

Known population and distribution of cormorants, shearwaters and Storm Petrels in the Mediterranean

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Abstract — Five species of Procellariidae, Hydrobatidae and Phalacrocoracidae breed in the Mediterranean: the Cory's Shearwater *Calonectris diomedea* (57,000-76,000 breeding pairs), the Mediterranean Shearwater *Puffinus yelkouan* (18,000 known breeding pairs), the Storm Petrel *Hydrobates pelagicus melitensis* (8,500-15,000 known breeding pairs), the Shag *Phalacrocorax aristotelis desmarestii* (about 7,000 breeding pairs) and the Cormorant *Phalacrocorax carbo* (8,000 breeding pairs). Large populations of seabirds occur on the Balearics archipelago, in the Sicilian channel and in the north of the Tyrrhenian Sea. The status of birds in the Adriatic, Ionian and Aegean Seas needs to be clarified by further survey.

Introduction

The first estimate of breeding numbers of Mediterranean seabirds was effected by James (1984), and later other surveys have been carried out, principally in the western Mediterranean. Regional and national syntheses are available for the Balearics (Aguilar 1991), France (Hémery in press), Italy (Brichetti 1992), Sardinia (Schenk and Torre 1986), Cyprus (Flint and Stewart 1992) and Bulgaria (Nankinov in press). Specific papers have been published on the Balearic form of Mediterranean Shearwater *Puffinus yelkouan mauretanicus* (Capella and Muntaner in press), the Mediterranean form of Cory's Shearwater *Calonectris diomedea* (Thibault in press), the Storm Petrel *Hydrobates pelagicus* (Massa and Sultana 1990-91) and the Mediterranean form of Shag *Phalacrocorax aristotelis desmarestii* (Guyot in press). Paterson (1992) has summarized these data and added the Cormorant *Phalacrocorax carbo*.

The purpose of the present study is to give detailed and up-to-date data concerning the known distribution and status of these seabirds and to provide a global synthesis for the Mediterranean, including the lesser known "Levantine" form of the Mediterranean Shearwater *Puffinus y. yelkouan*. Census methods are discussed, and populations analysed. Finally, research and conservation priorities are discussed.

Species account

Cory's Shearwater *Calonectris diomedea diomedea*

Distribution. The nominate race of Cory's Shearwater, restricted to the Mediterranean sea, breeds from the Chaffarinas Islands to the Northern Sporades, Crete and the Dodecanese. It is absent from the Levantine basin, and the Marmara, Black and Azov Seas. The Balearic population has recently been estimated at $10,972 \pm 2,633$ pairs (Aguilar 1991). The Filfla population was estimated at 100 pairs (Borg and Sultana 1990-91) and a small colony has been found in Corsica on Gargalo Island. The global population of the subspecies is now estimated at 57,000-76,000 pairs (extreme 80,000 pairs) with 120 breeding sites (Thibault in press). This represents less than 10% of the world population. Fifty five percent of the known population breeds in the Sicilian channel (principally on Zembra and Linosa). 16% on the Balearics and 11% on Crete in the Aegean.

Research programs. This species has been much studied in the Mediterranean over the last 15 years and long term studies have been initiated in Crete, Corsica and Linosa.

Conservation. No particular trend has yet been deduced from long term studies. A population decline is probable on Malta and the Maltese Islands, due to poaching (2,000 adults shot every year). The development of tourism probably causes disturbance on the Balearics, Linosa, Gozo (Malta) and Frioul (France). Eggs are collected nowadays on Linosa at

a rate of 3,000-4000 eggs per year. Deaths due to setlines are recorded around the Balearics, where an increasing concentration of heavy metal in birds body has also been noticed without visible consequences (Mayol 1986). Predation by rats occurs, at least on Balearics (Aguilar 1991), French coastal islands and Corsica, where it has been quantified (Daycard and Thibault 1990). Rabbits also disturb breeding on the Frioul Islands (Fernandez 1989).

Mediterranean Shearwater *Puffinus yelkouan*

Distribution. Western Mediterranean. The status of the species is now well known in the northwestern Mediterranean. The Balearic form is restricted to the Balearic archipelago where more than 3,301 ± 1174 pairs breed at 25 different sites (Aguilar 1991), with 73% of the population on Formentera. The French coast hosts 230-300 breeding pairs, distributed in seven small colonies (10-50 pairs each) on Port-Cros, Porquerolles and Le Levant Islands. Eleven to twenty one isolated breeders are also found on five islands and islets. In Corsica, a small number is known to breed on Giraglia Island (Hémery in press). Twenty five breeding sites are known around Sardinia (Schenk and Torre 1986) for an estimated total 7,500-13,000 breeding pairs. Most of the population breeds on Tavolara and Molara (6,000-9,000 pairs) and on San Pietro islands. Estimates were made by counting birds at sea around the islands and may be overestimated. Breeding has also been confirmed on Cavoli, Vacca and Maddalena Islands. In the Tyrrhenian Sea, James (1984) estimated the size of the population at 3,500 breeding pairs. The species is known to breed on Montecristo, Giannutri, Pianosa Islands (Brichetti 1992), and Salina and Vulcano Islands (Massa 1985, Iapichino and Massa 1989). Ten colonies are known in the Sicilian channel on Maretino, Levanzo and Favignano (Egadi Islands), on Lampedusa and probably on Linosa (Massa 1985, Iapichino and Massa 1989), and on Malta and the Maltese Islands (Sultana and Gauci 1982). Only two sites are known along the North African coast, on El Kala Island (Ledant *et al.* 1981) and on Zembretta (Deleuil 1958, Gaultier unpubl.) The total western Mediterranean population of this Mediterranean endemic species is estimated at 18,000 ± 4,000 pairs, distributed in 75 localities. Seventy five percent of the estimated population breeds in the north Tyrrhenian Sea. The Balearic subspecies represents 18% of the population.

Eastern Mediterranean. The species breeds on Tremiti (Brichetti 1992), the Kvarner archipelago (Lovric 1971), the Vis archipelago (Krpan 1968), and the Korcula and Lastovo Island and islets (Krpan 1976-1977). Surprisingly, only Vis and Kvarner have

recently been noted as nest-sites (Lovric and Obradovic 1988). The only known breeding site in the Ionian Sea is on the Strofades Islands (Handrinos, unpubl.). In the Aegean it breeds on the Northern Sporades (three localities which include Alonnisos and Yioura Islands), Southern Sporades, the Cyclades (Naxos and Paros), and on islets off the west coast of Crete (Kumerloeve 1972, Grimmet and Jones 1989, Maggioris 1988). No evidence of breeding is yet available from Turkey (Mangin unpubl.), although birds are recorded throughout year in the Marmara Sea (Beaman 1978). On Cyprus most of the observations have been in the non-breeding season, in August and September, and are scarce from December to March during the pre-breeding period (Flint and Stewart 1992), breeding has not yet been reported (Bennett unpubl.). In the Black Sea there are three records of isolated breeding pairs on coastal islets off Bulgaria (Nankinov in press). No estimate is available for the eastern population of the Mediterranean Shearwater. It is to be noted that the "Levantine" form is not known to breed in the Levantine basin.

Research programs. The ecology of the Mediterranean Shearwater has been initiated studied since 1982 on Port-Cros Island, where a long term project has been initiated. Ringing programs are also carried out on the Balearics and Malta; data about its breeding ecology are available for both localities. It would be interesting to carry out long term studies on the *mauretanicus* subspecies and on eastern populations of the nominate subspecies.

Conservation. There has been no decrease in numbers on Port-Cros Island during the last decade, while the small population of the Marseille Islands many have decreased during the last 30 years according to Fernandez (1987). The species has disappeared from Lavezzi Island (Vigne *et al.* 1991) and from the Cerbicale Islands (Guyot *et al.* 1985), and probably decreased with man's arrival on the Balearics (Alcover 1989). Subfossil bones have been found on Palmaria Island in Liguria (Brichetti 1992) and on the mainland of Crete (Alcover *et al.* in press). Predation by rats greatly varies from one year to another and can be important (Vidal 1985). Besson (1973) recorded adult mortality due to fishing nets in the south of France. The taking of birds and eggs has now diminished in the Mediterranean but were important along the Croatian coast until the 1960s (Krpan 1967-1968), and until recently in Balearics archipelago (Mayol 1986).

Storm Petrel *Hydrobates pelagicus melitensis*.

Distribution. The Mediterranean subspecies of Storm Petrel is known to breed in the Algero-provençal basin from the Spanish coast to the

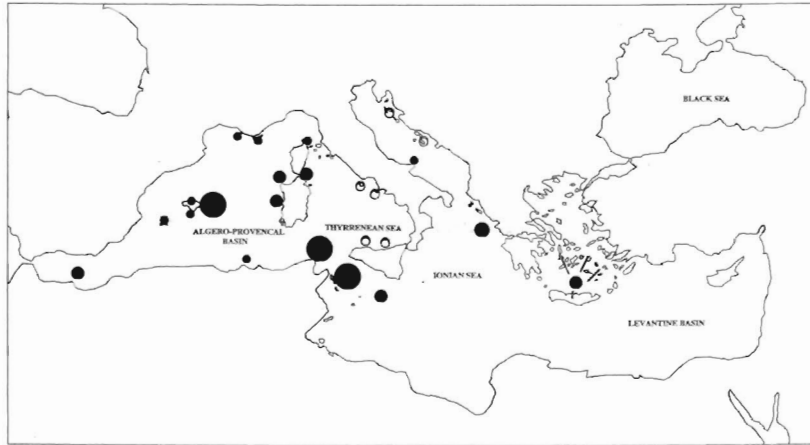


Figure 1 - Location and size of the known breeding sites of Cory's Shearwater in Mediterranean, Black and Azov Seas. Dots of increasing size represent 1-100, 101-1000, 1001-10000, and >10000 pairs; open circles: unknown numbers; probable breeding or old breeding record.

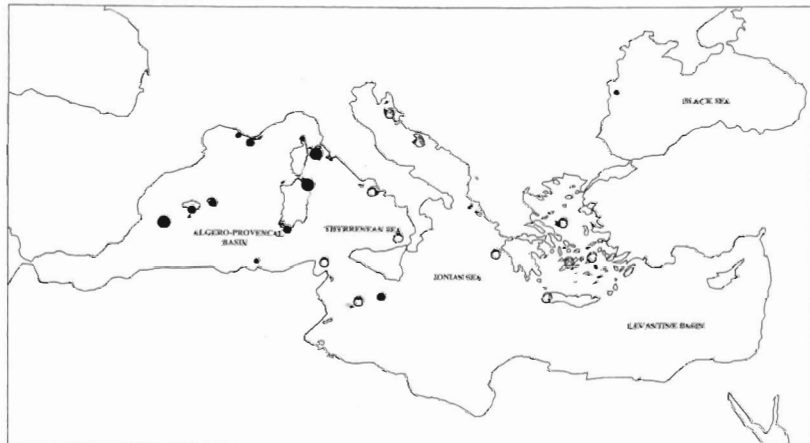


Figure 2 - Mediterranean Shearwater *Puffinus yelkouan*. Details in Figure 1.

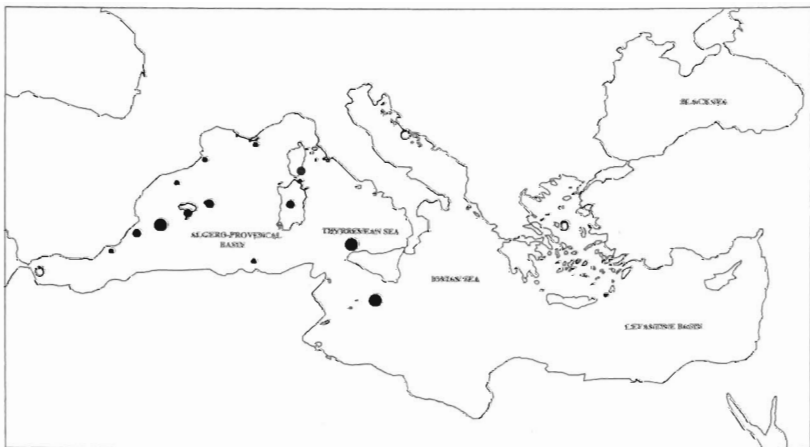


Figure 3 - Storm Petrel *Hydrobates pelagicus*. Details in Figure 1.

Sicilian channel. The Balearic population has recently been censused at about 3,000 pairs, with more than 90% on Ibiza (Aguilar 1991). It is an uncommon breeder in the Adriatic sea on the Vis archipelago (Lovric and Obradovic 1988). The only known breeding site in the Aegean is Prassoudha Island, Northern Sporades (Akriotis and Handrinos 1986), and birds have been observed along the Turkish coast (Haas 1990). The breeding status along the North African coast is not clear. The total known population does not exceed 15,000 breeding pairs. The largest colonies are in the Sicilian channel (Filfla and Marettimo Island) and on Ibiza. The other 22 known Mediterranean breeding sites host 5-300 pairs each. The total known population represents 5-10% of the world population.

Research programs. There is no long term study on this species, and data concerning its breeding ecology are scarce. It would be important to carefully survey the islets off Morocco and Algeria, and rat-free islets in the Aegean and Adriatic.

Conservation. The largest known colony of Filfla Island probably recently decreased in size, after storm modified the breeding sites (Massa and Sultana 1990-91). Predation by the Yellow-legged Gull *Larus cachinnans* and the Black Rat *Rattus Rattus* commonly occurs on coastal islets (Walmsley 1986, De Juana 1984). The development of tourism creates disturbance around Sardinia (Baccetti *et al.* 1989) and in the Sicilian channel (Massa and Catalisano 1986). Most of the known colonies are small, and Massa and Sultana (1990-91) raise the problem of the limited genetic potential of small isolated populations.

Shag *Phalacrocorax aristotelis desmarestii*

Distribution. The Mediterranean subspecies of Shag breeds principally in the Balearics, on Corsica, Sardinia and along the Croatian coast where actual numbers are unknown. It is also present in small numbers along the North African and Turkish coast, on Cyprus, in the Aegean and in the Black Sea along the Bulgarian and Ukrainian coasts (Guyot in press). The Balearic population has recently been censused at 891 ± 77 pairs (Aguilar 1991). The total number of breeding birds in the Mediterranean is probably less than 10,000 pairs (Guyot in press) and represents about 12-15% of the world populations.

Research programs. The breeding and feeding ecology of this species has been studied in Corsica (Guyot 1985a and 1985b).

Conservation. A 38% decrease in number was recorded on Mallorca between 1986 and 1991 (Aguilar 1991). A similar fluctuation has been noticed in Corsica and is probably not rare.

Cormorant *Phalacrocorax carbo*

Distribution. Most of the breeding population is in the Black and Azov Seas and along the Greek coast (Paterson in press). A small coastal population is known on Sardinia (Schenk and Torre 1986). According to Paterson (in press), a few pairs breed on the Medas Islands, on the north Spanish coast. Breeding is occasional along the Algerian coast on Agueli Island (Boukhalfa 1991). A total of less than 8,000 pairs breed around the Mediterranean (Paterson in press), 14% of the north Atlantic population.

Research programs. There is no program on this species. Study of the isolated Sardinian population appears important for the future.

Conservation. Populations are decreasing in Bulgaria (Nankinov in press), but are increasing in Romania and the Ukraine (Paterson in press).

Discussion

Knowledge of the status and numbers of these species is fragmentary around the Mediterranean. Future investigations should consider the Adriatic, Ionian and Aegean Seas where numeric data are scarce and generally old. There is also an important lack of survey along the North African coast. Most of the population of the Tuscan archipelago, Sardinia and the Sicilian channel has been estimated, and it would be interesting to conduct exhaustive censuses. Further censuses need to use a common methodology and to be synchronised. The species reviewed here, except for the Cormorant, are strictly dependent on marine resources. They are the only pelagic seabirds that breed in the three million square kilometers of the Mediterranean and Black Sea. Moreover, they do not commonly breed sympatrically and the total number of breeders in each colony is generally low. Large populations of seabirds only occur in three different areas of the western Mediterranean: the Balearic archipelago, the Sicilian channel and the north Tyrrhenian Sea. Mediterranean seabirds populations have undoubtedly been drastically affected by human presence in their breeding grounds since the Neolithic and most present-day colonies are probably relict. However the distribution of seabirds is primarily determined both by pelagic food availability and potential breeding biotope. Further studies should contribute to determine the exact place of each seabird species in the Mediterranean ecosystem. Seabirds are generally highly philopatric. It is therefore important for further conservation plans to determine the isolation level of the small populations in each species.

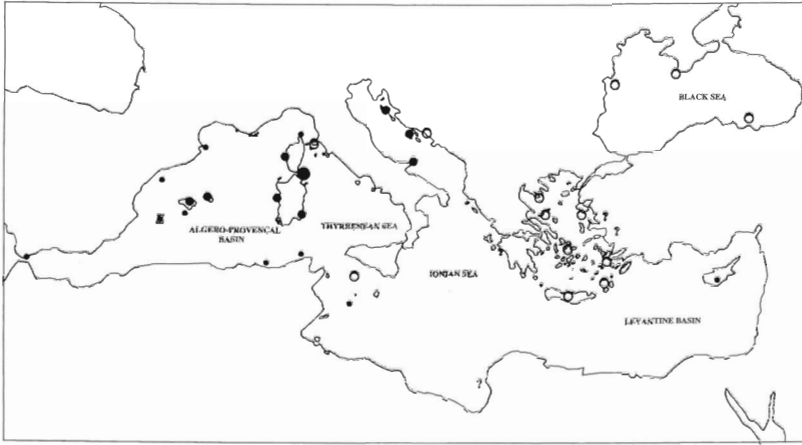


Figure 4 - Shag *Phalacrocorax aristotelis*. Details in Figure 1.

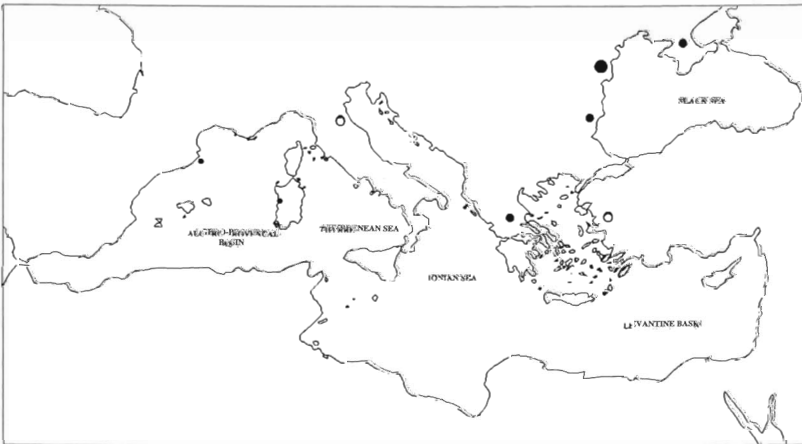


Figure 5 - Cormorant *Phalacrocorax carbo*. Details in Figure 1.

Table 1 - Status of shearwaters, Storm Petrels and cormorants in Mediterranean, Black and Azov seas (number of breeding pairs).

Locality	Species					References
	<i>Calonectris diomedea</i>	<i>Puffinus yelkouan</i>	<i>Hydrobates pelagicus</i>	<i>Phalacrocorax aristotelis</i>	<i>P. carbo</i>	
Iberian coast	(1)		(2)	(3)	(4)	
Gibraltar	—	—	—	4-5	—	(1): Thibault in press
Hormingas	—	—	30	—	—	
Cuevas de lobos	—	—	≥ 2	—	—	(2): Massa and Sultana 1990-1991
Palomos	≥ 29	—	≥ 15	—	—	
Terreros	≥ —	—	—	—	—	
Hitjana	—	—	≥ 25	—	—	(3): Guyot in press
Benidorm	—	—	100-200	—	—	
Nova Tabarca	—	—	10-20	—	—	(4): Paterson in press
Columbretes	170-200	—	≥ 10	(+)	—	
Medas	—	—	5-15	(+)	2-3	(5): Aguilar 1992
Balearics	(5)	(5)	(5)	(5)	(5)	
Mallorca	214 ± 69	400 ± 123	17 ± 5	517 ± 45	—	(6): Hémerly in press
Menorca	10,075 ± 2453	125 ± 33	50	186 ± 18	—	
Ibiza	313 ± 47	344 ± 86	2786 ± 1120	62 ± 5	—	(7): Schenk and Torre 1986
Formentera	60	2410 ± 885	breed?	54 ± 5	—	
Cabrera	427 ± 64	22 ± 7	59 ± 9	72 ± 9	—	
French coast	(6)	(6)	(6)	(6)	(6)	
Frioul	56-80	2-5	—	—	—	
Riou	132-162	8-15	10-20	—	—	
Porquerolles	110-130	50	—	—	—	
Bagaut	5	1	—	—	—	
Port-Cros	40-50	80-100	—	—	—	
Le Levant	40-60	100-150	—	—	—	
Corsica	(6)	(6)	(6)	(6)	(6)	
Giraglia	30	1-10	—	10-185	—	
Cerbicales	79-115	—	70-90	100-500	—	
Lavezzi	312-466	extinct	—	50-310	—	
West coast	—	—	—	45-100	—	
Bonifacio	10-50	—	—	—	—	
Gargallo	6-10	breed?	—	—	—	
Finocchiarola	—	—	—	10-20	—	
Sardinia	(1)	(7)	(3)	(4)		
Asinara	breed?	breed?	—	80-100	—	
Maddalena	>1,000	—	—	50-300	—	
Alghero area	1,500-2,000	—	—	290	35-45	
Costa Smeralda	—	—	—	145	—	
Figarolo	+	—	—	+	—	
Tavolara/Molara	+	6000-9000	3 localities	145	—	
Toro	300-400	—	around	—	—	
Vacca	—	+	Sardinia	+	—	
Cavoli	—	+	2 small	—	—	
Pan di Zuccherò	+	—	and one >300	—	—	
San Pietro	—	500	—	+	—	
Orosei/Quirra	—	—	—	200-400	—	
Costa Paradisea	—	—	—	120	—	
Mal di Ventre	—	—	—	40-60	—	
S. Catarina area	—	—	—	+	—	
Tuscan arch.	(1)	(2)	—	(3)		
Capraia	100-150	breed?	—	—	—	(1): Tribault in press
Gorgona	breed?	breed?	—	5-10	—	
Elba	50-60	breed?	—	breed?	—	(2): Bricchetti 1992
Pianosa	+	+	—	4-7	—	
Montecristo	breed?	+	—	—	—	(3): Guyot in press

Italian Coast	(1)	(2)				
Ponziante	+	+	—	—	—	(4): Massa and Sultana 1990-1991
Ustica	+	—	—	—	—	
Ischia	+	—	—	—	—	
Giglio	breed?	breed?	—	—	—	(5): Borg and Sultana 1990-1991
Aeolian	+	—	—	—	—	
Giannutri	—	+	—	—	—	
Sicilian channel	(1)	(2)	(4)	(3)		(6): Paterson in press
Levanzo	—	+	—	—	—	
Favignano	—	+	—	—	—	(7): Moutou unpubl
Marettimo	<100	+	>1,000	—	—	
Sicily	—	breed?	breed?	—	—	(8): Deleuil 1958
Pantelleria	<1,000	+	—	—	—	
Lampione	>400	breed?	+	—	—	(9): Ledant <i>et al.</i> 1981
Lampedusa	+	+	—	30-40	—	
Linosa	>10,000	breed?	—	—	—	(10): Boukalfa 1990
Malta	+	500 (6)	—	—	—	
Gozzo	100-2,000	—	—	—	—	(11): Lovric and Obradovic 1988
Filfla	<100 (5)	breed?	2,500-10,000	—	—	
African coast	(1)		(7)	(3)	(10)	
Lybian coast	—	—	—	breed?	—	(12): Krpan 1967-1968
Zembra	20-25,000	—	—	10	—	
Zembretta	—	—	—	1-2	—	
La Galite	>12	+(8)	—	+	—	
Colombi	—	—	—	+	—	
Cap Tenes	—	—	—	+	—	
Ronde Is.	—	—	—	+(20-40)	—	
San Piastre	—	—	—	+	—	
El Kala	—	8-12 (9)	—	+	—	
Srigina	—	—	—	+	—	
Collo	20	—	—	—	—	
Habibas	>20	—	breed?	—	—	
Rachgoun	100-1,000	—	—	—	—	
Agueli Is.	—	—	—	—	+	
Chaffarinas	1,000-3,000	—	—	—	—	
Adriatic Sea	(1)		(11)	(3)		
Tremiti	250-350	100-150(2)	—	100-150	—	
Kvarner	+	+(12)	—	800-1,000	—	
Dalmatian Is.	+(70-75)	+(12)	+	100-150	—	
Istria	—	—	—	+	—	
Cornati	—	—	—	+	—	
Croatian coast	—	—	—	—	—	
Ionian Sea	(1)	(2)				
Corfu	+	—	—	—	—	(1): Thibault in press
Zakynthos	+(5,000)	—	—	—	—	
Strofades	+	+	—	—	—	
Kythira	+	—	—	—	—	(2): Handrinos
Aegean Sea	(1)			(3)	(4)	
Greek coast	breed?	—	—	—	180	
Crete	2,5	extinct?(5)	—	—	—	(3): Guyot in press
Dyonidiades	+	—	—	+	—	
Naxos	breed?	+(6)	—	+	—	(4): Paterson in press
Fournoy	breed?	+(7)	—	breed?	—	
Youra	—	breed? (6)	—	—	—	
Siros	+	—	—	+	—	(5): Alcover <i>et al.</i> in press
Alonnisos	—	+	—	—	—	
Thassopula	—	—	—	+	—	
Vorioi Sporades	+	—	+	+	—	(6): Grimmet and Jones 1992
Prassoudha	—	—	—	—	—	
Kassos	+	—	—	+	—	
Saria	+	—	—	+	—	(7): Kumerloeve 1972
Chios	—	—	—	+	—	
Rhodos	—	—	—	+	—	

Cyprus				(4)	
Klidhes	—	—	—	+	—
Epishopi	—	—	—	+ (40-54)	—
Akrotiri	—	—	—	+	—
Cape Aspro	—	—	—	breed?	—
Cape Kormatiki	—	—	—	breed?	—
Aios Yeorgios	—	—	—	breed?	—
Orka	—	—	—	breed?	—
Mazaki	—	—	—	breed?	—
Turkey				(3)	(2)
West Turkey	—	—	—	+	+
North Turkey	—	—	—	—	+
Gelindere	—	—	—	+	—
Bulgaria		(8)		(8)	(8)
Zmiiski	—	(+)	—	—	—
Silistar	—	(+)	—	—	—
Cape Kaliakara	—	—	—	25-30	—
Vardim	—	—	—	—	+
Persina	—	—	—	—	+ (280-600)
Utova	—	—	—	—	+
Srebuna	—	—	—	—	22
Romania					(4)
Danube delta	—	—	—	—	+
Martinka lake	—	—	—	—	+ (7,000)
Purcellu	—	—	—	—	+
Mures valley	—	—	—	—	+
Ukraine				(3)	(4)
Tarkhanhut pen.	—	—	—	+	—
Balacava	—	—	—	+ (800)	—
Mouth of Azov	—	—	—	+	—
Kartinitsky	—	—	—	—	>356
Ivano-Frankivitsk area	—	—	—	—	11

+: number of breeders unknown

(+): irregular breeder

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