns represent different strategies in the exploitation of feeding resources. The Storm Petrel and the Mediterranean Shearwater are coastal and their bre eding time depends notably on feeding resources available in the

Table 2 - Number of eggs laid during the three years. First column given the number of eggs laid daily and second column give the cumulated total of eggs; — = no check.

Day/Year	1982		1992		1993	
≤141	4	4	5	5	—	—
142	0	4	1	6	—	5
143	3	7	8	9	5	10
144	4	11	8	17	—	—
145	8	19	8	25	—	—
146	14	33	5	30	—	—
147	13	46	8	38	—	—
148	10	56	9	47	—	42
149	5	61	3	50	3	45
≥150	6	67	7	57	6	51

Table 3 - Number of eggs laid in 1982 and 1992 in the two main subcolonies.

Day/Year	1982		1992	
	subcolony A	subcolony B	subcolony A	subcolony B
≤141	1	3	1	2
<142	0	0	1	0
<143	2	0	3	0
<144	3	1	6	1
<145	2	5	2	3
<146	2	10	1	1
<147	2	8	3	2
<148	1	6	6	2
<149	2	2	1	1
≥150	2	3	2	4

strict vicinity of the colony where periods of abundance are known to vary annually (Zotier *et al.* 1993). In contrast, Cory's Shearwater seems to be unhindered by the inter-annual variabili ty of feeding resources, as birds are able to fly long distances in search of food. Its short laying-period and high inter-colony a nd inter-annual synchronism may result from migratory habits (with the main part of the population leaving the Mediterranea n in autumn for a trans-equatorial trip) and more predictable food supply.

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Résumé - Une étude sur la période de ponte du Puffin cendré l'île Lavezzi (Corse) montre qu'il n'existe pas de différences inter-annuelles. Elle confirme également la grande synchronie, entre les différents sites de reproduction en Méditerranée, relevée par de précédents auteurs.

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