

COASTAL MEDITERRANEAN STORM-PETREL *HYDROBATES PELAGICUS* POPULATIONS: ISOLATED SMALL BREEDING SITES OR OUTLYING SUBCOLONIES OF LARGER BREEDING COLONIES?

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Gutiérrez, R., López, F., Ramal A. & Guinart, E. 2006. Coastal Mediterranean Storm-petrel *Hydrobates pelagicus* populations: isolated small breeding sites or outlying subcolonies of larger breeding colonies? *Atlantic Seabirds* 8(1/2): 31-40. *There are few known coastal breeding sites for the Mediterranean Storm-Petrel Hydrobates pelagicus melitensis in Spain and France, apart from their core breeding areas in the Balearics and central Mediterranean. In spite of the difficulty of documenting breeding in this species, islands closer to core breeding areas have well-known breeding populations, whilst sites in NE Catalonia and France have not, despite thorough research. Ringing effort has provided a different approach to addressing the issue of determining breeding colonies; ringing results suggest the possibility of an irregular, opportunistic breeding at sites in NE Catalonia and France when habitat conditions are optimal. Of 27 birds trapped and ringed in NE Catalonia from 2003-2005, five were recaptures from the Balearics and Murcia, W Mediterranean Spain (15,62%). In contrast, only an average of 0,22% of total Spanish ringings 1969-2002 (n=10.997) were long-distance recaptures. These differences support the idea of a breeding distribution composed of core breeding areas and isolated small breeding sites such as those in NE Catalonia. Given habitat resource variability, such small peripheral area could act as either irregular breeding sites, as some past evidence and body condition of trapped birds suggest or, alternatively, as part of core areas feeding grounds for either adults or non-breeding birds.*

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INTRODUCTION

The estimated 8.500- 15.500 breeding pairs of the endangered Mediterranean Storm-petrel *Hydrobates pelagicus melitensis* (Cagnon *et al.* 2004, Martí & del Moral 2003) are mainly distributed on islands across the central and western Mediterranean, especially around Malta and the Balearic Islands (Massa & Merne 1987, Martí & del Moral 2003, Cadiou 2004, Brichetti & Fracasso 2004). Several coastal island breeding sites isolated from major colonies have been

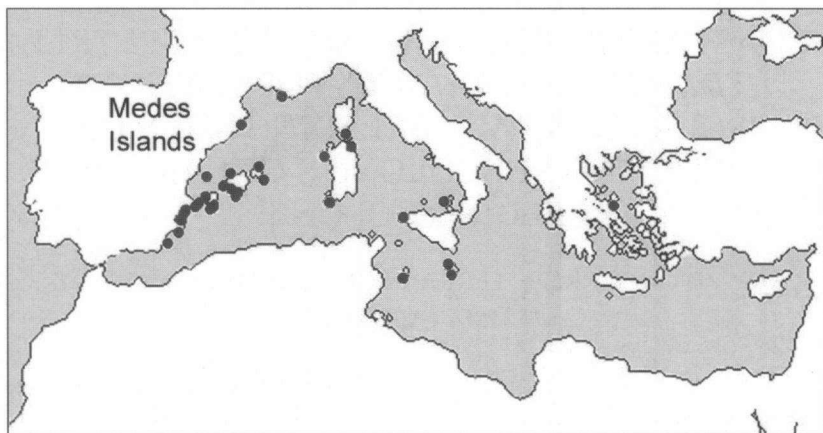


Figure 1. Location of Mediterranean Storm-petrel known breeding sites and the study area in the Spanish NE coast.

Figuur 1. Ligging van de bekende kolonies van het Midderraan Stormvogeltje in de Middellandse Zee en het studiegebied bij de Spaanse noordoostkust.

documented in Spain (Mínguez 1994c) and France (Marseille islands, Cadiou 2004), but not in Italy (Brichetti & Fracasso 2003, figure 1).

The Spanish *melitensis* population is estimated to be 3830-5310 pairs, concentrated mostly in the Balearics (Catalonia 0-10 breeding pairs, Gutiérrez *et al.* 2004; Valencia 555-685, Balearic Islands 2912-4046, Murcia 360-544, and Andalucía 3-20 breeding pairs, Mínguez in Martí & del Moral 2003) but estimates are rough due to difficulties in censusing (González & Hernández 1989, Mínguez 1994a). To obtain accurate breeding counts, direct evidence of breeding, such as finding active nests, is necessary. Indirect methods like capture of adults with vascularized brood patches or the presence of individuals attracted through vocalizations are not definitive proof of breeding (Walmsley 1986, Nogales *et al.* 1993, Mínguez 1994b). The capability of flying long distances to feed (200 km in a night, Cadiou 2004), the existence of over-summering populations (Martí & Del Moral 2003), and the presence of non-breeding birds around colonies (Mínguez 1992) complicate efforts to estimate breeding Storm-petrel numbers.

In Spain, away from the Balearics, some of the coastal islets with proven breeding populations hold large suitable caves where counting is fairly straightforward and where breeding has been encouraged through the installation of nest-boxes (e.g. Benidorm, De León & Mínguez 2003). Populations off the regions of Murcia, Andalucía and Valencia are close enough

to form an interrelated core area. All breeding sites are within 100 km of each other and Benidorm is only 137 km from Formentera in the Balearics, the stronghold for *melitensis* in Spain. Ringing recoveries support the hypothesis of a high interrelation between these SW Mediterranean breeding locations (Pinilla *et al* 2003).

The situation in N Catalonia and coastal France, however, appears to be different. The traditional breeding sites (Massa & Merne 1997) appear to be isolated from the main core populations in Corsica/Sardinia and the Balearics and contain lesser known breeding populations (Cadiou 2004, Gutiérrez *et al.* 2004). In Catalonia, unlike in the islands in southern Spain, research from 2001-2005 involving on-the-ground searches in suitable habitat plus ringing campaigns have not definitively proven breeding, despite having trapped and ringed 31 birds (Gutiérrez *et al.* 2004, this study). In the French islands of Hyeres and Marseille, recent evidence of breeding is also dubious because it was based on indirect methods (Cadiou 2004).

Given the negative results of the searches but the positive ringing results in NE Spain, an analysis of ringing effort and recoveries was carried out to determine if Spanish Storm-Petrel populations differed. Our primary goal was to attempt to establish the true status of what formerly have been considered firmly established colonies for the species (e.g. Massa & Merne 1997).

Results suggest that NE Catalonia locations, and possibly French sites as well, may have held local breeding populations but now seem to be opportunistic breeding sites, depending on factors such as food availability, presence of predators and site availability. Additionally, these sites may serve as dispersal areas for the core sites for both adults and non-breeding birds; in the case of Catalonia, the region would serve as a dispersal area for the Balearics. All in all supporting the threatened status of the taxon according to its breeding locations constraints (Mínguez 2000).

METHODS

During May 2001-July 2005, a total of 19 campaigns lasting 38 days were carried out in Catalonia, NE Spain. Of those 19, 3 were in 2001, 2 in 2002, 5 in 2003, 7 in 2004 and two in 2005. The studied areas covered the Montgrí coastal cliffs (4 campaigns), Medes islands (13 campaigns), Baix Empordà coast (one), Cap de Creus Natural Park (four) and Garraf coast (three). Activities included offshore bird counts (seven sessions), searches of potential habitat for breeding evidence (eight sessions), installation and monitoring of nest boxes (six sessions), recording of nocturnal vocalisations (eight sessions), and mist-net trapping and ringing during the night, aided by tape recordings (12 nights), see appendix.

Table 1. Proportion of ringings and long-distance retrappings of Storm-petrels in Spain.
Tabel 1. Aandeel van geringde en over grotere afstand terug gemelde Stormvogeltjes in Spanje.

Period	Area	Ringings	Retraps		Reference
			n	%	
1969-2002	Spain	10.997	25	0,22	Pinilla <i>et al.</i> 2003
1973-2003	Balearic Islands	7370	17	0,23	López-Jurado 2003
1986-1989	Catalonia	16	1	6,25	Gutiérrez <i>et al.</i> 2004
2003-2005	NE Catalonia	27	6	18,75	this study

The 12 ringing sessions were held from 2003-2005 between May-September, but primarily in June: May (2), June (6), July (1) August (2) and September (1). Except for two sessions on the Garraf coast in 2003 (no results) and one on the Montgrí coast (one capture), all sessions were held in the Medes Islands, L'Estartit, Torroella de Montgrí, Girona (42° 01,963 N, 3° 11,915' E). We used a battery of 3x18 m long mist-nets and a cd-player with 20W loudspeakers continuously playing vocalisations of *Hydrobates pelagicus ssp.* during the entire night-time period. Ageing of birds was carried out following Baker (1993) and measurements were taken after Svensson (1992) and Lalanne *et al.* (2001) by a single observer. These included maximum chord (wing length), longest primary length (P3), tail length, tarsus length and five measurements of bill: bill tip to feather, height of bill including the tubular nostril, height of mandibles (bill without nostril), nostril width, and bill width at tubenose tip. Weight, moult stage and behavioural notes if any were also recorded.

RESULTS

No direct evidence of breeding was found at any of the surveyed sites. Thirty-two Storm-Petrels were trapped in the study period: 3 in 2003, 25 in 2004 and 4 in 2005. Of those birds, five were recaptures of birds already ringed, four in the Balearic Islands (two in 2004 and two in 2005) and a fifth in the Hormigas Islands, Murcia, a distance of 590 km. Additionally, there is one long distance recapture from a bird ringed in the study area: an adult ringed on 22 May 2003 at Cala Pedrosa, Torroella de Montgrí, was retrapped 13 days later, on 4 June 2003, at S'Algar, Felanitx, Mallorca, Balearic Islands becoming the first ever long-distance recapture of a Storm-Petrel ringed in Catalonia. Considering both birds trapped in Catalonia, either ringed or already ringed and the S'Algar bird, recaptures represent 18,75% of the trapping total, 85 times the recovery ratio for the whole of Spain (0,22%) or 81 times for the Balearics (0,23%) but only three times the ratio of previous studies in Catalonia (6,25%, table 1).

Table 2. Biometrics of Storm-petrel in Medes Islands, Mediterranean Spain (present study) compared to those of *H.p. melitensis*: Lalanne et al 2001 (Corsica, n=32 and Riou islands, n=4) and Amengual et al 2000 (Cabrera, Balearic Islands, n>148). All measurements in millimetres except weight in grams.

Tabel 2. Biometrie van Stormvoetjje op de Medes Eilanden, (deze studie) vergeleken met die van *H.p.melitensis*: Lalanne et al 2001 (Corsica, n=32 en Riou Eilanden, n=4) en Amengual et al 2000 (Cabrera, Balearen, n>148). Alle maten in millimeter, behalve het gewicht (gram).

	Medes Islands				Corsica	Riou	Cabrera
	n	Mean	SD	Range			
Wing length	32	123,31	1,96	119,5-128	123,58 ±2,98	129,25 ±2,22	122,50 ±3,78
Bill height	32	5,22	0,28	4,7-5,8	5,56 ±0,22	5,75 ±0,24	
Mandible heighth	31	3,95	0,17	3,7-4,3	4,08 ±0,17	4,50 ±0,08	3,97 ±0,31
Bill length	32	12,38	0,41	11,4-13,4	11,99 ±0,71	12,25 ±0,29	12,32 ±1
Weight	32	25,87	2,06	22-31,4	28,94 ±2,97	28,25 ±1,89	27,60 ±2,74

Of the three birds caught in 2003, one was a first summer bird and the other two were adults. All but one bird (24 of 25) in 2004 were adults, 20 of them showing a different degree of development and vascularization of defeathered breeding patches. The twenty-fifth bird was a juvenile ringed in September. All four birds trapped in June-July 2005 were first summer, non-breeding birds.

All measurements fell within *melitensis* range (Lalanne *et al.* 2001, Amengual *et al* 2000), table 2.

DISCUSSION

In Catalonia, only one known, proven breeding record exists for the Storm-petrel (Raventos 1972). The species has been scarcely studied, except for a number of ringing campaigns from 1986-1990 which produced 16 ringings and, interestingly, a recapture of a bird trapped at the Balearics (Estrada 1988, 1989). The capture of a bird with an egg about to be laid on 12 June 1988, plus indirect evidence, led to the species being considered as a breeder in NE Spain (Estrada 1988). However, no direct supporting evidence was found during the 2001-2005 breeding seasons. However, ringing results during the breeding period overwhelmed previous trapping results in all of NE Spain. Anecdotal observations indicate that the species occurs regularly during the breeding season off NE Spain, particularly around the Medes Islands (*pers.obs.*).

Differences in ages of trapped birds between the 2004 and 2005 seasons may be influenced by local food availability. There have been strong fluctuations in fishing captures in the area in recent years, with an even stronger

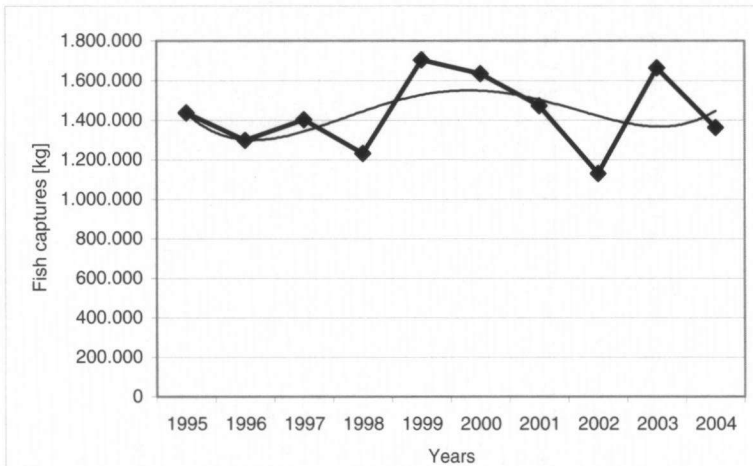


Figure 2. Fluctuations from 1995-2004 of total and polynomial trend (curve) fish captures [kg] landed at L'Escala Harbour, Girona, NE Spain ($42^{\circ} 07,711$ N, $3^{\circ} 08,220$ E), the closest harbour to the study area. Between 2003 and 2004 a 18,19% decrease in fish captures was noted. No data are available for 2005, but trend is negative (Medes Islands Protected Area, pers.comm.; DARP Marine Inspection Service pers.comm.).

Figuur 2. Fluctuatie in totale visvangst [kg] en trend (polynoom) in 1995-2004 in L'Escala, Girona, NO-Spanje ($42^{\circ} 07,711$ N, $3^{\circ} 08,220$ E), de haven die het dichtst bij het studiegebied ligt. Tussen 2003 en 2004 was er een afname in gevangen vis van 18,19%. Voor 2005 zijn geen data beschikbaar, maar de trend is negatief (Medes Islands Protected Area, pers.comm.; DARP Marine Inspection Service pers.comm.).

decrease in 2005 than in 2004, which, in turn, showed a 18,19% decrease relative to 2003 (figure 2; Medes Islands Protected Area, *pers.comm.*; DARP Marine Inspection Service, *pers.comm.*). It is known that fluctuations in zooplankton and fish availability are factors contributing to intermittent Storm-Petrel reproduction and even to the decrease of populations in some colonies (Elbé & Hemery 1998), including the decrease of breeding success in Atlantic French colonies (Cadiou 2004). Therefore, it is possible that seasonal lack of food could make the Medes Islands area less attractive for adult breeding birds, with only non-breeding or nomadic birds present in poor years, as the 2005 ringing recaptures, only including subadults, might suggest.

Considerations such as lack of an attractive cave (e.g. Benidorm), the historical evidence of human disturbance, competition with Yellow-legged Gull *Larus michahellis* populations (one of the largest colonies of the species is at the

Medes Islands, currently >6300 pairs but with a maximum of 14.000 in the 1980s, Bosch & Carrera 2003), or even high densities of mice (*Mus musculus*), could be additional factors explaining irregular breeding, something that regularly happens on the species on the other hand either naturally or induced by a previous breeding failure (Amengual *et al.* 2000).

The French populations off Marseille and Hyeres are largely unknown (Cadiou 2004), and their estimates are recently based on indirect evidence (Zotier & Vidal 1988). Ringing activities produced only four birds in May 2000 (Lalanne *et al.* 2001). This low capture rate suggests that this French region may function similarly to NE Catalonia areas, namely as a dispersal area with occasional breeding.

These sets of evidence bring out a new scenario. The relatively high proportion of ringing recaptures recorded in the Medes Islands (18,75% of trappings) suggests a close relationship with Balearic and even SE Spanish populations. This is particularly noteworthy when one considers that the 10.997 Storm-Petrels ringed in Spain from 1969-2002 and the 7370 ringed in the Balearics produced only 25 (0,22%) and 17 (0,23%) long-distance recaptures, respectively. The 6,25% recapture ratio of 1986-1989 campaigns in Catalonia matches this hypothesis of a relationship Balearics – Medes Islands. Compared with the current study, the eighties lower ratio might be explained by different local environmental conditions or sample size but is still well above Spanish or Balearic Islands average (table 1).

Estrada (1989) documented the first known long-distance recovery of a *melitensis* Storm-Petrel in the Mediterranean. The 241 km distance of that recapture could not eliminate the possibility of the bird being a local Medes breeder (it was an adult with brood patch) or a dispersive Balearic bird. In turn, none of the birds trapped in 2004-2005 was known to be an active breeder in those years in the Balearics (M.McMinn/Skua SL, *pers.comm.*). But the Murcia bird, mist-netted and ringed on 10.6.2003 in a colony of c.100 pairs without any tape-recording, could have been a local breeder there, as it was recaptured in the Medes Islands on 18 June 2004 showing a developed brood patch. Given the evidence of Storm-Petrels being capable of visiting sites more than 200 km apart in a single night (Cadiou 2004), the high ratio of recoveries in NE Spain both in the 1980s and in the current study suggests the possibility of a close relationship between the Balearic birds, and even beyond, and those off NE Spain. Thus, the coastal islets off NE Catalonia, as well as those off France, could be a foraging area for adults from well-established colonies and dispersal areas for subadults and non-breeders. It is even possible to reach NE Catalonia from the Balearics on a daily basis, as the distance, about 200 km, may well be within the flying range of the species. These coastal sites, depending on the year, might hold a breeding population, but different on-island factors discussed

above could make consistent breeding difficult. These coastal islets perhaps function as irregular small breeding sites which would certainly be linked to larger breeding grounds, thus serving as a connected extension of the core breeding area.

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BROEDENDE STORMVOGELTJES *HYDROBATES PELAGICUS* LANGS DE MIDDELLANDSE ZEEKUST: KLEINE GEÏSOLEERDE BROEDPLAATSEN OF SUBKOLONIES VAN GROTERE KOLONIES?

Naast de kerngebieden op de Balearen en in de centrale Middellandse Zee zijn er weinig bekende broedplaatsen van het Midderraan Stormvogeltje *Hydrobates pelagicus melitensis* aan de kust van Spanje en Frankrijk. Ondanks de problemen om het broeden van deze soort te documenteren is het duidelijk dat eilanden dichterbij het kerngebied bekende kolonies herbergen, terwijl ze in Noordoost-Catalonië en Frankrijk ontbreken, ondanks grondig onderzoek. Ringen van vogels heeft geleid tot een andere aanpak om broedkolonies vast te stellen; ringgegevens suggereren de mogelijkheid van onregelmatig, opportunistisch broeden in Noordoost-Catalonië en Frankrijk indien habitatcondities optimaal zijn. Van 27 terugvangsten van geringde vogels in Noordoost-Catalonië in 2003-2005, waren er vijf (15,62%) afkomstig van de Balearen en Murcia (westelijke Spaanse Middellandse Zee). Ter vergelijking; slechts 0,22% van het totaal aantal Spaanse terugmeldingen in 1969-2002 ($n=10997$) was afkomstig van (lange afstand)terugvangsten. Deze verschillen ondersteunen de idee dat de broedverspreiding bestaat uit kerngebieden en kleine geïsoleerde broedplaatsen zoals in Noordoost-Catalonië. Gezien de variatie in habitatkwaliteit zouden dergelijke kleine, perifere gebieden onregelmatige broedplaatsen kunnen zijn, zoals gesuggereerd wordt door resultaten uit het verleden en de conditie van gevangen vogels, of als deel van de belangrijkste foerageergebieden voor zowel adulte als niet-broedende vogels.

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Appendix

Survey data and methods used per field session (years 2001-2005)

	n.days	Marine Survey	Terrestrial Survey	Ringing	Nest-boxes	Night calls	Montari	Modes	Black Emponià	Cap de Craus	General
1	2001	8-9.5.2001	2	X			X	X			
2		23-24.5.2001	2	X			X			X	
3		25-28.5.2001	4	X			X				X
4	2002	10-13.6.2001	4	X			X	X	X	X	
5		12.7.2002	1	X				X			
6	2003	21-22.5.2003	2		X		X				
7		29.5.2003	1	X			X				X
8		10-11.6.2003	2	X			X				X
9		19-20.6.2003	2	X			X	X			
10		7-8.8.2003	2		X			X			
11	2004	11.3.2004	1	X				X			
12		05.4.2004	1	X	X					X	
13		10-11.6.2004	2		X			X			
14		16-18.6.2004	3	X	X			X			
15		22-23.6.2004	2	X			X	X		X	
16		12-13.8.2004	2		X			X			
17		6-7.9.2004	2	X				X			
18	2005	15-16.6.2005	2	X	X			X			
19		4-6.7.2005	2		X			X			
			39	8	12	0	9	4	13	1	4
				7	6	0	9	4	1	4	3