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For the sake of uniformity, authors submitting papers for consideration for publication are requested to follow the following sequence : Title; the name (s) of the author (s), an abstract (summarizing the main results) and the address (es) of the author (s); introduction; methods; results; discussions; acknowledgements; and references. Tables and figures should be presented on separate sheets with their desired position indicated in the manuscript margin. Manuscripts should be typed double-spaced on one side of the paper only, with a wide margin.

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STATUS AND CONSERVATION OF THE STORM PETREL *HYDROBATES PELAGICUS* IN THE MEDITERRANEAN

Bruno Massa & Joe Sultana

(This paper was presented at the second Mediterranean Seabird Symposium "Status and Conservation of Seabirds" organised by MEDMARAVIS at Calvia, Mallorca 21-26 March 1989).

Abstract

The current status of the Storm Petrel *Hydrobates pelagicus* in the Mediterranean is updated and new information is given. It seems that the most important colonies in the Mediterranean are found in the western and central parts. Natural predators interfere with the species' breeding success. This and a very low gene flow among different Mediterranean populations pose a threat to the survival of small colonies.

Introduction

The distribution, abundance and movements of the Storm Petrel *Hydrobates pelagicus* in the Mediterranean are very poorly known. The aim of this paper is to update the contributions by James (1984) and Massa and Catalisano (1986b) with some new available data, while highlighting the remaining big gaps in our knowledge of this species' status and range in this "inland sea".

Status

A questionnaire requesting information on the current distribution of this species was sent to several colleagues in all the Mediterranean countries. All the acquired information which indicates breeding or possibly breeding areas is presented in Table I, together with the known threats, if any, to the colonies. Only six countries, namely France, Greece, Italy, Malta, Spain and Yugoslavia, have confirmed breeding colonies, while no breeding records were reported from the following countries:

Cyprus - situation remains as reported by Flint & Stewart (1983) with 2 spring records and 'occasionally seen in summer in this century' (C.A. Charlaambides, pers. comm.).

Israel - 4 sight records, one in autumn (September) and three in winter (Paz 1987; Shirihai in prep.; J. Leshem, pers. comm.).

Libya - one undated specimen in Tripoli's Museum (Bundy 1976).

Tunisia - no new information. Reported breeding in the last century on the I. La Galite (Heim de Balsac & Mayaud 1962; T. Gautier, pers. comm.).

The Storm Petrel is not mentioned at all for Turkey (Vittery *et al.* 1971), Lebanon (A. Serhal, pers. comm.) and Egypt (Meininger & Baha el Din 1986), while no information could be acquired from Albania and Syria.

The present authors believe that due to this species' strange behaviour and haunts, the dearth of researchers in this field, as well as the difficulties to reach and investigate the areas likely to hold colonies,

TABLE I

Status of the Storm Petrel in the Mediterranean Sea

Locality	Current Status	Threats	Source
GREECE			
Islet off eastern Euboea	Colony of unknown size, probably small	No	Akriotis & Handrinos
YUGOSLAVIA			
Dalmatian islets	Breeding status not assessed. No reason why they are not there now, but no further investigations have been carried out	No	Krpan 1965; J. Muzinic & J. Gregori, p.c.
ITALY			
Sardinia	Three recently confirmed breeding sites, two of some pairs, and one of at least 300 pairs	Tourism, Nautical Sports	Baccetti et al., 1989, Grussu & Poddesu 1988, Moltoni 1971
Sicily, Islet of Lampione	Breeding site of some pairs	Probably <i>Larus cachinnans</i>	
Marettimo I.	At least 1,000 pairs, probably more	Tourism, Nautical Sports	Massa & Catalisano 1986a, 1986b, unpubl.
MALTA,			
Filfla I.	In 1975 estimated as 10,000 pairs. Probably decreasing after storms have washed away some of the rubble screes below the cliffs	Predated by <i>Larus cachinnans</i> . Loss of suitable nesting sites.	Sultana et al., 1975; Sultana, unpublished
FRANCE			
Archipel de Riou	Ca. 25-30 pairs	<i>Larus cachinnans</i> , <i>Rallus rallus</i>	Walmsley 1986, pers. comm.
Corsica	Three breeding sites, two of tens of pairs, and one of less than 10 pairs; in total some tens	No.	Guyot et al., 1985
			Hemery et al., 1988
SPAIN			
Columbretes Is.	1 ad. + broken eggs in 2 or 3 crevices	No	A.Mnz.Abrain, R.
Mitjana Is.	More than 25 pairs	No	Dolz, C. Carboneras
Benidorm Is.	Abundant, more than 100 pairs	Much predated by <i>Larus cachinnans</i>	Dolz, C. Carboneras
Nova Tabarca Is.	10 pairs	No	Malet, censuses by staff of Estacion Orn. de la Albufera, 1988
Medas Is.	Breeding recently proved	No	
Balearic Is.	Probably hundreds	<i>Larus cachinnans</i> , <i>Rallus rallus</i>	
Cabo de Palos	Probably few		De Juana 1984
ALGERIA			
West of Oran	Only possible breeding		K.De Smet, pers.comm.
MOROCCO			
Punta Ceres, Straits of Gibraltar	Probable breeding		Thevenot 1986

there are still several colonies yet to be discovered in the Mediterranean. Unless one has experience with Storm Petrel colonies it is quite easy to overlook them unless one stays overnight in the likely places. It must be pointed out that Table I does not actually show the status of this species in the Mediterranean, but only presents the meagre data which is presently available.

Since the status of the Storm Petrel in the Mediterranean was summarised by Massa and Catalisano (1986b) during the first Congress of Medmaravis, the most important information we acquired to date is the discovery of a previously unknown colony in Sardinia, consisting of at least 300 pairs (Baccetti *et al.* 1988); new information from Spain, including the confirmation of a colony at Medas Isles (Estrada 1988; C. Carboneras Malet, pers. comm.); and the possibility of breeding in Morocco and Algeria

(Thevenot 1986; B. Haddane and K. De Smet pers. comm.). It is strongly believed that further investigations in likely areas along the coasts of Morocco and Algeria will probably confirm the breeding of this species there. It is evident that the most important Storm Petrel colonies in the Mediterranean are found in Spain, Italy (Sardinia and Sicily) and Malta, with a concentration in the Sicilian Channel.

Threats at Colonies

Natural predators, namely the Yellow-legged Gull *Larus cachinnans* and the Black Rat *Rattus rattus*, frequently interfere with the breeding success of Storm Petrels. It has been observed that in rodent-inhabited islands Storm Petrels are generally few in numbers or totally absent. Some colonies on Marettimo Isle (Sicily) were deserted in the past years due to predation by rats and the only successful colony on this isle is, in fact, inaccessible to terrestrial predators. It is also believed that some colonies have been deserted in the past due to continuous disturbance of their breeding sites by tourism and nautical sports during summer. Extinction of small colonies has probably also occurred due to a reduction of the number of breeding pairs below the minimum level which assures the genetical variation.

Data on Morphometrics

The fact that only a very low gene flow exists among different Mediterranean populations of this species is a biological problem, which is generally overlooked, and undoubtedly is a negative factor for the survival of small colonies. The data on the morphometrics of the Storm Petrel, both from the Atlantic and the Mediterranean, is still scanty. Furness and Baillie (1981) have observed that there is a wide range of wing-lengths of individuals from different colonies in Great Britain, and James (1985) has hypothesized that there are geographical differences in the calls of British populations. As regards the Mediterranean, Hemery & D'Elbee (1985), observing that measurements of Mediterranean individuals are greater than those of Atlantic ones, have reevaluated the subspecies *melitensis* Schembri (1843). Massa & Catalisano (1986a, 1986b) have confirmed what has been observed by former authors, and Catalisano *et al.* (1988) found, as in Great Britain, morphometrical differences among Mediterranean populations too.

TABLE II
Biometrics of some Storm Petrels from Mediterranean and Atlantic

Locality	Wing Length	Tail Length	Source
Malta	123.9 (n = 99)	55.3 (n = 99)	Malta Ornithological Society
Sicily	125.1 (n = 64)	55.6 (n = 64)	Catalisano <i>et al.</i> 1988
Sardinia	123.9 (n = 38)	54.2 (n = 38)	Baccetti Massa Spina, unpublished
Corsica	123.6 (n = 39)	53.3 (n = 39)	Hemery & D'Elbée 1985
Atlantic	122.4 (n = 19)	53.3 (n = 19)	Hemery & D'Elbée 1985

In Table II we present some data of wing and tail lengths from 5 different sites. It is not possible from these to recognise any clinal trend, but some differences in lengths among the different populations are evident. It would be interesting to complete the picture with further biometrics from Spain and the Canary Islands. This could help to carry out comparative studies which could shed some light on the relationship between populations of the Atlantic and the Mediterranean.

As already observed for the Cory's Shearwater *Calonectris diomedea* by Massa and Lo Valvo (1986), the hypothesis that each Storm Petrel population is morphometrically and genetically isolated seems rather positive. The absence of a significant gene flow among populations is also confirmed by the high site tenacity of adults, observed both in Malta and Sicily. Very little data on site fidelity of juveniles

is available due to the very low number of ringed pulli as well as an insufficient number of regular ringing in consecutive years (the Storm Petrel should reach maturity before the age of 5 years).

One individual ringed as pullus at Marettime isle (Sicily) in July 1987 was controlled at Filfla (Malta) in July, 1989 with evidence of a brood patch. This interesting case is the only confirmation of some exchange of individuals between two populations and the achievement of probable maturity by the Storm Petrel at the age of 2 years.

Discussion

Studies have enforced the suspicion that the decrease of survival probability in natural populations is caused by loss of genetic variation. Small populations indeed are affected both by the decrease of genetic diversity and the loss of rare alleles per each generation, well-known effects of the "bottle-neck", as well as by frequent inbreeding and alteration of allele frequencies, caused by genetic drift.

According to Lacy (1988) extinction is fundamentally a demographic process, the failure of one generation to survive and reproduce a subsequent generation. Conservation does not mean the survival of the last **individuals**, but the survival of **populations**. As pointed out by Frankel & Soulé (1981) it is necessary to carry out long-term programmes to achieve the conservation of genetic potential and consent a regular evolutionary process, and consequently prevent the population extinction. Populations numbering less than 50 individuals are candidates for immediate artificial gene flow. For those populations larger than 50 individuals, the danger of genetic and phenotypic deterioration is less, but erosion of genetic variation must still be controlled, at least as long as the population has an effective size of less than 500. Natural populations numbering less than 100 individuals are in immediate danger and require immediate genetic management (Frankel & Soulé 1981).

The pattern of genetic variation of the populations might show past amounts of gene flow, and consequently the amount of migration between different areas (Slatkin 1987). Measurement of evolutionary divergence among populations is necessary to define the demographic units that need conservation plans. According to Lacy (1988) genetic data, as well as morphological ones, should be used to assess relationship among all populations of concern that may have diverged genetically during periods of isolation.

Genetic processes in small and fragmented populations have to be seriously considered in management plans. Among Mediterranean populations of Storm Petrels that we know of, according to previous theory, only those living in the Sicilian Channel are out of danger. Others need a serious conservation programme. We believe that in the following years studies on the biology (especially site fidelity, breeding success, etc.), on morphometrics and genetics of different populations of the Storm Petrel have to be carried out to plan a long term programme for the species' conservation.

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~~THE DISTRIBUTION OF THE SHORT-TOED LARK *CALANDRELLA*~~ ~~*BRACHYDACTYLUS* DURING THE BREEDING SEASON IN~~ ~~THE EASTERN SECTION OF MALTA~~

~~Denis Caehia~~

Abstract

A survey was carried out during 1986 and 1987 to establish the distribution of the Short-toed Lark during the breeding season in the Eastern section of the island of Malta. A map has been drawn showing the areas where Short-toed Larks were found breeding or possibly breeding. The main breeding areas of the species in the area are briefly described. Some of the threats to the future of the Short-toed Lark and its breeding habitats are mentioned.