ALBATROS PROJECT MONOGRAPH 2012

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YELKOUAN SHEARWATER

Puffinus yelkouan

Updated state of knowledge and conservation of the nesting populations of the Small Mediterranean Islands

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CONTEXT

Mediterranean Small islands Initiative:

The Conservatoire du Littoral has been coordinating , since 2005, an international programme for the promotion and assistance for the management of Mediterranean insular micro-spaces, known as the PIM Initiative for the Mediterranean Small islands, which is co-financed by the Fonds Français pour l'Environnement Mondial (FFEM) (French Global Environment Facility), the Agence de l'Eau Rhône Méditerranée-Corse and the city of Marseilles. The PIM initiative is developing a mechanism for the exchange and sharing of knowledge which is necessary for the emergence of good management practices of exceptional spaces. The Albatross project has been set up within the framework of this programme to enhance the knowledge of Mediterranean nesting bird species. To update the knowledge on these species, the PIM initiative has coordinated the preparation of monographs for each of the project species.

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SUMMARY

GENERAL DATA

Scientific name: *Puffinus Yelkouan*
French name : Puffin Yelkouan
Spanish name : Pardela Mediterránea
Italian name : Berta minore

Protection Code
Barcelona convention : Annex II
Bird Directive : Annex I
Bern Convention: Annex II
IUCN: Near threatened (status vulnerable currently studied)
Barcelona convention: Annex I

DESCRIPTION OF SPECIE

Like many pelagic marine birds, the Yelkouan Shearwater has a strongly contrasting plumage between the back and the underside. The upper part is brown blackish contrasting clearly with the lower parts and the underside of the wing is nearly completely white with a dark line at the extremity and the rear edge of the wing as well as through the secondary coverts and variable on the sides and under the tail. During flight the pink and black feet stick out slightly from under the short tail. The black beak has tubular nostrils. The Yelkouan Shearwater is an average sized marine bird with a span of 73 to 88 cm and an average weight of 430 g. The females are slightly smaller than the males and can be distinguished from the males through their characteristic calls. (Bourgeois *et al.* 2007). The young when they take to flight and immature birds have slightly striated flanks and the back is sometimes greyish and even black, very dark compared with the adults. (Zotier 1997)

The Yelkouan Shearwater can possibly be confused with the Balearic Shearwater (*Puffinus mauretanicus*) when in flight over their common foraging areas or when at sea, especially on the French and Spanish side of the Mediterranean. However, the Balearic Shearwater is slightly bigger, with a generally more diluted brown plumage on the lower parts and much lighter colour on the back (Brooke 2004); but both species look alike and some individuals can hardly be distinguished with certainty on the ground (Yésou & Paterson 1999).
Like most Shearwaters, the Yelkouan Shearwater flies close to the water, and the tip of the wings can sometimes touch the water. When the weather is calm, it flies in a straight line with rapidly beating wings alternating with a gliding flight. When the sea gets rougher and the wind rises, it uses the air currents formed by the surface movements of the sea, rising a few meters above the sea surface and going down close to the water, showing in turn its ventral and then its dorsal side with practically no beating of the wings. The wings are generally stretched, the body and wings forming a right angle.

The birds' cries are raucous and very loud in the burrows and in flight near the colonies. These cries are powerful, plaintiff and can be compared to croaking and miauing. The cries of the females are deeper and hoarser than the males (Bourgeois *et al.* 2007).

Their droppings are generally quite liquid, whitish with pinkish or greenish bits depending on what the bird has eaten (crustaceans or fish).


Karen Bourgeois – A dos d'Ile

The Yelkouan Shearwater nests in rocky cavities (cracks, fissures, crevices) under rocky blocks (under fallen earth) or in burrows it digs out in the ground (Bourgeois & Vidal 2007).
It breeds exclusively on rocky islands or islets in colonies of variable size, either mono-specific or mixed (in association with Cory's Shearwater). Its colonies are generally to be found on littoral cliffs or rocky scree with a variable vegetation cover (Bourgeois et al. 2008b). The species can sometimes nest in human constructions such as the surrounding wall of a fort on the Port-Cros islands and the retaining wall of the railway on the Zembretta Island.
Yelkouan Shearwaters prefer to select breeding sites (cavities and colonies) which provide better protection (Bourgeois & Vidal 2007, Bourgeois et al. 2008b) against external environmenal conditions and predators (deep cavities with a sinuous entrance tunnel, sloping sites, minimum vegetation cover and a stable substrate) or those places which facilitate nest building) size of the entrance to the cavities adapted to their own size, deep soil so that the burrow can be built or a substrate which is suitable for the formation of cavities, sloping sites with sparse vegetation in a mature forest for easy landing and take-off).
The female lays one single completely white egg. Breeding success is enhanced in deeper cavities with a sinuous tunnel and higher overlapping layers. (Bourgeois & Vidal 2007)

The Yelkouan Shearwater comes to land only for nest building and is a nocturnal bird which can be recognized due to its raucous and powerful song. Vocal activity is considerable but irregular during the breeding season with peaks in December (prospection), in February (mating) and at the end of April-beginning of May (hatching) (Bourgeois *et al.* 2008a). As is the case with many nocturnal Procellariiformes, they are strongly influenced by the light of the moon (Zotier 1997), but the strength of the wind also influences the presence of the birds in the colonies (Bourgeois *et al.* 2008a). Individuals tend to come to breed on or close to the site of their birth (philopatry) and are faithful from one year to another to their breeding site. The pairs too are faithful to each other. In the colonies are breeding individuals as well as prospectors looking for a partner and a burrow in which to breed. The latter stay out longer outside the burrows and cavities vocalizing loudly and frequently.

The Yelkouan Shearwater feeds exclusively on marine prey. Fish, in particular the *Clupeidae* (sardines), the Engraulidae (anchovies) and the *Scombridae*, constitute their main resource in terms of biomass (99,7 % of the ingested biomass ; Bourgeois *et al.* being printed). Crustaceans (*Euphasiacea* and Decapods) constitute a considerable portion of their diet in terms of relative numbers (63,3 %) but do not contribute much to the ingested biomass due to their small size. The species can dive several dozens of meters to capture their prey (Zotier 2007, Péron *et al.* unpublished).

The Yelkouan Shearwater congregates in several thousands of birds close to colonies during the breeding period (Thibault & Bonaccorsi 1999, Zotier 1999). A pelagic bird, with lengthy trips at sea, the Yelkouan Shearwater can be seen regularly close to the coast, much more often than Cory's Shearwater. The characteristics of the marine areas sought by the specie are being studied (Borg *et al.* 2010, Péron *et al.* unpublished). Migratory movements have recently been studied in France and Malta (Bourgeois *et al.* being prepared, Raine *et al.* being prepared). It seems that the species migrates mostly in the Eastern Mediterranean and the Black Sea during the internuptial period

(Nankinov 2001) whereas some individuals stay relatively close to their breeding areas (Bourgeois *et al.* being prepared).

DISTRIBUTION OF POPULATIONS

The distribution of breeding pairs of Yelkouan Shearwater was still poorly known in 2007 (Bourgeois & Vidal 2008). The setting up of European projects LIFE in France (2 in 2003-2007, in the Hyères and Marseilles islands), in Malta (2006-2010) and in Greece (2007-2011) as well as national programs (Italy: Baccetti *et al.* 2009) made it possible to enhance the available knowledge. But there is still some incertitude namely in Croatia and Turkey and the size of some of the populations is still estimated by counting them at sea so that there is a tendency to over-estimation (Bourgeois & Vidal 2008, Baccetti *et al.* 2009). This incertitude is demonstrated by the great difference between the lower limit and the upper limit in estimating the size of the global breeding population of this species: 7,311-53,785 pairs (please see table below).


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Table 1 (next page) Breeding status of the Yelkouan Shearwater in each Mediterranean country

'No'; 'unknown' if there is no known reference;
'Certain' if breeding has been proved (occupied burrows terriers, eggs, chicks);
'Possible' if breeding is proved "extinct" if species has disappeared from site)
Detailed status for each site (Archipel: Ar., Ile(s): I(s)., Islet(s): It(s).), with No. of pairs (?: unknown),
Census method : ('on land' if eggs, flying or singing birds have been counted in the colonies, 'at sea ' if based on counting of rafts), data dates when known & references (according to Bourgeois & Vidal 2008 update). Countries are listed in alphabetical order.

Country		Breeding sites	Breeding status	No. of pairs	Method	Dates	References
ALBANIA		Sazan I.?	Certain	1-10	?	1992-2002	BirdLife International 2004a, BirdLife International 2004b
ALGERIA		El Kalah It.	Certain	8-10	On land	1980	Ledant *et al.*,1981, Isenmann & Moali 2000
BULGARIA		Rohers between the Silistar & Veleka rivers	Certain	1-2	On land	1964-1965	Nankinov 1993
		Sveti Ivan I.	Certain	?		1940	Nankinov 1993
		Zmiiski I.	Certain	2-3	On land	1963	Nankinov 1993
	Total Bulgaria			*0-10*	*?*		*BirdLife International 2004a*
CROATIA		Islets & islands west to Korčula I.	Possible	?		1976-1977	Krpan 1976-1977
	Kvarner Ar.	Pvric and Grgur Is.	Possible	?		1971-1988	Lovrić 1971, Lovrić & Obradovic 1988
	Lastovo I.	Kopište I.	Possible	250-300		1970	Jelena Kralj *comm. Pers.*
	Vis Ar.	Biševo I.	Possible	?		1965	Stipčević & Lukač 2001
		Brusnik It.	Possible	?		1965	Stipčević & Lukač 2001
		Jabuka It.	Possible	?		1965	Stipčević & Lukač 2001
		Kamik It.	Possible	?		1965	Stipčević & Lukač 2001
		Palagruža I.	Possible			1965	
		Sušac I.	Possible			1965	
		Svetac Id	Certain	50 - 100	On land	1965	Jelena Kralj *comm. Pers.*
		Vis I.	Possible	?		1965	Stipčević & Lukač 2001
	Total Croatia			***300-400***			Jelena Kralj *comm. pers;* Tutiš *et al.* 2010, *in print*
CYPRUS			No	0			Flint & Stewart 1992
EGYPT			No	0			Goodman & Meininger 1989, Tharwat 1997
FRANCE	Corsica	Forana Id. (Cerbicales Ar.)	Extinct	0	On land	1908-1982	Guyot *et al.* 1985, Zotier & Vidal 2004
		Gargalo I.	Extinct	0	On land	1947-1980	Guyot *et al.* 1985, Zotier & Vidal 2004

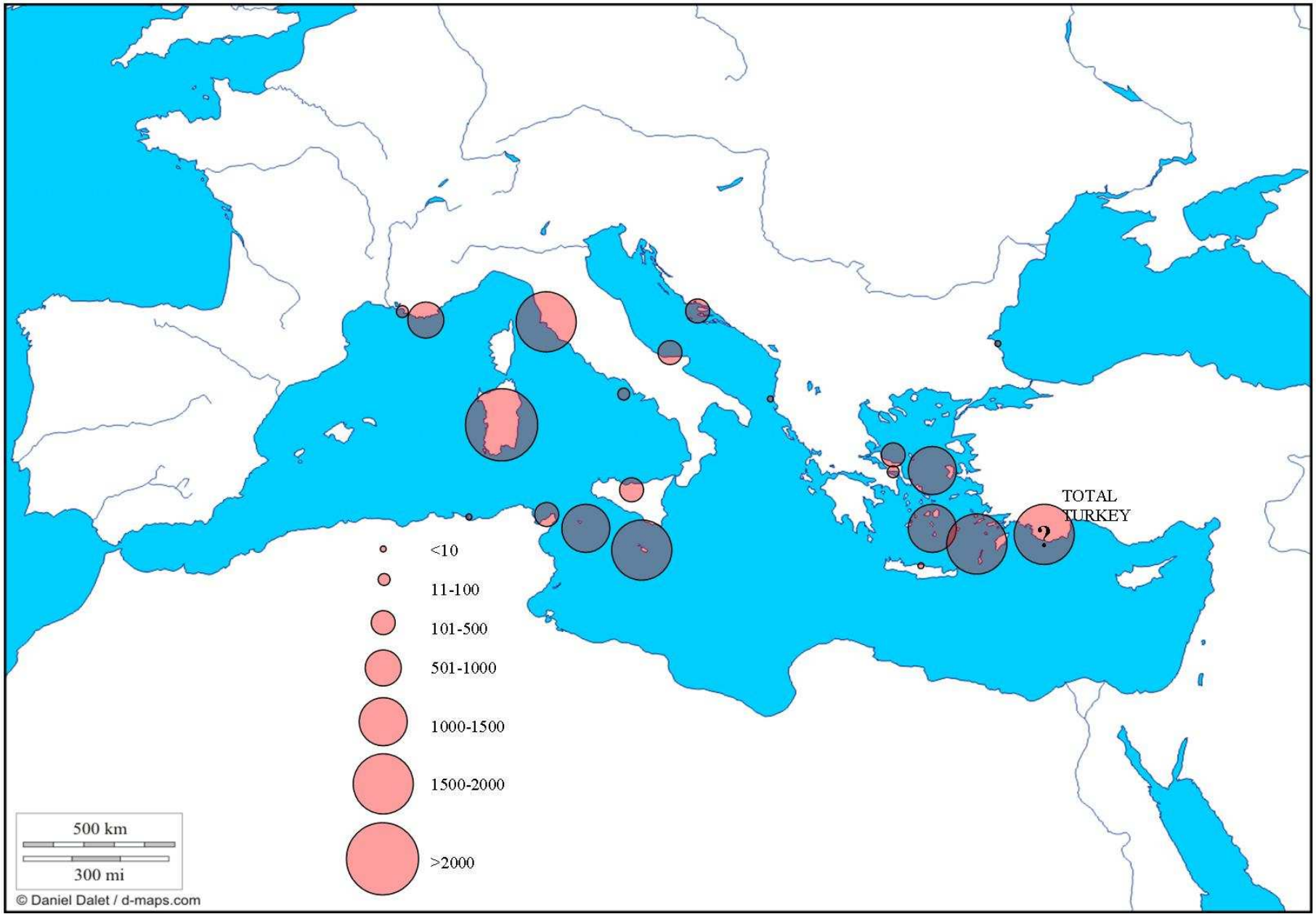
		Giraglia I.	Certain	0-5	On land	1979-1996	Thibault & Bonaccorsi 1999, Zotier & Vidal 2004
		Lavezzi Is (Lavezzi Ar.)	Extinct	0	On land	After 1700	Vigne *et al.* 1991, Zotier & Vidal 2004
	Hyères Ar.	Bagaud I.	Certain	3-10	On land	2004-2006	Bourgeois 2010
		Le Levant I.	Certain	384-641	On land	2004-2006	Bourgeois & Vidal 2009
		Porquerolles I.	Certain	66-121	On land	2004-2006	Bourgeois & Vidal 2009
		Port-Cros I.	Certain	143-235	On land	2004-2006	Bourgeois & Vidal 2009
		Total Hyères is.		596-1007			
	Marseille Is.	Frioul I.	Certain	1-3	On land	2004-2007	Cadiou *et al.* 2011
		Grand Congloué It.	Extinct	0	On land	1954-1981	Zotier & Vidal 2004
		Jarre I.	Certain	2-4	On land	2004-2007	Cadiou et al. 2011
		Maïre I.	Possible	?			Zotier & Vidal,2004
		Riou I.	Certain	29-34	On land	2004-2007	Cadiou et al. 2011
		Total Marseille		33-41			
	Total France			*628-1053*			
GEORGIA			Unknown				
GREECE	Crète		Certain	10		2010	*Comm. pers*. HOS-BirdLife Greece
	Cyclades		Certain	1100-1350		2010	
	Dodecanese Is.		Certain	1480-2080		2010	
	NE Egéennes Is.			1000-1400		2010	
	Ioniennes Is.	Strofades Is.	Possible	?			Zotier 1992, Handrinos & Akriotis 1997
	Sporades Is.		Certain	50-250			*Comm. pers*. HOS-BirdLife Greece
	Thrace Is.		Possible	?		1996	BirdLife International 2005
	Eyvoia		certain	10-50		2010	*Comm. pers*. HOS-BirdLife Greece

	Total Greece			***3660-5320***			
ISRAEL			No	0			Shirihai *et al.* 1996
ITALY	Adriatic Is. (Tremiti Ar.)	San Domino I.	Certain	30-50	On land	1988-2000	Brichetti 1988, Brichetti & Fracasso 2003, Baccetti *et al.* 2009
		San Nicola	Certain	70-100	On land	1988-2000	Brichetti 1988, Brichetti & Fracasso 2003, Baccetti *et al.* 2009
		Total Tremiti Archipelago		100-150			
	Ponziane Ar.	Palmaria I.	Extinct	0			Brichetti 1992
		Palmarola I.	Certain	10-30	On land	2005-2007	Baccetti *et al.* 2009
		Ponza I.	Certain	10-30	On land	2005-2007	Baccetti *et al.* 2009
		Santo Stefano Ponziane	Certain	1-10	On land	2005-2007	Baccetti *et al.* 2009
		Ventotene I.	Certain	10-30	On land	2005-2007	Baccetti *et al.* 2009
		Zanone I.	Certain	1-10	On land	2005-2007	Baccetti *et al.* 2009
		Total Ponziane		32-110			
	Sardinia Is.	Asinara I.	Possible	?			Schenk & Torre 1986, Monbailliu & Torre 1990
		Baunei (east coast)	Certain	100-1000	At sea	2006	Baccetti *et al.* 2009
		Cavoli I.	Certain	1-20	On land	1982	Demartis 1986, Baccetti *et al.* 2009
		Capo Caccia (west coast)	Possible	150-200		2000	Torre 2003, Baccetti *et al.* 2009
		Figarolo It	Certain	10-100	On land	2006	Baccetti *et al.* 2009
		Maddalena	Possible	10-100	En mer	1992	Baccetti *et al.* 2009
		Molara I.	Certain	300-600	On land	2006-2007	Baccetti *et al.* 2009
		San Pietro I.	Certain	500		1980	Schenk & Torre 1986
		Santa Maria I.	Possible	1-20	At sea	1995	Rabouam *et al.* 1995, Baccetti *et al.* 2009
		Serpentara I.	Certain	10-50	On land	2008	Baccetti *et al.* 2009
		Spargi I.	Certain	10-20	At sea	1995-1998	Rabouam *et al.* 1995, Fozzi *et al.* 2000, Baccetti *et al.* 2009
		Tavolara I.	Certain	1,200-7,800	At sea	2003-2008	Baccetti *et al.* 2009

		Vacca I.	Certain	1-20	On land	1965, 1980	Schenk & Torre 1986
		Total Sardaigne		2293-10 430			
	Sicily Is.	Favignana I.	Certain	2-20	On land	2005	Baccetti *et al.* 2009
		Levanzo I.	Certain	100	On land	2005	Baccetti *et al.* 2009
		Lipari I.	Certain	2-20	On land	2006	Baccetti *et al.* 2009
		Marettimo I.	Certain	20-50	On land	2006	Baccetti *et al.* 2009
		Salina I.	Certain	2-20	On land	2007	Baccetti *et al.* 2009
		Vulcano I.	Certain	2-20	On land	2007	Baccetti *et al.* 2009
		Total Sicily		128-230			
ITALY	Straits of Sicily Is.	Lampedusa I.	Certain	500-1,000	On land	2007	Baccetti *et al.* 2009
		Linosa I.	Certain	2-20	On land	2007	Baccetti *et al.* 2009
		Pantelleria I.	Certain	2-20	On land	2005	Baccetti *et al.* 2009
		Straits of Sicily		504-1040			
	Toscan Is.	Argenterola It	Certain	1-2	On land	2001	Baccetti *et al.* 2009
		Capraia I.	Certain	110-500	On land	2008	Tellini Florenzano *et al.* 1997, Baccetti *et al.* 2009
		Giannutri I.	Extinct	0	On land	2005-2007	Baccetti *et al.* 2009
		Montecristo I.	Certain	400-750	On land	2007	Baccetti 1994, Baccetti *et al.* 2009
		Pianosa I.	Extinct	0	On land	1989-2001	Arcamone & Sposimo 2002, Baccetti *et al.* 2009
		Total Toscan Is.		511-1252			
	Total Italy			*3,568-13,212*			*Baccetti et al. 2009*
LEBANON			Unknown				
LIBYA			No	0			Bundy 1976, Meininger *et al.* 1996, Gaskell 2005, G. Bundy, comm. pers. [Avr 2006]
MALTA		Comino Id. and Cominotto It.	Certain	80	On land	2010	*Borg J. comm. pers.*
		Filfla It.	Extinct ?	0-?	On land	Début	Borg & Sultana 2002

						1980's	
		Rocher Fungus	Possible	?			
		Gozo I.	Certain	600	On land	2010	
		Malta I.	Certain	1000	On land	2010	*Borg J. comm. pers.*
	Total Malta			*1,680*			*Borg J. comm. pers.*
MONTENEGRO			Unknown				
MOROCCO			No	0			Thévenot *et al.* 2003
RUMANIA			Unknown				
RUSSIA			Unknown				
SLOVENIA			No	0			Markovec 1995
SPAIN			No				Genovart *et al.* 2007
SYRIA			Unknown				
TUNISIA		Rocky islets off northern coast	Possible	?			Isenmann *et al.* 2005, T. Gaultier, comm. pers. [Mai 2006]
		Zembretta Id.	Certain	176-200		2011	Ouni *et al.* 2011
TURQEY			Possible	?		1962	Kumerloeve 1966, Kirwan *et al*. 1999
	Suspected on western coast of Black Sea			Several hundreds – several thousands	At sea		S. Baris, comm. pers. [Fev 2005]
				1,000-30,000	At sea		BirdLife 2011
UKRAINE			Unknown				
TOTAL				**11 023-52 000**			

- **Next page are presented a mapping of the Mediterranean breeding populations (the numbers of breeding pairs used for the mapping are in grey in the previous table**



PIM –2012- Puffinus yelkouan - Geographical distribution of the Mediterranean breeding populations (in breeding pairs)

- **Breeding Phenology:**

The birds go to their breeding sites at the end of October (Bourgeois unpublished). Mating takes place in February in general inside the burrows. The female lays one single egg between the beginning of March (the earliest date observed was on 28th February) and the beginning of April (no egg laying was observed after the 6th April. The egg hatches between the end of April (earliest date observed was 23rd April) and end of May and is not replaced in case of failure. Both partners take it in turn to brood for approx. 50 days and then to feed the chick which takes to flight between the end of June and the end of July, 60 to 68 days after hatching (Vidal 1985).

	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
Mating												
Egg laying												
Hatching												
Fledging												

- **Period Table of field work**

	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
Presence in the field				1st control		2nd control		3rd control				
Ringing Periods				Adult			Adult		Chicks			

- **State of population dynamics**

Breeding was monitored between 2003 and 2011 on the Hyères islands (Bourgeois *et al*. being prepared). Breeding success was 79,5 % in 2009, this was the best success rate recorded in the nine years of monitoring. However, it should be noted that breeding was very good (> 80 %) in Port-Cros and the Levant while it was mediocre (< 55 %) in Porquerolles. The worst breeding success rate was in 2011 with less than 20 % of young birds flown off due to a predation peak by the black rat *Rattus rattus*. The parents' lack of experience and intra- and/or inter-specific competition for nest building burrows, the competition with Cory's Shearwater *Calonectris diomedea* and the collapse of the burrows occurs at a higher rate in Porquerolles.

The number of pairs in the Porquerolles monitored colonies also dropped by 42,5 % between 2008 and 2009 due to the disappearance of the nesting burrows because of bad weather conditions during the winter. The breeding habitat seems to be more saturated and less stable on this island. Predation by the black rat seems to be generally low on the Hyères islands but peaks of predation may occur and cases where eggs and chicks have disappeared are probably to be attributed to this meso-predator.

Finally the problems of incubation (egg not incubated) are a major cause of breeding failure and can be linked to a lack of experience of the parents or to the death of one of both parents (predation of feral cats or mortality at sea). Ringing and monitoring the Yelkouan Shearwater which was set up in 2004 made it possible to estimate the survival rate of the adults on the Hyères islands (Oppel *et al.* 2011). The rate was particularly low with the breeding individuals (82 %, 70 – 94 %) and surprisingly high with the prospectors (95 %, 81 – 100 %). Such a rate of survival does not make it possible to maintain the population which probably gets an influx of new breeding birds.

Furthermore , the individual monitoring in Malta from 1969 to 1994 and from 2007 to 2010 show low rates of survival at least for part of the population (74 ± 2.8 %, 85 ± 13 %) which means that theoretically the population is declining. It is difficult to monitor the breeding in Malta, as the Yelkouan Shearwater nests in cracks/ rocky places which are too deep for monitoring. Elsewhere some populations have become extinct (Bourgeois & Vidal 2008) and others seem to be declining (Sposimo & Tellini 1995). Monitoring success in Italy to assess the breeding success show that the black rat has a strong negative impact (Baccetti *et al*. 2009). (Militão *et al.* 2012, on press)

MAIN THREATS IDENTIFIED IN THE INSULAR ENVIRONMENT

The following table summarizes the threats facing the Yelkouan Shearwater on its breeding sites and at sea. A priori all populations are faced with the same threats at sea. The threats may vary on the breeding sites but they are quite similar all over the archipelago. The black rat, for example, is present on most of the Mediterranean islands (Baccetti *et al*. 2009, Ruffino *et al.* 2009) and the probability is very high for it to be present on at least some of the islands of an archipelago.

Threat		State of threat	Zone studied	Level of threat	Impact of threat	Research priority to be developed or actions to be undertaken
On breeding sites						
Introduced predators	Feral cat (*Felix catus*)	Quantified	Hyères & Marseilles islands, France	Strong	Predation of prospector & breeding adults by cats	Necessary to quantify impacts on the whole population
	Black Rat (*Rattus rattus*)	Quantified	Hyères & Marseilles islands, France ; Tavolara & Molara islands, Italy ; Malta	Potentially strong	Predation of eggs & young chicks in the burrows	Necessary to quantify the whole population
Indigenous predators	Eurasian Eagle-Owl (*Bubo bubo*)	Quantified	Marseilles islands, France	Low	Predation of adults	Collect material on distribution area to see if there is predation or not.
	Peregrine Falcon (*Falco peregrinus*)	Quantified	Crete Archipelago	low	Predation of adults	On Porquerolles a study (O.R.P.H.E.E) has shown that Shearwaters are an insignificant portion of the falcon's diet
	Yellow-legged Gull (*Larus michahellis*)	Quantified	Hyères & Marseilles islands, France	Average	Disturbance of adults	Necessary to study interactions on common nesting sites
	Common Rabbit (*Oryctolagus cuniculus*)	Quantified	Marseilles islands , France	average	Competition for habitat, direct or indirect destruction of burrows	
Competition for breeding sites	Cory's Shearwater (*Calonectris diomedea*)	Quantified	Hyères islands, France	Low & strong locally	Expulsion of Yelkouan Shearwater pairs already settled on common breeding sites	Necessary to study interactions on joint nesting sites

Disturbance	Lighting	Mentioned	Hyères islands, France; Malta	low	Disorientation of birds by public lighting	Monitoring & awareness creation actions
	tourism & human activities	Mentioned	Hyères islands, France	Potentially strong	Collapse of burrows due to visitors. Perturbed return & birds disturbed by boats mooring near the colonies	Identification & diagnosis on each breeding site
Taken away	Adults, young ,eggs	Mentioned	Balearic islands, Corsica, Croatia	Low , strong locally		Monitoring & actions to be set up
At sea						
Fisheries	By-catch in fishing nets	Mentioned	South-east of French coasts	strong	Mortality of adults captured through drowning	Necessary to quantify impacts on the whole population
	By-catch through long-lines	Mentioned	Gulf of Lion, detroit of Bonifacio, Italian & Maltese	strong	Mortality of adults captured through drowning	Necessary to quantify impacts on the whole population
	Diminution of fish stock d	Suspected		Potentially strong	Impossible for adults to feed the young adequately	Monitor the availability of prey
Pollution	Bio-contamination	Quantified	Hyères islands, France	Potentially strong	Biological disorders , even mortality, reduced breeding success rate	Quantification of bio-contaminants, monitoring of health of adults and breeding parameters
	Hydrocarbons	Suspected		Potentially strong	Biological disorders, even mortality	Search for oil-covered birds

Table 2 : Main threats for the Yelkouan Shearwater in the breeding sites & at sea (according Bourgeois & Vidal 2008 update).

CONSERVATION CHALLENGES & ACTIONS UNDERTAKEN HITHERTO IN THE INSULAR ENVIRONMENT

▪ Conservation challenges identified :

- Better knowledge of the species distribution
- Better knowledge of the biology and ecology of the species
- Find out state of health of populations
- Better knowledge of threats & their impact
- Limit the causes of mortality
- Enhance the breeding success rate
- Limit the degradation of the habitat

▪ Conservation actions carried out hitherto

- Census campaigns in some countries (France, Italy, Malta)
- Study of the biology & ecology of the species in France and Malta
- Monitoring of populations (Breeding monitoring & ringing) & analysis of demographic dynamics (Franca & Malta : Bonnaud *et al.* 2009, Oppel *et al.* 2011, Bourgeois et al. being prepared, setting up in Zembretta : Ouni et al. 2011)
- control/eradication of introduced predators (cats in Port-Cros Bonnaud *et al.* 2010 ; black rats in Italy : Baccetti et al. 2009, Capizzi *et al.* 2010 ; black rats in Zembretta : Abiadh *et al.* 2010 ; black rats in Malta : Borg *et al.* 2010)
- providing artificial burrows (France)
- public awareness creation campaigns (France, Malte)

▪ Ringing campaign underway

Ringing programmes have been set up in France (namely the Hyères islands) and in Malta a few years ago and even ten years ago. Their implementation has been greatly enhanced by European projects as outside such a framework, their maintenance and adequate efforts cannot be guaranteed. In Malta, for example, even though ringing started in 1969, the number of birds ringed and monitored was limited before the setting up of the LIFE project (Oppel *et al.* 2011). On the Hyères islands, the programme is being placed under the responsibility of the Port-Cros National Park so as to make it sustainable. In Italy ringing is very limited and it is desirable that a greater proportion of the population be monitored to see what the national numbers happen to be. Finally ringing was started recently in Zembretta (Tunisia).

▪ Monitoring techniques generally used for this species

- capture at night in nets placed before the entrance to the crevices and caves or by hand at the entrance to the burrows

- captured in burrows if they are not too deep (bird song is hardly effective in luring the individuals out of their burrows, artificial burrows could facilitate access to the birds)
- monitoring of breeding and census with preferably an infra-red mini-camera and playing of bird song to stimulate the response of the breeders and even the chicks. Assess the stage of breeding failure (egg, young chick or older chicks)

CONSERVATION ACTIONS ADVOCATED FOR MEDITERRANEAN SMALL ISLANDS

- **Directly on breeding sites**

  - **Locate and carry out census of the colonies**
    There is still a lot of uncertainty about the distribution and size of the breeding population of the Yelkouan Shearwater.

  - **Monitor the colonies registered and extend the prospections**
    Continue monitoring (such as breeding monitoring, regular censuses, ringing programmes) and set up monitoring for other sites (in Italy namely).

  - **Assess and limit the impact of introduced predators**
    A preponderating factor limiting the establishment of new pairs and the development of already established colonies so that measures must be set up to monitor the evolution of the populations of these predators. Depending on the results achieved, it should be possible to set up measures to limit or to eradicate the predators.

  - **Awareness creation of the public and the pleasure boating public of the presence of this heritage species**
    Intentional or non intentional disturbance can lead to failed breeding of all the breeding sites of the species where the frequentation is not strictly controlled . Thus it seems to be necessary to limit the access to breeding areas to limit the trampling of the burrows as these can collapse when trampled upon. It also seems to be necessary to limit the berthing of boats or else encourage them to moor at the foot of the cliffs so that the birds are disturbed as little as possible. The pleasure boats could also be forbidden to use strong lighting or play very loud music.

  - **Develop a network of stakeholders working on this species**
    Today several research teams or managers of natural spaces work on the conservation of Mediterranean marine birds. It is of the greatest importance to structure this network of stakeholders. This network could elaborate harmonized protocols between several monitored sites.

  - **Protection of associated marine bird species**
    The measures developed for the Yelkouan Shearwater would also be of benefit to other species such as Cory' Shearwater (*Calonectris diomedea*), the European Storm

Petrel (*Hydrobates pelagicus melitensis*), Mediterranean Shag (*Phalacrocorax aristotelis desmarestii*), and Audouin's Gull (*Larus audouinii*).

- **In connection with the feeding areas at sea**
  - **Better knowledge of feeding areas at sea**

    These feeding areas could be close to the breeding sites or the continental coasts during the breeding period. Their identification and the setting up of protection measures for these areas could be of interest for the setting up of conservation measures for the species. Electronic equipment would make it possible to obtain this sort of information.

  - **Better knowledge of their movements during the internuptial period**

    Their movements during the internuptial period are still poorly known. Large bird groups are observed in the eastern Mediterranean but it is not known where they come from and what their destination is. Here again the electronic device would make it possible to obtain this type of information and also to act more directly to limit the impact of human activities at sea (such as fishing).

  - **Setting up actions to limit the impact of fishing activities**

    In the Mediterranean it is important to implement measures which have been developed on an international scale by the BirdLife International network.

    Add the specie to Agreement on the Conservation of Albatrosses and Petrels (ACAP)
  - **Ensure the development of the Natura 2000 network at sea and propose management actions in favour of these species**

    The Natura 2000 network at sea is now in its setting- up- phase. Marine birds must be taken into account effectively. There should also be participation in the setting up of such a network and this should be a strong proposal which includes the elements developed in Spain which include propositions for the management of marine protected areas.

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