1. LIFE NATURE PROJECT: GENERAL DESCRIPTION

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1.1 INTRODUCTION

The Tuscan Archipelago shelters many colonies of seabirds: Audouin's Gull *Larus audouinii* (15-20% of the Italian population and about 1% of the global one), Cory's Shearwater *Calonectris diomedea* (2% of the Italian population and about 0,5% of global population of subspecies *diomedea*), Mediterranean shearwater *Puffinus yelkouan* (15% of the Italian population and 5% of the global one) and Cormorant shag *Phalacrocorax aristotelis* (3% of the Italian population and 0,5% of subspecies *desmarestii* global population). All these species are more or less seriously threatened by factors directly or indirectly linked with anthropic action: terrestrial mammals introduced long ago (rats) or recently (rewilded domestic cats, wild boar), tourism which causes disturbance in the breeding areas, increased anthropic level along the coasts, the great diffusion and numerical increase of Yellow-legged Gull *Larus michaellis*, and the impoverishment of trophic resources (particularly for Audouin's Gull).

Fig. 1 Mediterranean shearwater (photo De Faveri)

In the National Park there are also habitats with a significant surface which are of Community Interest. These are rarer and rarer, or threatened by several dangers: "Mediterranean Temporary Ponds" (Cod. Natura 2000 *3170) and "Pseudo-steppe with grasses and annuals (*Thero-Brachypodietea)"* (Cod. *6220), mainly in Capraia and decreasing because of the ceasing of agricoltural activities (above all grazing), and "Arborescent matorral dominated by *Juniperus phoenicea ssp. turbinata*" (Cod. 5212), above all in Giannutri and Pianosa. In Pianosa they are threatened by the expansion of *Pinus halepensis* pinewoods, created by human action (planting).

Fig. 2 – *Juniperus phoenicea ssp. turbinata*; in Pianosa there are large and well preserved groups, mixed with other species, such as Aleppo Pine *Pinus halepensis* (photo Giunti).

1.2 OBJECTIVES OF THE PROJECT

The main objectives are:

- Eradication of the Black Rat (*Rattus rattus*) in Giannutri (about 240 hectares) in order to immediately increase the reproductive success of Cory's Shearwater and, on in the long run, increase the breeding population by creating fit conditions for the colonization of other seabirds
- Control of the rat population in the main nesting areas for Cory's shearwater in Pianosa, and eradication of rewilded cats from the whole territory in order to increase the reproductive success for Audouin's Gull
- Annual monitoring of Audouin's Gull and Yellow-legged Gull breeding colonies;
- Monitoring of Procellariiformes: survey of Cory's shearwater breeding colonies; better knowledge of Mediterranean Shearwater *Puffinus yelkouan*; search for Storm petrel *Hydrobates pelagicus* breeding sites; analisys of Cory's shearwater reproductive success
- improvement of the present knowledge of factors and causes of threat for Audouin's Gull (also concerning other species);
- protection of Phoenicean juniper *Juniperus phoenicea* coastal formations in Pianosa, by controlling intrusive Aleppo pine *Pinus halepensis*
- Recovering of about 3 hectares of habitat *3170 and *6220, in Capraia, deteriorated / threatened by tall grass and spread of shrubs

1.3 RESULTS

1.3.1 Giannutri: complete eradication of Black Rat

The density of the population of Black Rat in Giannutri was very high: about 10.000 - 12.000 rats assessed. Their eradication was very difficult because of the dimension of the island itself (about 240 hectares: the greatest Mediterranean island submitted to such an intervention) and because of a very tangled vegetation, difficult to cross. Rodenticide baits were given by special dispensers (about 1000, 1 / 50 m); works began in October 2005 and ended in May 2007, apparently with success (an eradication is "declared" successful if no traces of rats are found during a period of two years). At the end of the campaign, an activity of monitoring and "prophylaxis" has started, with a net of dispensers always in action near the 2 landing places (to "intercept" rats brought ashore on boats).

1.3.2 Localized rat control in Pianosa

A campaign of local control of rats has been carried out near Brigantina Point which has a colony of around 15 pairs of Cory's shearwater; the same techniques were used as in Giannutri. Rodenticide baits were placed inside 15 dispensers along the cliff occupied by the colony, several times from mid June and mid August (when the chicks can be plundered by rats), in 2005, 2006 and 2007. Such intervention has significantly reduced the chicks mortality rate in this small colony.

1.3.3 Eradication of rewilded cats in Pianosa

The intervention, carried out through bloodless actions, started in the spring 2005 with the assessment of population size and analysis of the feline population health, and a preliminary research to determine the methods to be used (testing of the traps, choice of suitable sites to shelter captured cats, etc.). Between April 2006 and December 2007, five separate campaigns for trapping the cats were also carried out thanks to the help from volunteers, who utilized dozens of traps placed on the whole island. During such campaigns, a monitoring activity has been performed; this allowed an estimate of the starting population of cats: about 50/60. Captured cats have been transferred to Elba, sterilized and released near the local feline colonies (some weaned kittens have been adopted by the volunteers themselves). At the end of the last campaign, the cats surveyed on the island were no more than 5. The problems we have run into are mainly due to the restrictions imposed by the national and regional laws on the capture methods; for this reason it hasn't been possible to guarantee a complete success before the end of the project. Nevertheless, the steps necessary to complete the intervention or at least carry on the numerical control of the population were decided.

1.3.4 Annual survey of Audouin's Gull and Yellow-legged Gull colonies

Every year in April, special monitoring activities were carried out: circumnavigation of the coasts of all the islands during the installation stage of the colonies of Audouin's Gull, in order to locate them early in time, as they often change from year to year. This has allowed us to adopt, at the right moment, protection measures which are often necessary for every colony, for instance to avoid entering these sites by land and/or by boat.

In every colony the eggs, then the chicks and finally the fledged birds were counted. The results changed significantly from year to year. In 2005 the reproductive success was null on Giglio (the colony had abandoned the site during the late spring), while in Pianosa, 85 juveniles fledged from 121 pairs. In the same year a very small colony of Audouin's Gull has bred in Gorgona. In 2006, about 100 juveniles fledged from 137 pairs in Pianosa, and about 10 juveniles from about 20 pairs in Giglio; in 2006 very few pairs bred in Gorgona too.
2007 was the least successful year: an almost complete failure was recorded in the whole Tuscan Archipelago. In Pianosa, on 137 nests only 10-15 pulli fledged because of predation by one or more Peregrine falcons (*Falco peregrinus)*, also plundering during previous years but to a lesser extent. On the other islands, the installed colonies did not complete the reproduction and abandoned the site before hatching or in the following days for unknown causes.

1.3.5 Monitoring of Procellariiformes

The aim of the project was to increase our knowledge of the distribution of these mysterious birds in the islands of the Tuscan Archipelago, and to verify the effectiveness of conservation projects, past and in progress. Numerous surveys were performed by listening to the birds singing during the night and the searching of nests, in all the suitable islands: Capraia and Montecristo for Mediterranean shearwater; Pianosa, Cerboli, Palmaiola and Giannutri for Cory's shearwater. The results were very satisfactory: the Mediterranean shearwater population size in Montecristo has increased (400-750 pairs). This number is around 10% of the whole Italian population. Cory's shearwater has 3 separate colonies in Pianosa (Great Figure 4), 30-50 pairs in all, added to 60-100 pairs breeding on the islet La Scola. Knowledge of Cory's shearwater in Giannutri improved considerably. In the known breeding sites, a strong decreasing of the population size was verified, and a new colony was discovered (whose size is still unknown but certainly the biggest of the island). Appraisals that were already known for Palmaiola were confirmed (4-10 pairs); evaluations for Cerboli were increased and specified (50-85 pairs).

Fig. 3 – Cory's shearwater; juvenile about 2 months old, nearly ready to fly (photo Baccetti)

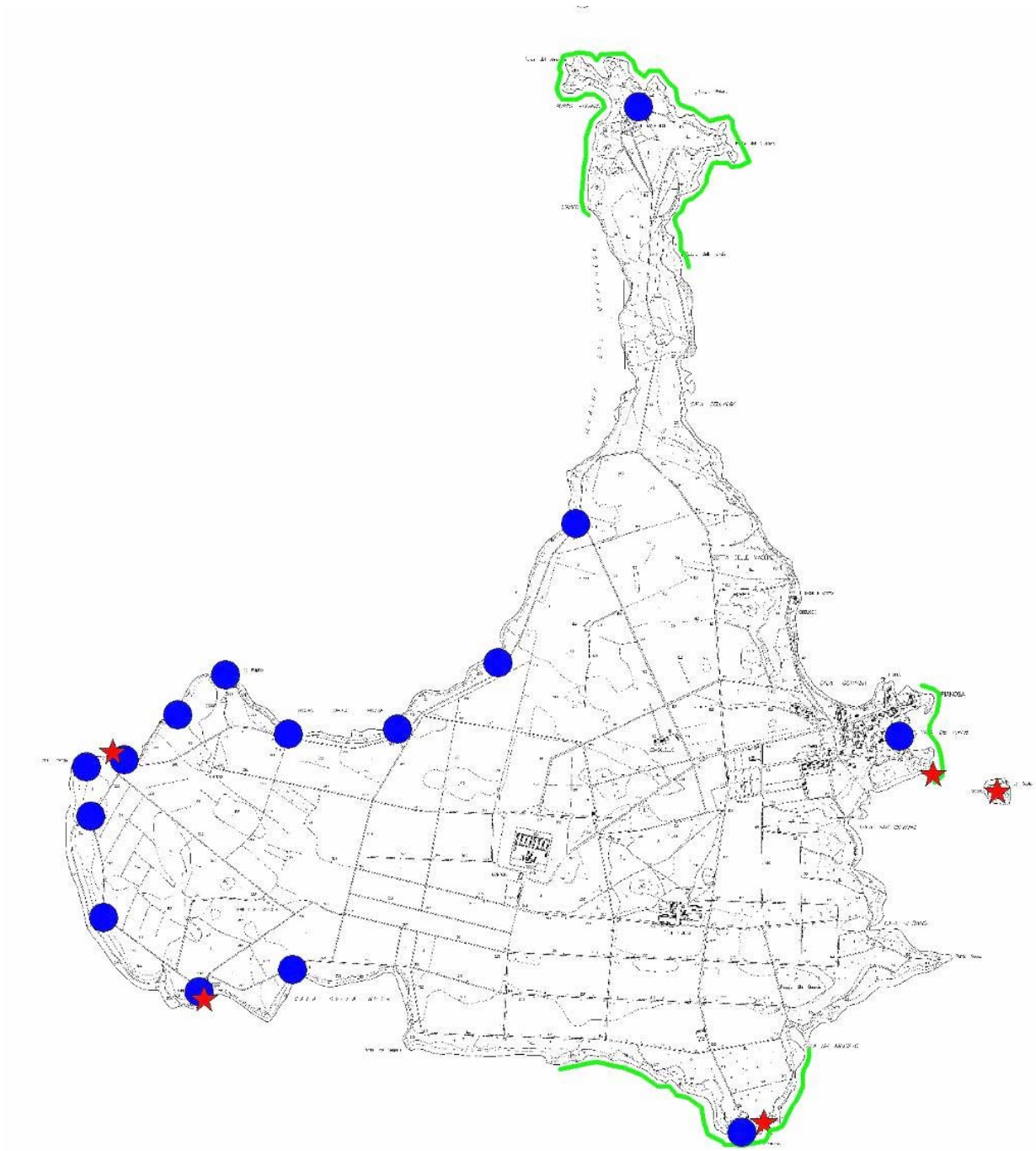

Fig. 4 - surveyed areas: searching for the nests (coast stretches in green); listening for night songs of Procellariiformes (blue circles) and breeding sites of Cory's Shearwater (red stars) in Pianosa

Storm petrel research was carried out by play-back method and through nets set in seemingly suitable areas on Pianosa, Cerboli and Giannutri, with no result.

1.3.6 Interventions supporting the habitat "Arborescent matorral dominated by *Juniperus phoenicea ssp. turbinata*"

Coastal Phoenicean juniper formations are one of the emergencies concerning the vegetation of the Tuscan Archipelago. After about 10 years from the end of all agricultural and grazing activities - which coincided with the closing of the high security prison -, the vegetation of Pianosa is characterized by waste lands which cover about 50% of the whole surface. Leftover surface is taken up by Mediterranean maquis shrubby formations with rosemary *Rosmarinus officinalis* (12%), inner or coastal scrubs mosaic which includes Pine, shrubs, suffrutex and grasses(12%), artificial woods of Aleppo pine (10%), scrub mosaic dominated by Phoenicean juniper and other Mediterranean maquis typologies. As it does not have to compete with Aleppo pine, Phoenician juniper constitutes by compacting formations as a terminal sequence (*climax* stage) characteristic of vegetation series of rocky coastal environments, influenced by sea spray. In the inner areas and on normally richer soils, the competition with other vegetable species becomes stronger and, in addition to the pine, juniper can be dominated by Holly Oak, Wild Olive Tree and, sometimes, by Mastic.

This habitat, which become very rare in its typical physiognomy, is threatened by the competition with Aleppo Pine. In Pianosa, there are exclusively artificial groups, planted in the 60's, or individuals originated by these. The expansion of the pine is often very rapid, both in uncultivated lands and in clearings mixed with junipers along the coastal stretches. This inevitably causes the junipers to disappear.

It is necessary to limit the Pine expansion, if we want to protect the habitat of the *Juniperus phoenicea ssp. Turbinata*, at least along the coastal strip, where competition with other species is nearly absent. The control of Pine has a further positive consequence: to reduce the risk of fires, particularly naturally caused ones. Pines, if isolated and standing out against wide surfaces of shrubby maquis, can increase the chance of attracting lightning and start a fire.

Fig. 5 – An example of close and well preserved formations of *Juniperus phoenicea* in Pianosa (photo B. Foggi)

A generally accepted practice is to concentrate all efforts on few, wide and easily manageable areas, instead of carrying out spreadout interventions, because these are usually fruitless in the long run.

40 parcels were screened, chosen as physiognomic units of vegetation and intervention methods;

two kinds of treatment were carried out:
1 - Clearcutting and complete removal of timber on 3 hectares of pinewoods
2 - Cutting or girdling and release of trees *in loco*; intervention to carry out on small trees scattered along 25 hectares of maquis

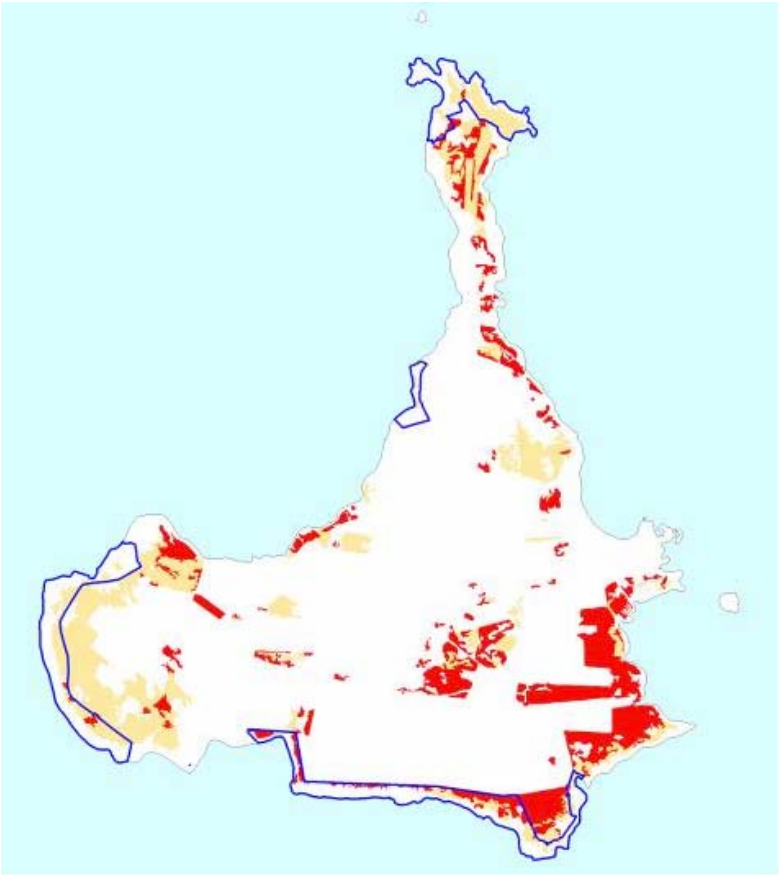

Fig. 6 – Map of interventions in Pianosa. Blue line = intervention areas. Red line = pine woods. Yellow line = shrub formations with scattered pines

The timber removed, about 600 tons of trunks and branches, will be used as energy source for the prison facilities of the island.
A monitoring program on the flora was arranged, *ante* and *post operam*, to check development of vegetation and verify the success of the intervention.
In the Autumn after the cutting, a further control was carried out in all the intervention areas to remove all Pine seedling.

Fig. 7 – Clearcut: Pine trees are cut down, deprived of branches and sliced radially *in loco*. Small branches are at once removed to avoid the risk of propagation by seeds. Timber was carried out of the wood at the end of the intervention (photo Giunti)

Fig. 8 – The intervention has shown the real arrangement of the tree – regularly lined, unmistakable sign of artificial plantation – even when the wood structure appeared to be natural

Fig. 9 – Small branches were immediately removed from every area and transported to a suitable collecting place

Fig. 10 – Live Juniperus trees quickly started growing as an immediate result of Pine cutting (photo Giunti)

As a secondary action, few small interventions were carried out to support the spreading of Holly Oak *Quercus ilex*, with no additional cost for the project. Holly Oak grows only in a few small groups, probably artificial plantations, which cover no more than one hectare altogether. In any case, this species has to be considered autochthon on the island, being also present on Elba.
Within these groups, Holly Oak can reproduce successfully, but its natural territorial expansion on distant areas is greatly limited by the absence of "natural spreaders" (such as Jay *Garrulus glandarius* and Wood Mouse *Apodemus sylvaticus*, in continental environment). For this reason, acorns were hand picked and immediately sowed in some artificial pinewoods. To evaluate the best sowing technique (connected with possible plundering by Black Rat, as already happened in Giannutri) a test was carried out in Autumn 2006. The test on 300 seeds, distributed in 10 *plots*, was successful, showing non-significant predation rates. Consequently, during Autumn 2007, 810 acorns were picked up and sowed in 9 areas inside pinewoods, which spread 90 seeds in groups of three, 3-4 cm underground.

Fig. 11 – Acorns in groups of three inside small holes, eventually covered with 3-4 cm of earth (photo Giunti)

Fig. 12 – map of the 9 sowing places. Brown Line = Artificial pinewoods

1.3.7 <u>Interventions supporting annual grasslands (Cod. Natura 2000 *3170 and *6220) in Capraia</u>

"Mediterranean Temporary Ponds" and "Pseudo-steppe with grasses and annuals (*Thero-Brachypodietea)*" are distributed on a few hectares; these habitats suffer from the effects of the ceasing of agriculture and extensive grazing, to the point that they are counted among the priority natural habitats by Directive 92/43/CEE. These formations tend to disappear because of the progressive invasion of shrubs (above all *Inula*, *Asphodelus*, *Cistus*) which is itself caused by the ceasing of recurring natural disturbance phenomena (such as fire). In Capraia, shrub cutting has been carried out on 3,2 hectares of suitable surface (ridge passes), in 2006 and 2007. Interventions were followed by special scientific surveys to evaluate the results, as was done in Pianosa.

Fig. 13 – one of the ridges before the intervention (photo Giunti)

Fig. 14 – The same ridge after the intervention (photo Giunti)

Fig. 15 – *Romulea insularis*: characteristic of temporary height ponds of Capraia and Elba

2. FEASIBILITY STUDY FOR A DERATIZATION PROJECT IN PIANOSA

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2.1 Introduction

2.1.1 The Black Rat in the small islands of Mediterranean sea

From 1600 to the present day, most extinctions of animals happened amongst endemic insular species and were caused mainly by the introduction of exotic invasive Mammals; rodents (Rats *Rattus sp*. and House Mouse *Mus musculus*) are the main causes of extinctions and changes in the insular environment (Howald et al., 2007).

The arrival of man on the Mediterranean islands, and the consequent introduction of domestic or commensal species dates back a few millenia: consequently, global and local extinctions due to such events occurred before they could have been scientifically recorded. In this environment, the Norwegian Rat, *Rattus norvegicus*, and, in a smaller measure, House Mouse, *Mus domesticus*, can cause serious problems, but at present the Black Rat, *Rattus rattus*, is the species with the greatest impact and by far the most widespread mammal on the islands. *Rattus rattus* is present in every medium and large island (> 100 hectares) and in many small islands, even smaller than 1 hectare (Perfetti et al., 2001); in Italy, setting aside still-active eradication, it seems to be absent from only 4 islands broader than 5 hectares (the largest has a surface of nearly 12 hectares). *Rattus rattus* can reach islands far from the mainland, carried unintentionally by boats; as rats can easily swim to cross short distances, islands nearer than 500 m to other islands or to dry land, can be spontaneously colonized (Russel e Clout, 2005).

In Mediterranean islands, it has been demonstrated that *R. rattus* causes the decrease of reproductive success of at least 6 species among sea-birds and rock-birds (Thibault 1995, Penloup et al. 1997, Amengual e Aguilar 1998, Vidal e Zotier 1998). A negative impact on Chiropetera, Invertebrates, cenosis, plants and ecosystems have been also documented (Palmer & Pons, 1996; 2001). In different insular environments, an important relationship must be underlined between Black Rat and other invading species that were introduced and the native (autochthonous) commensal ones. The population size of this species on medium and small islands is strongly affected by the dimensions of *Larus michaellis* breeding populations, which has had a dramatic increase in recent years (for Tuscan archipleago cfr. Arcamone et al., 2001). Gull colonies, producing a great availability of leftovers, such as carcasses, eggs' remains, etc., allow the rat population to grow (Cassaing et al., 2005), causing a higher predation rate on sea-birds. Furthermore, possible groups of rewilded cats where rats are present, can reach high numeric values and become predators with a great impact on sea-birds (Bonnaud, 2004).

2.1.2 Rats eradication and control interventions

In the last years, actions were implemented in different parts of the world to eradicate commensal species from small islands (cf. Howald et al., 2007). The results up to now suggest that eradication is generally achieve success if carried out on islands smaller than 200 hectares. Nevertheless, positive experiences related to islands of bigger dimensions are more and more numerous, up to 1.000 hectares for *Rattus rattus* and to over 11.000 hectares for *R. norvegicus*, while the broader island where *Mus musculus* has been eradicated, extends up to 710 hectares (Howald et al., 2007). In the Mediterranean sea the wider island where eradication of *R. rattus* has been completed with success is Lavezzi (ca. 66 hectares) in Corsica (Lorvelec and Pascal 2005). Eradications of the same species in the islands of Giannutri (Tuscan Archipelago, 239 hectares, present project LIFE) and Zannone (Ponziane Islands, 104 hectares, National Park of Circeo) are in progress, apparently with good results.

The complete eradication of rats from islands, even small ones, is considered a non-attainable objective, at least through the sole aid of traps (Courchamp et to the. 2003); but on the contrary, the

case of interventions that include a first phase of numerical reduction of the population by trapping, and a second phase of eradication of survivors by rodenticide baits, is rather successful (Lorvelec and Pascal 2005). In this way it is possible to reduce considerably the quantities of baits to be introduced in insular habitats, even if the costs increase with the island's surface, so that a similar approach appears impracticable for middle and great islands. The whole of the employed toxic baits for rodents has, as an active principle, anticoagulants acting on blood coagulation factors, thus inhibiting the formation of vitamin K. The most utilized anticoagulant is Brodifacoum. Interventions carried out up till now were completed by different methods of distribution of the baits. In some cases, these are positioned inside "poisoning boxes", whilst in others, often on the greatest islands, a manual shedding of baits is used, free from any protection; sometimes these were thrown from helicopters.

The first solution, certainly preferable as far as the reduction of risks for non-target animals is concerned, can be applied only on small surfaces, not too irregular and running across easily walkable surfaces.

Manual delivering of baits without protection is advisable only on uninhabited islands, as these can expose non-target species to the risk of poisoning; throwing baits from helicopters is preferable on wide surfaces, where the treatment's costs by manual delivering would be too high, and where this appears technically impossible because of inaccessible areas. Sometimes it is possible to integrate both techniques, i.e. laying bait-dispensers in the most accessible areas, and using aerial dropping for unapproachable zones.

Since these kinds of interventions have high environmental and economic costs, their opportunity must be evaluated properly. Moreover, economic resources for nature conservation are generally very scarce; for this reason it is necessary to carefully choose the areas where interventions are likely to be more urgent. (e.g. Howald et al., 2007). Recently, some attempts have been made to classify the islands according to a "priority scale" for a possible eradication (allochthonous terrestrial Mammals), and according to the foreseeable costs (e.g. Brooke et al., 2007). This kind of analysis has been carried out by Baccetti et al. (in prep.) for Italy; this has allowed the classification of islands on the basis of the best ratio benefits/costs, with at least one breeding *Procellariiformes*, with the presence of Black Rat, and with acceptable re-colonization risks. Among 17 Italian islands (often groups of islands next to each other), 3 belong to the Tuscan Archipelago. These are (in order of decreasing benefits/costs ratio): Giannutri, Montecristo and Pianosa (together with the latter's satellite islets, La Scola and La Scarpa).

2.2 Pianosa: environmental characteristics, alien mammals and native species at risk

The isle of Pianosa is located in the northern Tyrrhenian Sea, around 60 km from the Italian coasts, 40 km from Corsica and 14 km from Elba; it is approximately triangular shaped, 5.8 km long and 4.6 wide, with a surface of around 10.2 km^2 and a coastal perimeter of ca. 26 km.

Classified as Special Area of Conservation (SAC) and Special Protection Area (SPA), its whole territory is included in the National Park of the Tuscan Archipelago ("Parco Nazionale dell'Arcipelago Toscano").

Its morphology is flat, with an average altitude between 14 and 20 m (maximum height 29 m); the coasts are predominantly rocky, tall, with cliffs separated from the sea by accumulations of rock falls. The island was formed by sedimentary rocks of calcareous origin, with many caves all along the coast. Surface fresh water is available in very small quantities.

The presence of man was already consistent in the Neolithic period; during the Roman period a great system of catacombs was dug, and other important works were carried out. Since the middle of the XIXth century till 1998, Pianosa was turned into a penal colony, and the territory was managed by the penitentiary administration agricultural farm; a large part of the island land was used as pasture (37%) and to grow crops(40%), using most of the available sowable lands. From

1998 onwards all agricultural activity ceased and there are no domestic animals, except from some farmyard animals.

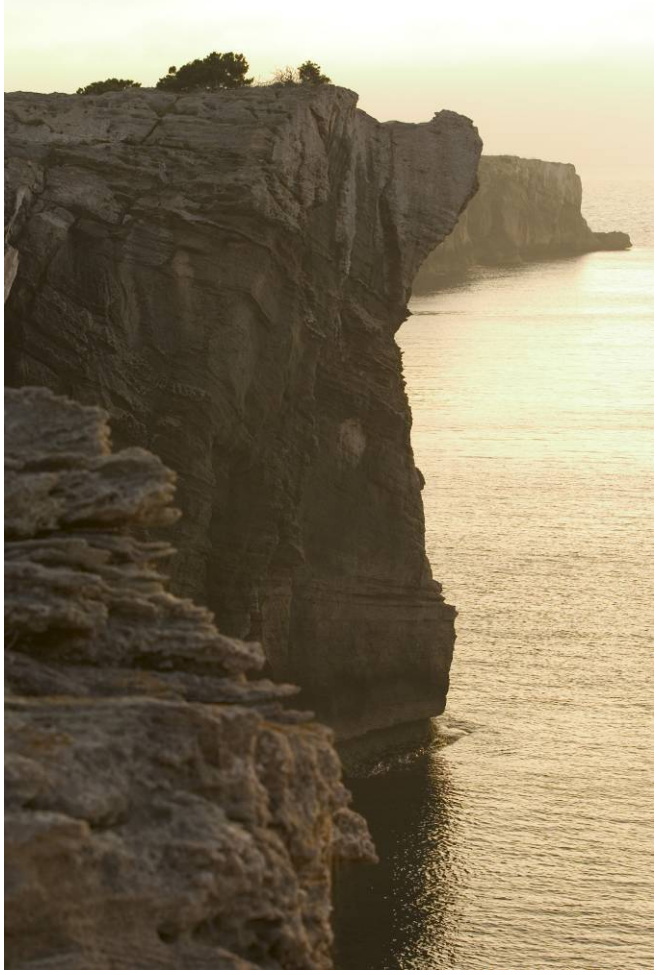

Fig. 16 – Punta Libeccio cliffs (photo Muscetta)

Pianosa natural vegetation is essentially composed of brushwood and maquis of Mediterranean evergreen species, situated in a narrow coastal edge which surrounds the central area previously cultivated and pastured. The coastal brushwood is mostly made up of Phoenician juniper (*Juniperus turbinata*) and Mastic Tree (*Pistacia lentiscus*) in various percentages. Sometimes, Aleppo pine (*Pinus halepensis*) is also present, especially together with the Phoenician juniper. The inland areas, and partly the coastal ones, are covered with woods, for the great majority plantations of pines (above all Aleppo Pine). The low-growing maquis formations, especially diffused in the south-western part of the island, are mainly made of Rosemary (*Rosmarinus officinalis*), *Pistacia lentiscus* and Montpelier cistus (*Cistus monspeliensis*).

As for the island's fauna, only the species directly or indirectly favoured by the intervention will be described here (species possibly exposed to some risk will be examined in the next chapters). Among the Reptiles: Mediterranean House Gecko (*Hemidactylus turcicus*), fairly diffused but with a concentration of population in areas not particularly elevated; European Leaf-toed Gecko(*Euleptes europaea*), very rare or even entirely absent from the main Island, but common on the islet La Scola; Moorish Gecko (*Tarentola mauritanica*), not very numerous either; Common Wall Lizard (*Podarcis muralis*), very common and diffused in Pianosa with its well diversified population of previously classified subspecies (*P.m. insulanica*). The birds of Pianosa were the object of recent investigations (particularly Arcamone and Sposimo 1998; Centro Ornitologico Toscano, in progress). Pianosa is particularly interesting as it includes both endangered terrestrial species which breed on the island, and important colonies of seabirds; in addition, the island is extremely important for migratory species as a stopping place along flight paths. The only Mammals that were not artificially introduced in the island belong to the taxon Chiroptera.

2.2.1 Black Rat and other invasive species in Pianosa

The presence of *R. rattus* in Pianosa is conspicuous and diffused; before 2001 it was also diffused on the islet La Scola. *Mus musculus* is also present, though in much smaller colonies. In the past, *Rattus norvegicus* was also reported but such surveys were always quite uncertain and were definitely never confirmed in recent years.

After the agricultural penal settlement has ceased its activities (1998), some cats have survived and have given rise to a wild population, estimated in 50-60 individuals, now subjected to an eradication campaign (see cap. 5).

Fig. 17 - Black Rat (photo Baccetti)

Up to the present day, the aim of all surveys has been to evaluate the effects of *R. rattus'* on different parts of Pianosa ecosystems, except for the surveys concerning the reproductive success of *Calonectris diomedea's*.

On the small island La Scola, the consequence of the predation of this species by *Rattus rattus* is impressive: before deratization (winter 2000-2001) all the checked nests (about 15 in 1989, 9 in 1999 and 22 in 2000) had been plundered; whilst reproductive success of *Calonectris diomedea's* in the years following deratization was always consolidated on optimum values (0.8-0.9 on a theoretical maximum value = 1). In the few small colonies that settled on the main island (4 different sites and 30-50 pairs), partly located on inaccessible rocks, few nests were reported since 2000 and they were usually eventually plundered. Since 2005, 6-8 nests are regularly monitored, in an area subjected to localized deratization: although the sample is quite small, the intervention clearly produces positive results, for only one case of probable rat plunder was reported during the first 2 years.

In the past, the impact of rats on seabirds was devastating: the island could shelter large populations of *Puffinus yelkouan* (breeding with few pairs in 1989, in only one site which was no longer used in the following years) and of *Hydrobates pelagicus* due to the abundance of caves and natural hollows in the rocks all along the coast, but their breeding population would not have survived the arrival of the rats. The Shearwater population in Pianosa is small in relation to the availability of suitable sites. However, evident traces of the previous existence of a breeding population were found in numerous caves, probably counting hundreds or thousands of pairs, a relevant number for the Mediterranean area as a whole. It is also likely that the presence of *R. rattus* may influence other components of the island's ecosystems in a positive way, both floristic - vegetational and faunistic.

No information is available of the impact of other species of introduced Mammals: *Mus domesticus* and a rewilded population of domestic cat, as well as Hare (*Lepus europaeus*) and Hedgehog (*Erinaceus europaeus*). Only cats, among these species, represent a real threat to seabirds, as demonstrated for many insular environments (e.g. Couchamp et al., 2003).

As previously mentioned, two separate interventions to eradicate the population of *R. rattus* have recently been performed in Pianosa: the complete eradication from the satellite islet La Scola, carried out during the winter 2000-2001, and actions of localized control in the main island ("Punta

Brigantina" spot), repeated annually in the period 2005-2007. In both cases, rodenticides were distributed by special dispensers. Anticoagulants of the second generation (active principle: Brodifacoum in the concentration of 0.005%) are the main ingredients of these poisons.

2.3 FEASIBILITY STUDY

2.3.1 Main objectives of the intervention

The main objectives of an intervention to eradicate *Rattus rattus* from Pianosa Island are the following:

1 - Increase of the Island's level of naturality, with benefits for the autochtonous species of flora and fauna, for the vegetation and for the whole ecosystem.

2 - Increasing of the reproductive success and therefore of the breeding population of *Calonectris diomedea*; possible re-colonization of the Island by other species of Procellariiformes (*Puffinus yelkouan* and *Hydrobates pelagicus*)

Only the second one of these objectives is partially attainable through an intervention that only includes localized rat control. The main merit of the project would be to make the whole island fit for *Procellariiformes* to live in, as the place would have almost unlimited suitable nesting sites. This could also possibly lead to an improving of the conservation status of the central and northern parts of the Mediterranean. In the Mediterranean Sea, there are no islands as big as Pianosa with no rats living on them (Perfetti et al., 2001; Baccetti et al., in prep.), and this is true even after the recent conclusion of deratizations.

2.3.2 Target species for eradication: Black Rat (*Rattus rattus*) and House mouse (*Mus musculus domesticus*) frequency analysis

To appraise the relative abundance of the two species of rodents in the main habitats of Pianosa Island, a survey has been effected with the purpose of planning the best operational conditions for the intervention (density of the dispensers - feeding-boxes -, quantitatives of bait, etc.). The survey was carried out through standardized trapping, along 8 transects (which measured 100 m each), with a trap every 10 m for a total of 80 traps. Both the scheme of sampling and the traps (snap-traps primed with alimentary baits) are identical to those used, with the same purpose, in the propaedeutic phases of the eradications on Giannutri and Zannone (Pontine Islands).

The traps were left to work for 5 consecutive nights (starting on 29/9/2006); in total, 56 individuals of *Rattus rattus* and 2 of *Mus domesticus* were captured, divided among the different transects as shown in the following chart:

Transect: code and habitat	tot *R.rattus*	tot. *Mus musculus*
a – Fully-grown pinewood with undergrowth	5	1
b – Maquis – scrub with pinewoods and Holli oaks	3	
c – Abandoned crop-lands with *Helichrysum italicum* garrigues	0	
d – Abandoned crop-lands re-colonized by shrubs and pines	11	

e – Low maquis with Rosemary	14	1
f – Coastal maquis with Phoenicean juniper	6	
g – abandoned crop-lands with tall grasses and *Inula viscosa*	10	
h – Pinewood without undergrowth	4	

Capture rate for *R. Rattus* in Pianosa is quite diversified among the different transects and is altogether a great deal inferior to that recorded in Giannutri and Zannone (cfr. Cap. 4). This sampling has confirmed the great scarcity of *Mus domesticus* already supposed on the basis of personal observations and information picked up *in loco*.

2.3.3 Available options for the management of the population of *Rattus rattus* on Pianosa Island: control or eradication

In order to safeguard small and well delimited colonies of seabirds on wide islands, it is preferable to perform interventions only on specific areas, and only during sensible periods of time (cfr. Thibault, 1995). For instance, as far as *Calonectris diomedea* is concerned, such periods could be limited to two months, middle-June to middle-August, corresponding to the last phase of brooding and to the first 15-20 days of the chicks' life, when they are most vulnerable to the rats plundering. If so, the control would have to be limited to the 2 or 3 main breeding colonies. Obviously the reproductive success of the birds would depend on the repetition of the control interventions every year; besides, the positive effects would be limited to *Calonectris diomedea*.
Eradication actions, if crowned by success, would solve the problem once and for all, even if the risk of re-colonization on Pianosa would still be not negligible: this is in fact an island where freighter ships regularly dock, unloading food-stuffs and other materials.

2.3.4 Risk test

A control intervention on rodents by poisoned baits expose other no-target species to the risk of direct (swallowing toxic baits) or indirect poisoning (swallowing poisoned animals).
As for possible unfavourable effects of this intervention, apart from "direct" ones (see next chapter), we must take into consideration the possible unexpected effects resulting from the removal of a species that, although non-native, has been an important element in the trophic-chain during the centuries (Zavaleta et al. 2001). The following are some of the negative effects that can be foreseen:

1. possible demographic increase of other allochthonous species, above all of the House Mouse *Mus domesticus* if the eradication would not affect this species.
2. possible momentary increase of predation on autochthonous species by the cats if the cats should not be removed, unlike the House Mouse (anyway as this would quickly produce a positive effect: the drastic numerical reduction of the prey available would lead to that of the predators).
3. possible numerical reduction or extinction of Barn owl *Tyto alba*, apparently rather common in Pianosa, due to the sudden disappearing of principal preys, especially in case of an eradication of the House Mouse

2.3.4.1 Risks of direct poisoning

Using proper dispensers and choosing baits in small blocks that can be easily fixed inside the dispensers (to stop the rats from taking the baits out the boxes), allows a considerable reduction of the risk of direct poisoning.

Among the mammals of Pianosa, there is a significant risk of direct poisoning for House mouse and for young hedgehogs. These are introduced species and their eradication would be considered as a positive effect as it would both increase the naturality of the insular habitats, and would avoid the risk of possible (very probable for House mouse) demographic explosion (also helped by the disappearance of the cats). By a quite simple, though expensive adjustment of the work procedure, the House mouse eradication appears possible (although till today about 20% of all attempts have failed: Howald et al., 2007)), while that of the hedgehog appears unlikely: this method of eradication has no effect on the adults of the species as these are too big to reach the bait within the dispenser. There is no risk of direct poisoning for Hare and Chiroptera.
As for the birds, baits protection inside the dispensers completely eliminates the risk; besides, birds are notably not attracted by the paraffin blocks of baits.
Among Reptiles, Lizards, Geckos and Western Wip Snake (*Hierophis viridiflavus*) can easily enter the dispensers (on Giannutri Island, during part of the year, presence of these species has frequently been reported inside baits boxes which are used as a shelter) but there is nearly no risk for these species as they mainly feed on insects. In many reported cases of deratization on islands, the lizards populations have remarkably increased (because of the end of plundering by rats), while there are no recorded cases of a significant negative impact or extinction of local species (Towns, 1994; Bell, 2002; McClelland, 2002). This demonstrate the lack of danger connected with treatments with anticoagulant rodenticides. This is also confirmed, on one hand by the fact that many of these events concern islands with tropical or equatorial climate, and therefore areas where Lizards are active all year around, and on the other hand by the fact that the interventions were carried out without any special caution, by the simple settling on the ground of rodenticides baits in grains (e.g. Bell, 2002). On the islets of the Tuscan Archipelago, where deratization by rodenticides have taken place, a survey of the number of lizards carried out along pre-established tracks, has shown an increasing of the frequency index (Perfetti and Sposimo, 2002).

2.3.4.2 Risks of indirect poisoning

Although secondary or indirect poisoning generally is quite rare, also for species with a diet based mainly on target animals (i.e. deratization actions in islands never caused the extinction of rewilded cats: Nogales et al., 2004), in this specific case the risks of indirect poisoning appear to be higher than those caused by direct poisoning.
Because of its small size and its diet mainly based on Insects, European Scops Owl *Otus scops*, breeding on the island, doesn't seem to be exposed to the risk of poisoning by eating rats; however, it could be more at risk for eating *Mus domesticus* (rare in Pianosa). Barn Owl *Tyto alba* is resident on the island while Long-eared Owl *Asio otus* is present in Pianosa during migratory and wintering periods. For these last two species, a higher level of risk than that run by *Otus scops* is predictable (*Otus scops* is a migrant breeding species, absent during winter, when the main part of the intervention could be carried out); for *Asio otus* the risk would be limited to the loss of few individuals. As for *Tyto alba*, the risk is more significant, either because its population is resident on the island, or because the eradication of *Rattus rattus* and *Mus domesticus*, if carried out at the same time, would deprive it of its main prey (Agnelli ined.).
Among Falconiiformes, Peregrine falcon *Falco peregrinus* feeds only rarely on terrestrial mammals; Kestrel *Falco tinnunculus*, which feeds mainly on smaller preys than an adult rat (see Brichetti et al., 1992), can in some ways be considered exposed to risks, because it can plunder the House mouse. For the same reasons, the death of individual birds of prey, migrants and/or wintering, such as Harriers (*Circus* sp.) and Common Buzard *Buteo buteo* is also possible. The secondary poisoning of Yellow-legged Gull *Larus michaellis* is also a possibility. 400-600 pairs breeds in Pianosa, and they are certainly capable of feeding on adult rats, although this species usually hunts in coastal dumps and in the sea. In Giannutri, where 5500 pairs breed on a surface that is about ¼ of that of Pianosa, and where rats abundance is by far higher, an apparent increase in the number of gull corpses' was noticed during the first phases of the eradication action (together with maximum presence of death or dying rats). The size of the breeding population, however, does

not appear to have undergone major changes, and it has kept a regular increasing trend in 2007 too. On the contrary, Audouiin's Gull *Larus audouinii* does not seem to be exposed to same amount of risks. Hooded crow *Corvus corone cornix* certainly has been feeding on corpses, as its presence and breeding in Pianosa is regular and increasing. As for the latter, single poisoning events can be predicted. As well as *Larus michaellis*, *Corvus corone cornix* is a species whose numerical increasing is a threat for the most important species of conservationistic concern.
Among Reptiles, Western Wip Snake (*Hierophis viridiflavus*) is a possible regular predator of young rats. On the other hand, *Mus musculus* is a major prey for Western Wip Snake, but its rarity in Pianosa should in itself prevent the risk of indirect poisoning. This risk is directly correlated to the amount of plundering activity of the Reptiles which stops almost entirely in the period November – February. As a matter of fact, although it is not rare to observe active snakes during the winter, it is quite improbable to find one that has swallowed a prey.
As far as Invertebrates are concerned, no data is available regarding the dangers of anticoagulant substances. However, during a program of eradication of *Rattus rattus* from Ascensione Island (Atlantic Ocean), Pain et al. (2000) reported no damages on crabs, and recorded a low permanence of active principle in their internal tissues.
The following table shows the taxa at risk in relation to the possible types of poisoning (- no risk; +/-negligible risk; + low or medium risk; ++ high risk)

Species at risk	**Primary poisoning**	**Secondary poisoning (by *M. musculus)***	**Secondary poisoning (by *R. rattus)***	**Notes**
Sauria (Reptiles)	-	-	-	-
Hierophis viridiflavus	-	++	+	Reduced risk in winter
Tyto alba	-	++	++	Eradication of the main preys
Asio otus	-	++	++	Eradication of the main preys; low risk in winter
Otus scops	-	+	-	No risk in winter
Falco peregrinus	-	-	-	
Falco tinnunculus	-	++	+	
Circus cyaneus, Buteo buteo	-	+	+	Greatest presence during migratory periods, regular but restricted to winter
Other Accipitriiformes	-	+	+	Only present during migratory periods
Corvus cornix	-	+	+	
Larus michaellis	-	+	+	

Erinaceus auropaeus	+ (juv)	-	-	Allochthonous species
Felis silvestris (Domestic Cat – rewilded cat)	-	+	+	Eradication attempt in progress

To summarize, the major risks among those listed above seem to concern Barn owl and Long-eared Owl, as their diet is based mainly on Rodents they are presumably more vulnerable to secondary poisoning. In addition, the successful eradication of both the rodents would probably make the island automatically unsuitable for breeding for both these species.
As for all the other species in the chart, a sensible choice of the period for interventions (and therefore of maximum presence of poisoned rodents) and the use of special dispensers should be sufficient to reduce the impact of the action itself to a level that could finally be tolerated.
As for these risks, it is finally necessary to remember that IUCN (2000), when recommending the use of means and techniques which are as selective as possible, recognizes that some losses among non-target species are an inevitable part of a successful eradication with long term benefits.

2.4 ACTION PLAN

Due to its morphology and to the presence of a good network of unsurfaced roads on the island, the use of helicopters or airplanes for the distribution of baits does not appear necessary or economically viable. In order to reduce the negative effects caused by intervention, it is preferable - and not too expensive – to use dispensers on the whole island.
These two points (distribution of the baits by land and inside dispensers) should be used as a reference when deciding over the technical aspects of the intervention. Eventually, it is necessary to estimate the costs, to evaluate the risk of re-colonization of the island by rats, and the possibilities of reducing such risk, and to compare the benefits of eradication and control actions.

2.4.1 Intervention methods and actions list

2.4.1.1 Choosing an active ingredient

An active ingredient is to be chosen among “second generation anticoagulants”. Up to the present day, Brodifacoum is by far the most utilized (71% of islands and 91% of surface treated with positive outcome: Howald et al., 2007); probably it is the most effective but it also involves high risks. In any case, the choice must be made during the executive project, on the ground of either an improved knowledge of effectiveness and negative effects of different products, or on the ground of attractiveness tests conducted on the Island before the intervention start. Eradications are more and more successful, and recently other active ingredients have been used with positive outcome.

2.4.1.2 Choosing the formula

Baits must be sufficiently attractive to target species, durable and have the possibility of being fixed inside the dispensers. The best answer to these requirements is offered by the formula "baits in blocks", available with different active ingredients. This has been used in interventions on Zannone and Giannutri. During the last stages of these actions, alternative solutions were used, characterized by a greater attractiveness. As well as for the active ingredient, all other choices must be made on the ground of tests carried out on the island before the intervention.

2.4.1.3 Choosing the type of dispensers and their density

Fixed dispensers will be chosen among the many types available on the market. They must have the following characteristics: durability to atmospheric disturbances, they should be easy to fasten, and be large enough to contain at least 400 g of baits in blocks; have a safe shutting gear to prevent children and non-target animals from opening them, and have an access hole of 5-6 cm diameter.

For the eradication of *Rattus rattus*, dispensers are generally set in 50 m long grids (4 dispensers per hectare); for *Mus musculus* the suggested length is 25 m. In Pianosa, where this species is very rare and localized, the best solution could be offered by setting different grids in different parts of the Island, with more dispensers around buildings and in areas where the mouse is present, and fewer dispensers (one every 50 m) in the rest of the Island, and perhaps even less in the broad southern uncultivated lands, where *Rattus rattus* is also very rare. On the whole, we can estimate 6 dispensers per hectare as an average quantity.
As for inaccessible cliffs, it could be useful to prepare simple boxes of baits to be thrown from a boat or from the top of the cliff. These must be similar to those set on the ground and they must be resistant to the inevitable impact.

2.4.1.4 Working period and pace of the interventions

The best period for these interventions, in areas with no tropical or equatorial climate, is winter, between the end of November and the start of March for the Mediterranean area. During this period the risks for non-target animals are small, as far as both direct and secondary poisoning are concerned. A recent intervention of eradication was carried out on a Mediterranean islet (Isola Piana, Marsiglia) during the summer season, which is considered crucial for rats, and therefore the best one to eradicate them (cfr. Aucelum de mar n. 3: www.puffin-hyeres.org).
In Pianosa, the best period to start the intervention is probably during the winter; in any case, a final choice can be made only after the tests mentioned above.
Baits can be distributed all at once, scattered in big quantities and all over the territory, or over various periods of time; this last solution is the only possible one when using the dispensers.
Baits must be distributed, initially, every 15-20 days, after the rats who first ate them have died; other individuals can then feed from the baits subsequently distributed. A massive distributions of baits (this is necessary when baits are all scattered at one time) must be avoided. It is necessary to check the consumption of baits in the different part of the island in order to find out as soon as possible the necessity of a further localized distribution. When consumption appears to be almost ended on the main part of the island, (this should happen after the third distribution), other kinds of baits can be used, i.e. blocks integrated with little bags of fresh bait. Appropriate solutions must be adopted to check the possible presence of rodents not feeding on baits (e.g. scattering sticks covered in bacon fat or wax and melted chocolate, etc.).
Because of the extent of the island's surface, the distribution of baits should continue for about 2 years, also because of the presence of House Mouse which is much more difficult to eradicate. This time should be long enough to avoid the risk of some individuals refusing to feed on the baits, thus escaping monitoring, and then reproducing after the eradication is finished. After the third distribution, and therefore after 3 months from the start of intervention, the check-up of the dispensers could be spaced out to once every 3-4 months (this should be decided on the basis of bait consumption by Invertebrates and of baits perishing).

2.4.2 Monitoring

Monitoring the effects on target species will be necessary during the intervention: it will be carried out either by recording bait consumption, or by distributing and checking especially attractive food.
As for the effects on target species which are undergoing ecological restoration, as well as the Cory's Shearwater's reproductive success, the abundance of Lizards could be evaluated by counting the individuals of this species along fixed tracks.
Chiroptera, terrestrial Gasteropods and geckos appear to be other elements of this ecosystem whose monitoring could supply very useful information concerning the Mediterranean area. It could also be rather interesting to monitor the vegetation structure in coastal environment, where rats live in great numbers, as well as monitoring the renewal of some plants whose seeds are eaten by rats (first of all Holli Oak *Quercus ilex*).

2.4.3 Risk reduction and re-colonization

There are many cases of islands re-colonized by rats a few years after the eradication (cf. Howald et al., 2007). This is often the case for islands placed near the mainland coasts or near non-deratized islands (i.e. La Scola), and sometimes even for oceanic islands linked by boats (e.g. Merton et al., 2002). Once the eradication has been completed, some preventive measures must be carried out in order to reduce the risk of re-colonization. There are three main types of prevention:
1) Maintain a net of dispensers with rodenticide baits on a perimeter of 100 m around the port;
2) Reach an agreement with the steamships disembarking on the Island which would guarantee the dis-infestation of the boats themselves; similar agreements should be made with truck companies which collect waste on the island;
3) Prepare a storage area for incoming goods to be held for a period of quarantine;

2.5 COSTS ESTIMATE

A hypothetical budget is shown below. The estimate of the number of poisoning stations and quantities of baits was made for 1020 hectares. 3 monthly distributions were considered necessary (after settling the baits), and a further 5 distributions a month for the subsequent part of the action.
The following table shows the cost estimate for the intervention and for the subsequent prophylaxis. The costs for the monitoring of the effects are not included.

MATERIALS		**Quantity**	**Total/ partial**	**Cost per unit**	**TOTAL €**
	Bait stations	6 x ha	6120	€ 6,00	36.720,00
	Baits	4,03 kg x ha	4036	€ 6,00	24.300,00
WORK IN PROGRESS		**Quantity**	**Total/ partial**	**Unit cost**	**TOTAL €**
	installation	90 gg x 2 people	180 gg	€ 176,00	31.680,00
	Creation of tracks	10 gg x 1 people	10 gg/pp	€ 200,00	2.000,00
	controls (n=7)	80BS./gg x 1p x 7	560 gg/pp	€ 14.080,00	84.480,00
	Supplement for coastal areas (n=2)	2 gg*2pp*2 times	8 gg/pp	€ 176,00	1.408,00
	Last control and removal of bait stations	40 BS/gg *1pp	160 gg/pp	€ 176,00	28.160,00
	Monitoring				No calculated
	Transport	50km*0,6€*control		€ 240,00	250,00
	Field-superintendent	30 gg/man		€ 300,00	9.000,00
TOTAL					**232.078**
Feasible project and supervision of works			Flat-rate		30.000,00
Prophylaxis	Starting intervention and quarantine area		Flat-rate		12.000,00
	Prophylaxis at full capacity		Flat-rate per year		

TOTAL	**€ 274.078, 00**
Annual prophylaxis	**8.000,00**

2.6 FEASIBILITY AND OPPORTUNITY OF INTERVENTION: CONCLUSION

The eradication of the Black Rat from Pianosa seems to be an achievable objective, also by using a simple method of hand distribution of baits, which is also the one with the lesser negative impact on the environment.

Risk of re-colonization seems to be controllable: the possibility of a "natural" arrival can be excluded, and prophylaxis measures on landing boats and goods can be easily applied thanks to the limited access of the coasts and the protection system already in operation on the island.

Fig. 18 - The port of Pianosa

As for the question of a "total eradication" or "local control" the choice is clear: the methods of control used during this LIFE Project seem to give good results with low costs (the cost can be assessed on about 1000 € / year, even including two other small colonies of Cory's Shearwater), but it produces benefits for this species only. Eradication is much more expensive but can have better results in the long run. A reasonable option could be to continue with the local control, while waiting for the right conditions for a total eradication to be carried out. Possible negative effects on non-target species appear to be limited, especially when compared with the advantages for some threatened species and for the global naturality of the insular ecosystem.

3. Protection of colony of Cory's shearwater (Calonectris diomedea) on the islet "La Scola"

The islet La Scola, or La Scuola, set about 250 m east of Pianosa, is 1,5 hectares wide and roundish shaped. The maximum altitude is 32 m (34 according to some maps), just a few meters higher than the maximum altitude of Pianosa (29 m). Steep limestone cliffs form a sort of small plateau at the top, hardly accessible, occupied by an unusual almost monospecific brushwood of Olive (*Olea europaea* var. *oleaster*). Various kinds of natural vegetation are present (cliff vegetation, maquis dominated by *Pistacia lentiscus*, grasslands of nitrophilic tall grass); the northern slope, next to the rocky walls, is covered by a thick brushwood of fig trees (*Ficus carica*). The presence of man is ancient; up to the present day, the most interesting Neolitic remains found in Pianosa area originated in La Scola. Even if covered by vegetation for a large extent, numerous signs remain of activities developed by man in the past; a few dry-stone walls suggest an attempt at cultivation, a small concrete table was built and used by Pianosa inhabitants for their Sunday picnics which only stopped in the 80's of the XXth century.

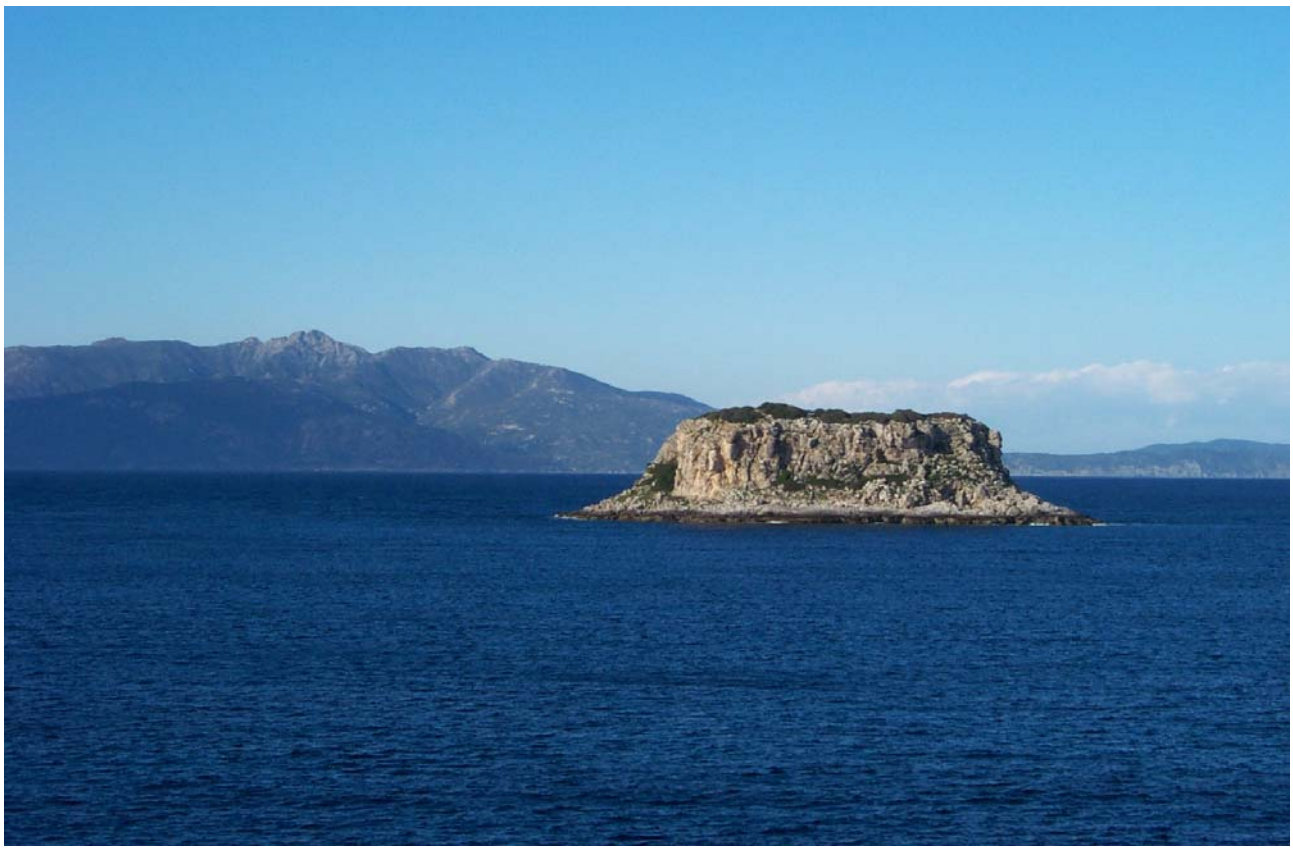

Fig. 19 – La Scola islet and Elba Island in the background (photo Sposimo)

In spite of its small extension, La Scola holds an absolute naturalistic interest. Besides the seabirds, it shelters various rare or even very rare species of terrestrial Molluscs and Insects (some of them are absent from Pianosa: an exclusive endemism of this islet, recently described as *Planasiella aptera* Constantin & Liberti), an abundant population of a Mediterranean gecko (*Euleptes europaea*), not been found in Pianosa for several years, and a particular form of lizard (very common), previously classified as separate subspecies (*Podarcis muralis muellerlorenzi*). Some

species of terrestrial birds breed on La Scola: Peregrin Falcon (*Falcus peregrinus*), Sardinian Warbler (*Sylvia melanocephala*), Spotted flycatcher (*Muscicapa striata*) and Linnet (*Carduelis cannabina*); before disappearing altogether from Pianosa, a good number of Rock pigeons (*Columba livia*) also used to nest on the islet. Besides Yellow-legged Gull (*Larus michahellis*), with 40-50 couples breeding every year, two species used to breed on the island, making the islet one of the most important sites of the Tuscan Archipelago: Cory's shearwater (*Calonectris diomedea*), 60-100 couples (first or second population of Tuscan Archipelago), and Mediterranean shag (*Phalacrocorax aristotelis*), 1-2 couples until 2003, 8-10 couples in 2004 and 10-14 couples in the following years (first or second population of Tuscan Archipelago).

According to a report by some agents of the Penitentiary Police, rats have appeared on La Scola only in the 80's, but in reality, they must have arrived at an earlier stage. In fact, Black rat (*Rattus rattus*) spread over the Mediterranean islands since at least Roman times and it is practically certain the species has been on the island since at least two thousand years. During this time, the Black rat has probably colonized and re-colonized the islet many times, becoming extinct during particularly difficult years (a well known phenomenon for small islets set within 500 m from the continent or from wider islands: e.g. Palmer and Pons 2001). In any case, rats must often have been absent on the island since a predation rate like that recorded before their eradication was certainly incompatible with the permanence of a consistent population of *C. diomedea*.

Fig. 20 – Cory's Shearwater juvenile nearly ready to fly (photo Sposimo)

The eradication has been performed during winter 2000-2001. To reduce to the minimum the risks of negative effects on other species, the rodenticide baits (paraffin blocks containing a second generation anticoagulants, Brodifacoum) have been put inside rigid bait stations, with such characteristics to result inaccessible to animals bigger than a rat. The carrying out of the intervention during this period has notably reduced the possible risks for the two species of Reptiles, both poorly active in winter (the risk that geckos and lizards feed on such baits is almost void). On the islet there are no other species of Mammals (except potentially Chiroptera, that surely don't feed on any baits for the rats) and the active principles of rodenticides seem to be harmless to Invertebrates. Shortly, the only risk was the so-called "secondary poisoning" of a possible rats plunderer and this is actually very low, both for the importance of actions (reduced in comparison to

the interventions of routine Rodents control carried out in the inhabited areas and in many agricultural zones), and for the absence of usual rats predators on the islet.

No secondary poisoning has been ascertained, unlike an apparent increase of Lizards which on the other hand can be verified (these are potentially subjected to a certain risk of secondary poisoning, if feeding on Invertebrates that had ingested the baits). This increase, due to the stop of plundering by rats, has been registered in the other islets of Tuscan Archipelago, where analogous interventions have been carried out together with a survey of the number of Lizards; European Leaf-toed Gecko (*Euleptes europaea*), not surveyed by specific researches, is at present on the islet and the size of its population seems not to have undergone variations.

The result of Black Rat eradication on the species we mainly aimed to protect, i.e. Cory's shearwater, is excellent. Before this intervention, the local population of this Procellariformes seemed bound to become extinct: during 3 years of investigations on the islet (1989, 1999 and 2000), the predation rate in the checked nests has been 100%, and it is clear that such rate would have signed the destiny of Cory's shearwater. Thanks to the rats' eradication, its population seems now in good health, with a reproductive success always maintained on optimal values (0,8 - 0,9 chicks stolen per couple, in comparison to a maximum theorist equal to 1), with the first signs of an increase in the breeding population recorded at the beginning of 2006.

The risk of a return of the rats is high because of the proximity of Pianosa: in April 2005, over 4 years after their eradication, few but unequivocal signs of Black Rat presence (prints and rests of meals) have been found. Some rodenticide dispensers have immediately been installed, and the consumption of the baits noticed to the first control makes it probable that there was only one individual on the islet (or no more than 2-3; in this last case we suppose the arrival on the islet of a pregnant female); during the following controls further signs of the presence of rats have not been found.

In order to eliminate the risk of further colonizations, which are almost certain in the future, it would be advisable to proceed with the eradication of this species from the whole island of Pianosa: this is an expensive and exacting work but at the same time it is technically executable and of course desirable. If this is not done, it is however sufficient to effectuate an inspection once a year at the beginning of Shearwaters' breeding season and proceed quickly with the eradication if necessary.

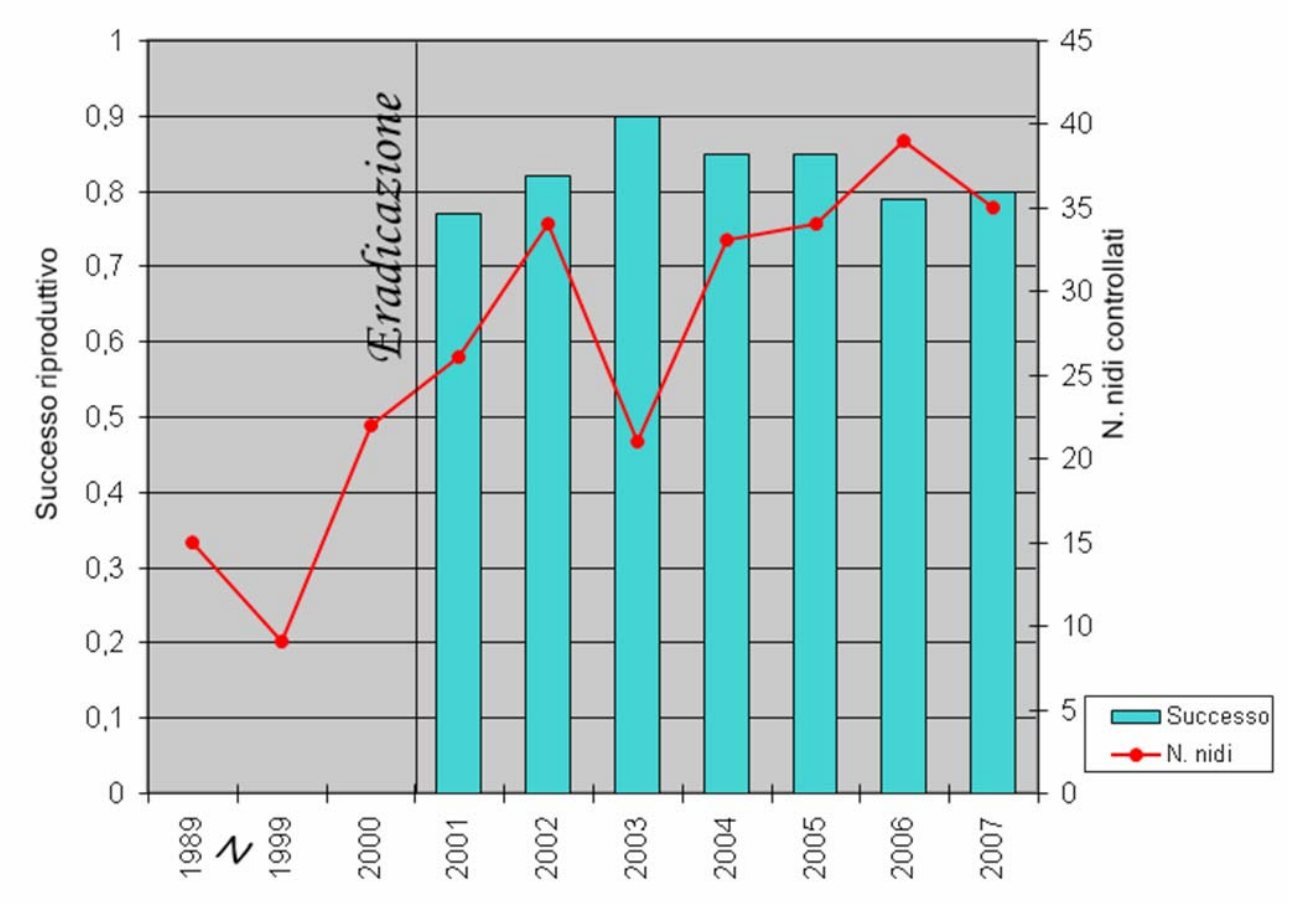

Fig. 21 – Shearwaters' reproductive success in La Scola (blue broken line), before and after rat eradication (January 2001)

4. ERADICATION OF BLACK RAT (RATTUS RATTUS) FROM GIANNUTRI

Paolo Sposimo, Dario Capizzi, Francesca Giannini, Michele Giunti, Nicola Baccetti

4.1 INTRODUCTION

The first eradication of rats from Italian islands was carried out during 1998-2001 (Nature LIFE Project "Capraia and other small islands of the Tuscan Archipelago: biological diversity conservation"), during which Black Rats were poisoned on 7 islets whose dimensions varied from1 to 7 ha, in the Tuscan Archipelago (Perfetti et al., 2001). The project showed that an eradication of these rats from larger islands was necessary, for both species of shearwaters (*Puffinus yelkouan* and *Calonectris diomedea*), and perhaps for *Hydrobates pelagicus* (though probably extinct in Tuscany). The only four existing rat-free islets were actually already inhabited by *C. diomedea*. The island is as densely populated as allowed by the local availability of breeding sites, and therefore hardly suitable for any new settlement. For example, in Cerboli, nests of Cory's Shearwater built in seemingly unsuitable sites are not rare. For this reason, an increasing of the breeding populations in Tuscany seemed to be unlikely and restricted to the islet La Scola, which can only shelter a few more pairs (besides the 60-100 already breeding on the islet).

Fig. 22 - Cliffs along Costa dei Grottoni (photo Sposimo)

We then evaluated the possibility of a project on Giannutri Island (239 ha), presently hosting 50-200 pairs of *C. diomedea. P. yelkouan* was present in the island too until the early nineties. All the other Tuscan islands were judged either too large for our possibilities (1000-2000 ha) or did not host shearwaters. During these last few years, the decreasing of both species in Giannutri is probably due to an increased predation rate by rats, whose population has in itself increased because of the

demographic success of *Larus michaellis* (Arcamone et al. 2001 and Cap. 6).
Despite immediate conservation benefits deriving from the eradication of the rats, the scope of this project appeared limited because of the small number of breeding shearwaters currently on the island. However, Giannutri seemed to have a huge and historically documented potential for an increase of *C. diomedea* and for the return of *P. yelkouan*, as it has unlimited possible breeding sites.
Other favourable conditions included:

- a relatively low human presence (less than 10 people resident during the winter) and consequently low harbour traffic, and limited size of the two existing docking places (which means a low risk of re-colonization)
- few non-target species likely to suffer from primary or secondary poisoning (terrestrial mammals other than rats are: wild rabbits and very few domestic cats and dogs). One species of snake is present (*Hierophis viridiflavus*), whereas the only breeding bird of prey is *Falco peregrines*, feeding nearly exclusively on birds; No breeding or wintering species of owl seem to be present on the island.

The main difficulties were on one hand the presence of large areas with inaccessible maquis vegetation (opening of paths was necessary on about 100 ha) and on the other a high rat density, probably favoured by a large breeding population of *Larus michahellis* (> 5000 pairs in 2005).

4.2 THE INTERVENTION

For this eradication, we chose the distribution by land of rodenticide baits, protected inside "bait stations" (dispensers) inaccessible to animals bigger than a rat.
A preliminary survey was carried out by trapping rats in an area covered by the vegetation types that seemed more significant, in order to obtain an index of relative rat abundance as well as information about the possibility of opening paths, and consequently about the total monetary cost of the operation.

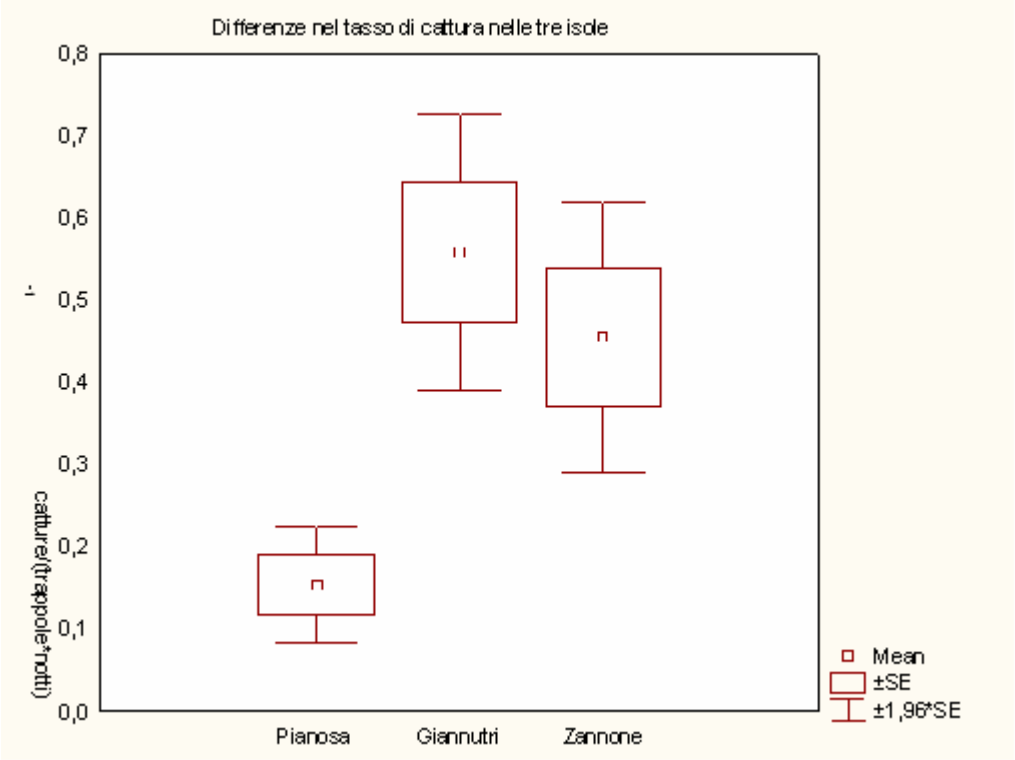

Fig. 23 – Capture rate of Black Rat in Giannutri compared with Pianosa's and Zannone's

The total cost of the intervention + designing and co-ordination is about 80.000 €

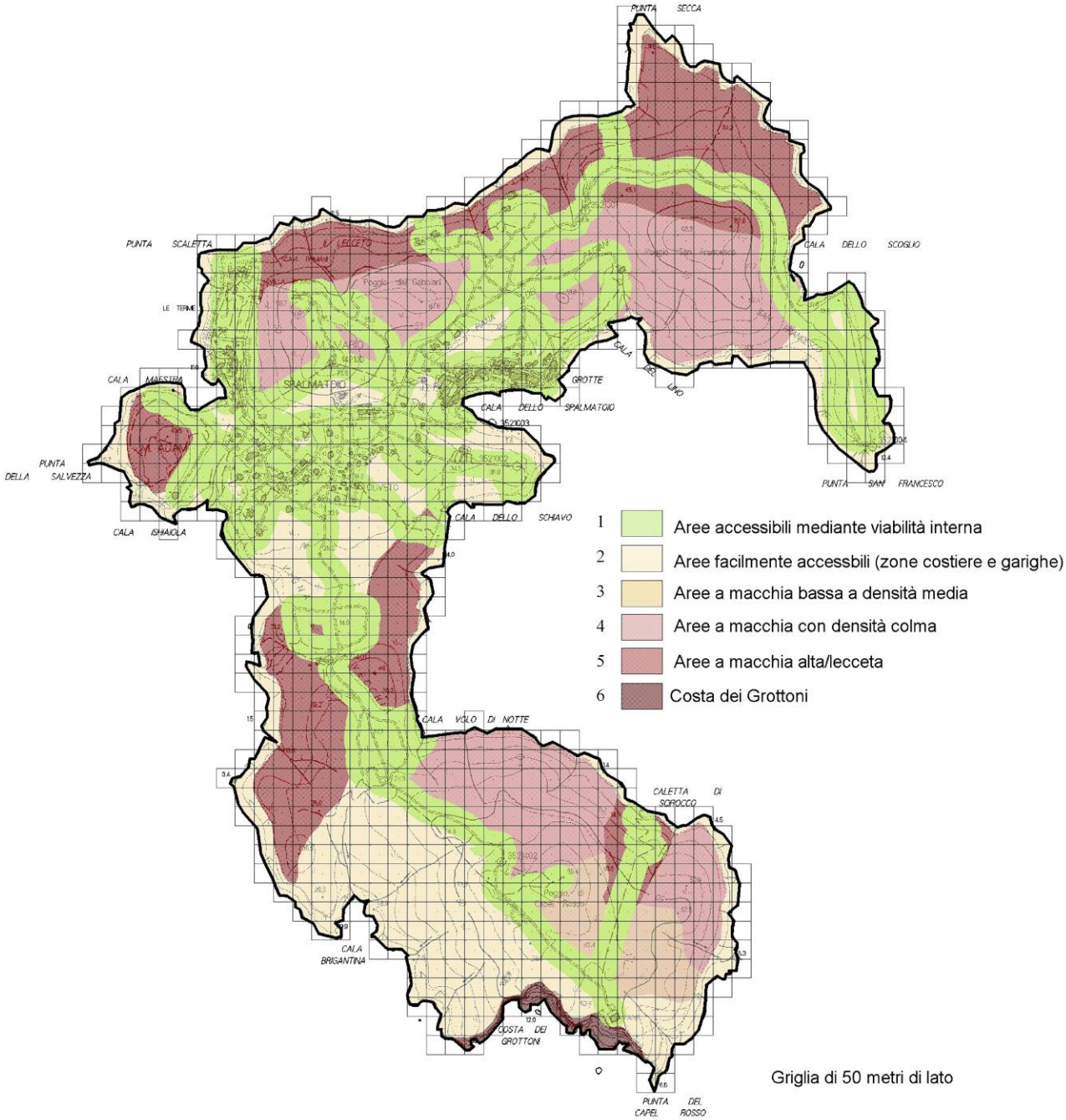

Fig. 24 – Accessibility level of Giannutri Island in connection with development and density of vegetation (buildings, roads and paths, coastal areas, garrigues, low maquis, tall maquis, scrubs)

In the executive phase started in January 2006, paths were built in the vegetation and the dispensers set. Slightly more than 1000 bait stations were placed in a 50x50 m grid (25x25 m in areas with a maximum rat abundance and along the upper edge of the cliffs). Rodenticide baits consist of blocks of 20 – 200 g, containing Brodifacoum at 0.005% as an active ingredient.
The first bait application took place in early February 2006; all the bait stations were refilled after 20-

25 days making a total of four times. The first control revealed 100% of baits were eaten in the whole island, except for some dispensers placed in the village. Near the southern coast, which is the most critical zone because of its morphological characteristics and abundance of rats, an additional distribution of baits has been carried out between the first and the second control. The second control revealed a smaller and more variable consumption of baits (about 60%): in some areas only 10% of the baits were eaten, while in other areas the consumption was 100%. The third control showed an average level of consumption lower than 10%, but again with a strong variability: almost 0% in the greatest part of the island, nearly 20% in some southern areas.

Fig. 25 – Dispenser with Brodifacoum baits (photo Sposimo)

No traces certainly left by rats were observed in the fourth control. Less than 10 dispensers showed traces of rat excrements, probably left by mistake during the previous control. In parallel to the reduction in bait consumption by rats, an increase in bait consumption by invertebrates (mainly land snails and ants) was recorded. This consumption has become significant starting from the late Spring (10-20% of baits, rarely 50%). Although rats marks on the baits are very different from those left by Invertebrates, in a few cases it was impossible to decide which species had eaten the baits. In September, November and December 2006, partial controls were carried out on 15%, 50% and 20% of dispensers, respectively. No trace of rats was observed, except for one single rat dropping, probably left by mistake during the previous control.

Fig. 26 – Plastic dispenser gnawed by rats (photo Sposimo)

Further controls were carried out by the project coordinators in early 2007: in February and March some pinecones clearly gnawed at in recent times were found, discernible from the old ones. In spite of the uncertain dating of these marks, a completely new round of controls was carried out, replacing baits in 50% of the dispensers. This time a new kind of bait was also used (fresh baits packets with

Bromadiolone at 0.005%), more attractive than the pieces of Brodifacoum (the 2 kind of baits were both present inside all dispensers); simple countermeasures were put in place to reduce Invertebrates consumption.
No trace of baits consumption was found during the following controls, till December 2007.

4.3 INTERVENTION CONCLUSION AND MEASURES TO REDUCE RE-COLONIZATION RISKS

Traces of rat presence were successively observed in a small pine forest in the central part of the island, but these were not always of certain origin: 1-2 excrements in a bait station in November 2006 (possibly being older) and some pine cones which might have been recently bitten (March 2007). Therefore, the success of the eradication cannot be considered certain before the end of 2008.
Total bait consumption by rats was about 1 ton, over than 4 kg/ha.
No indication of negative effects on other species was observed, though wild rabbit, snakes, lizards, cats and dogs were never formally protected against secondary poisoning risk (i.e. a cat living free near the village). The only possible indication of an unwanted result concerns Yellow-legged Gull: during the first stages of the intervention (therefore during the maximum presence of poisoned rats), more gull corpses than usual were found. Surveys on gull corpses frequency (during 2007) suggests that a few dozens gulls have undergone secondary poisoning. In spite of that, their breeding population (the main in Tuscany) maintained its increasing trend: about 5500 pairs were recorded in 2007, 10% more than in 2005.
From September 2006 till May 2007, “prophylaxis measures” were applied in order to reduce the risks of re-colonization: a net of dispensers with rodenticide baits near the 2 landing ports (Cala Maestra and Cala Spalmatoio) and operative protocols are under scrutiny for an effort by the shipping companies to carry out de-ratizations on their ships. Furthermore, a few “poisoning stations” were also left on the island. These actions are intended to continue indefinitely, and other measures to reduce the risks of re-colonization are at present being examined.
During and after the end of this project, a campaign of information and awareness raising was realized: many posters were put up on the island and on boats; leaflets were distributed to the few shops of the island. Moreover, getting into contact directly with the inhabitants and land owners of the island also allowed the raising of awareness among the local population of the benefits of the eradication actions.

5. INTERVENTIONS TO ERADICATE PIANOSA'S REWILDED CATS

Francesca Giannini, Francesca Baldinelli

5.1 INTRODUCTION

Rewilded cats in the insular systems can have dramatic consequences on the birds, both seabirds and landbirds. There are several cases documenting the extinction of seabirds because of these feline, usually introduced by man (Courchamp et to the. 2003, Lorvelec and Pascal 2005). On Pianosa, after the closing of the prison (1998), the abandoned cat population has grown consistently thanks to the favourable environment (a lot of prey and the absence of other carnivorous mammals). Cats can be a threat, particularly for the Audouin's Gull and the Procellariiformes (cf. Bourgeoix and Vidal 2005). The objective of this intervention was to eradicate the cat population, as to remove in the short-term a threat for breeding seabirds and, in the long-term, as to install other species. Moreover, the elimination of introduced species can re-naturalize the whole system. The choice of the method was strongly influenced by the necessity to adopt bloodless systems of capture. The national legislation, and in particular Law n. 281/1991 "law concerning animals of affection and prevention of randagism", forbids the maltreatment of cats living free, and states that they can be suppressed only if seriously ill or incurable. The only permitted action is the sterilization carried out by a competent sanitary authority.

Art. 12-bis of the Regional Law of Tuscany n. 43/1995 "law on the management of dog registry, protection of animals of affection and prevention of randagism" contains further indications for the transfer of animals. These limitations caused difficulties in the operation to eradicate the rewilded cats, especially in terms of capture and trap effectiveness. In fact, as several previous experiences in other insular contexts show, an intervention of eradication is successful only if it is carried out with a combination of techniques: distribution of poisoned baits together with snare traps or capture cages, sometimes using bloodhounds and slaughter. Cage traps can result ineffective due to the capacity of learning and distrust of the cats.

In consideration of these difficulties, it was necessary to involve many operators, mainly volunteers, coordinated by veterinarians, zoologists and professional staff of the Florence Police Department and of the Forest Body and to start a collaboration with the administrators of Elba and Pianosa, with the Local Sanitary Company and the Association for Animal Protection (ENPA).

The intervention started in spring 2005, with some preliminary actions, and ended in December 2007. After an initial phase of technical control of the traps, cats were captured, medically checked, sterilised, and temporarily kept in special enclosures to be finally transferred and released nearby on Elba's feline colonies.

5.2 METHODOLOGIES

The technique used was to trap the cats in cages with automatic closing doors, directly operated by the animal. We used different sized "Havahart" Traps, with double or single entrances. When the cages were positioned they were camouflaged outside and inside (Fig. 27).

Fig. 27: baited trap (photo Giannini)

The traps were tested for a week in spring 2005; cats captured in that period were then released. As an index of capture effort, we used the number of nights/trap and, as effectiveness capture index, the number of captured cats / night / trap. We created five capture campaigns: 21st March -2nd May 2006, 3rd October – 14th November 2006, 6th - 20th March 2007, 25th September – 16th October 2007, 4th - 19th December 2007. During the first two campaigns the cages were allocated both on roads and paths, along the junctions as a "grid", about 200 meters apart from one another, the greater the number of cats present the more traps. 28 were the maximum number of cages utilized at the same time. From the third campaign onwards, the traps were allocated only in areas where some traces of existence were found. The alimentary baits, chicken and fish, were replaced at an average of every three days, according to their deterioration degree. In addition, the bait was tied up to an automatic release mechanism and used as an alimentary call, left both inside and outside the cages. The cages were checked not less than twice a day, in the morning and in the evening. Captured cats, waiting for the transfer, were maintained in special enclosures (Fig. 28).

Fig. 28: a cat inside the enclosure for temporary detention

The sterilization during the first campaign was performed on Pianosa; the cats once sterilised and marked, were put into a separate enclosure (on Pianosa as well), from where some of them escaped

(nearly all re-captured subsequently). During the second capture campaign, the animals were immediately transferred to Elba, where they were sterilized and freed after a brief hospitalization. All the captured animals were medically checked.
During the first campaign, in order to detect the cat population, we calculated the traces left on certain tracks. In total, 24 tracks were identified of 1 km, we crossed each track every week for 34 days, and every time we removed the observed traces (excrements). We evaluated the number of excrements / unit of length in relation to the number of days passed between each calculation (N excrements / days of exposure). The total result - for the island (N excrements / total days of exposure) -was put in relation, through linear regression, with the average number of cats held in the enclosure. In order to have a further comparison, during the second campaign, thanks to the re-capture of the cats already sterilized, we calculated the Petersen index with the Bailey correction, recommended when the number of animals to be recaptured is not initially determined (Seber 1973).

5.3 RESULTS

The capture activities were conducted for 134 days (excluding the week of experimentation), for a total of 379 days / man.
During the first campaign 43 cats were captured, 5 of which were under seven months old. The maximum density of positioned traps were 2,8 traps / kmq, while capture intensity was 654 nights / trap. When cats were trapped inside a cage, the bait was almost always completely eaten; we can then suppose a lower level of stress for the captured cat. During the second capture campaign, 247 points of capture were supervised, with a maximum of 21 traps (2,1 traps / kmq) contemporaneously active. Capture effort was equal to 776 nights / trap. In this period 37 cats were captured, 15 young and 22 adult (13 of which escaped during the spring). In spring 2007 only 5 cats were captured, more consistent result arrived in the following autumn campaign (10 cats with 329 nights / trap). In December 2007, with a capture effort of 232 nights / trap and a maximum of 20 active traps in the same night, only 3 more cats were captured. Each trap was kept on the place of capture for an average of 3-4 days. The table below, summarises the different campaigns, underlining the number of the animals recaptured once sterilised.

Campaign	Already sterilized	Not sterilized	Total
Spring 2006	-	43	43
Autumn 2006	13	24	37
Spring 2007	3	2	5
Autumn 2007	0	10	10
December 2007	1	2	3

Table 4 – Captures during the campaigns

The table (Fig. 29) shows a decreasing trend of capture starting from the first campaign (during the experimental trap developed in spring 2005, the capture rate is even higher, equal to 0,11 cats per night / trap), with an apparent tendency to the stabilization on low values (no more than 1 cat every 100 nights / trap).

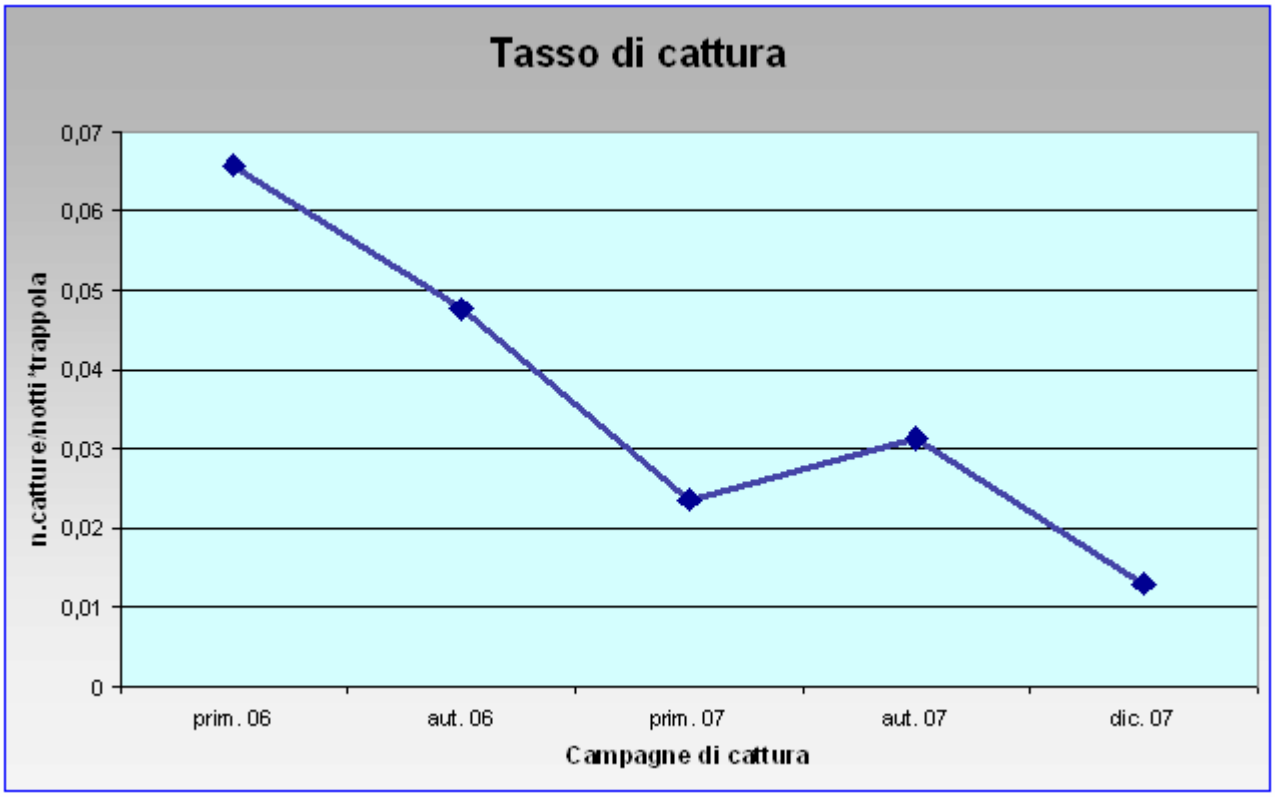

Figure 29 – Capture trend during each campaign

With reference to the cat population, there is a significant regression between the number of excrements found (N excrements / days total esp for the island, once a week) and the number of captured cats. Assuming that no excrement can be found only if cats are absent, before the beginning of the first capture campaign, the initial population should have amounted to about 47 cats (Fig. 30). By using capture/re-capture method, on the basis of the results of the second campaign, we estimate about 57 cats.

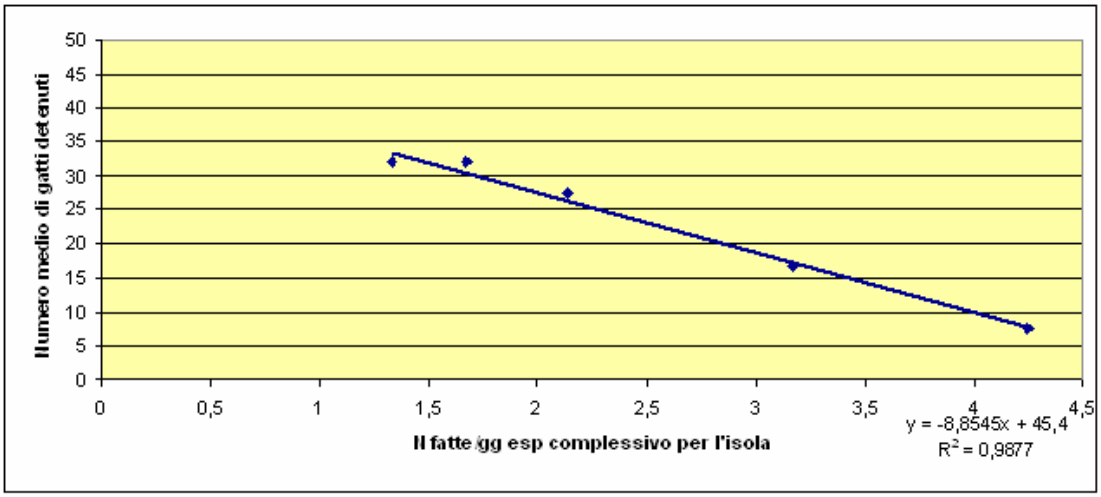

Fig. 30 – Trend of the excrements found along the transects in connection with the cats captured

5.4 CONCLUSIONS

During two years 71 cats were removed from Pianosa following the intervention described above. We did not have any information on the number of the initial population; we estimate about 5-6 cats / kmq. The following table summarizes the achieved results.

Campaign	Transferred	Adopted	Dead	Total
Spring 2006	0	3	3	6
Autumn 2006	39	7	1	47
Spring 2007	5	0	0	5
Autumn 2007	7	3	0	10
December 2007	3	0	0	3
Total	54	13	4	71

Table 5 – Results of the capture campaigns

Only three out of the cats we marked and sterilized in 2006 were not re captured (they might have died). In the final phase of the last campaign, the end of December, cat traces were found in three areas of the island. Therefore, it appears that the intervention did not eradicate all the cats, unless the few remained were of the same sex. However, this result is extremely interesting since most of the 48 (75%) cases of eradication documented in literature concerns islands smaller than 5 kmq (Nogales et to the. 2004).

The poor results of the last campaign show that the system used did not work for the last remaining cats, it would have probably been necessary to adopt other methods, within those permitted by the law. The number of human resources involved in comparison to the results reached (0,18 cats / day-man), show that this method did not prove successful as to eradicate the feline populations, even in a small and isolated system. Thanks to the high effort performed, however, the population of rewilded cats has been drastically reduced and we believe that it can be maintained at a low level using a sustainable effort.

6. Audouin's and Yellow-legged Gull in the Tuscan Archipelago: few of the former, too many of the latter

Monitoring of the two breeding gull species – Yellow-legged Gull *Larus michahellis* and Audouin's Gull *Larus audouinii* – in the Tuscan Archipelago started in the 70ies with the discovery of Audouin's colonies on Capraia island by the Leghorn Ornithological Group (Meschini et al. 1980, Arcamone et al. 1986). For the Yellow-legged Gull, despite colonies were locally known since the times of Lord Lilford and Giacomo Damiani, the first relatively complete figures were obtained in 1983, during the so-called Progetto Laridae Italia (Fasola 1986). In following years, Audouin's Gull went on being monitored almost continuously (Lambertini 1993), while for the other species only in 1994 could the next complete survey be organized, by the Centro Ornitologico Toscano (Livorno II cruise, Arcamone et al. 2001). From 1998 on, thanks to two LIFE projects and funds made available following the National Park institution, regular surveys could take place up to now on a yearly basis.

6.1 Yellow-legged Gull

6.1.1. Population size and trend. The population of the Tuscan islands was obviously increasing when the available count data were analyzed for the first time (Arcamone et al. 2001), 8150 pairs censused in 1983 having become 12.380 in 1994 (mean yearly increase: +3,8%) and 15.950 in 2000 (mean yearly increase 1994-2000: +4,3%). Doubling of the earliest total was observed in 2004 (16.465 pairs), but the increase rate already since 2000 had slowed down considerably, as shown by the highest total (recorded in 2007) being still of 17.607 pairs and the mean for 2005-2007 (years covered by the ast LIFE project) of 16.000 pairs.

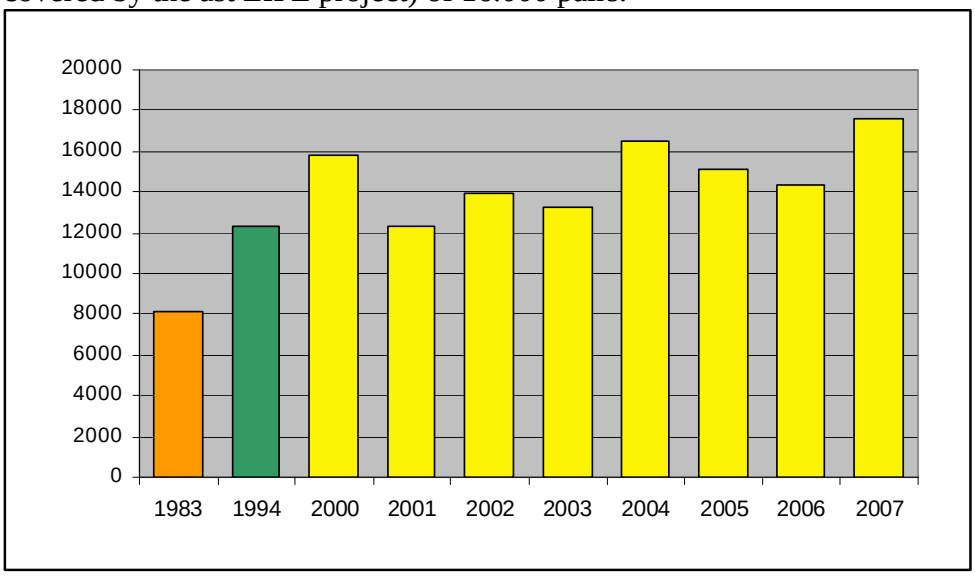

Fig. 31: Totals of Yellow-legged Gull pairs breeding in the Tuscan Archipelago in 1983 (orange: data from Progetto Laridae Italia), in 1994 (green: COT data from the Livorno II cruise) and in all years of existence of the National Park (yellow).

Fig. 32: Adults of YLG in urban habitat on the tiny Gorgola island: the exploitation of human habitats and resources is the main reason of success of this species, endemic of the Mediterranean and Macaronesia.

6.1.2. Distribution and local numbers. Beside the clear size variation of the overall population, very obvious changes were recorded only among censused totals from individual islands (Fig. 3). In 1983,

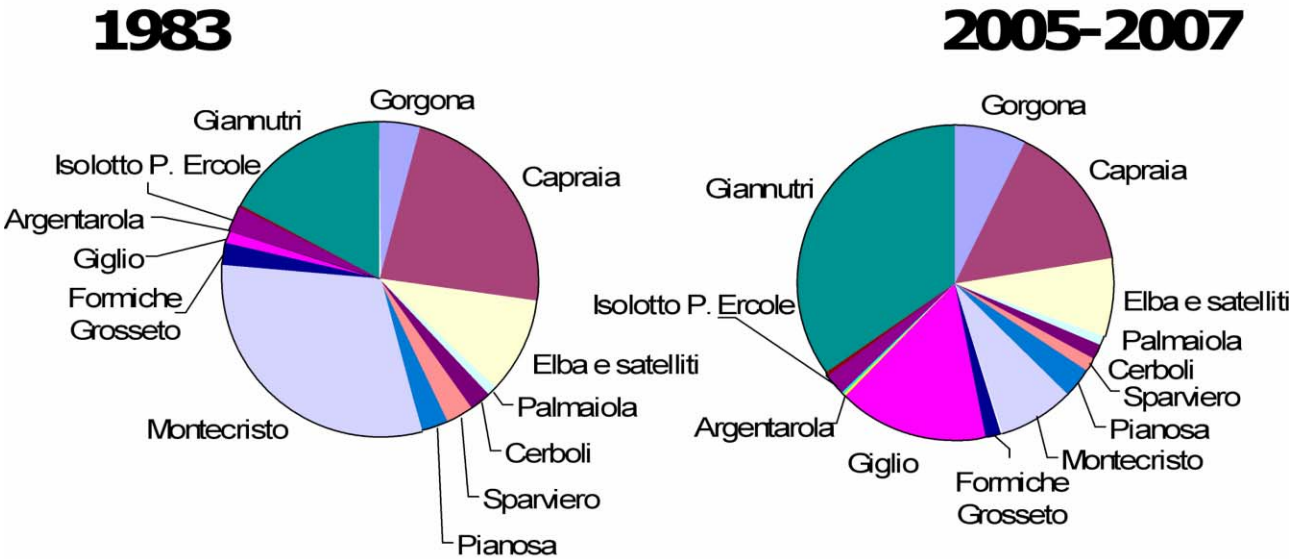

Fig. 33: Importance of individual islands for the overall Yellow-legged Gull population of Tuscany in 1983 (left) and 2005-2007 (right; 3-year mean); islands are ordered N to S, clockwise.

Montecristo was the island with the highest numbers, and along with Giannutri and Capraia reached nearly ¾ of the total. Over the last three years, Giannutri has reached an importance that is proportionately very close to that of Montecristo 25 years ago (and much higher absolute values), Capraia has roughly mantained its former importance, while Giglio has gained the third position, with numbers slightly lower than Capraia (in 2007 higher than). These changes, that may determine consequences on the level of conservation and management, seem to be due also to a redistribution of the population continuously re-shaped by trophic constrains (in particular, the location of the operational refuse dumps). Absolute totals on each single island, therefore, may substantially differ between each other or from the general trend (Fig. 4).

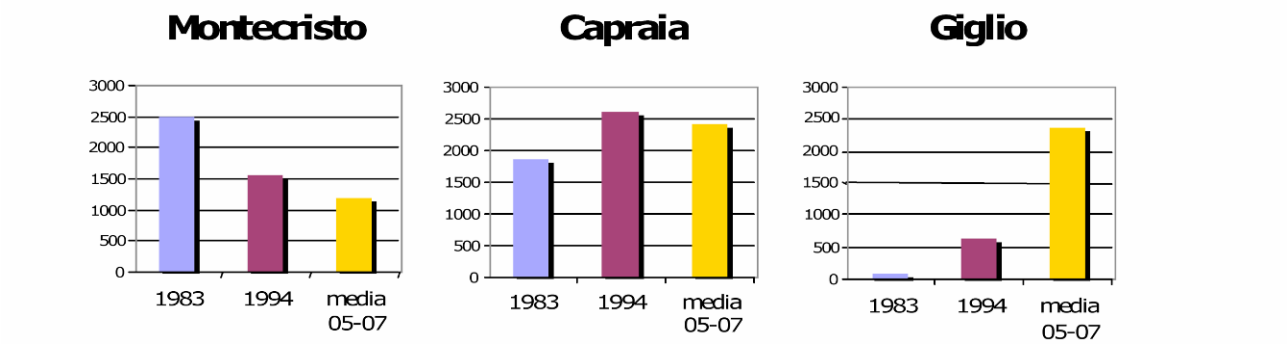

Fig. 34. Yellow-legged Gull pairs on three Tuscan islands (a: Montecristo, b: Capraia, c: Giglio) showing contrasting trends; the final figures are 3-years means.

6.1.3. Breeding success. This important parameter should be locally determined in order to explain the growth of a population; this holds true, in particular, for a species which is being actively controlled across a relevant fraction (France and Spain) of its range and could theoretically be controlled also in our study area. Very few data, however, are available to us and all of them involve islands of minor importance. Obtaining a productivity value for islands that host large colonies, which may uniformly cover the entire coastline and reach relatively high altitudes, has been impossible so far. During the 2007 breeding season, fledged juveniles were counted on three minor islands and revealed surprisingly low productivity values, especially when considering that they refer to a species which has a modal clutch size of three eggs: 0.62 juveniles/pair on Argentarola (55 from 88 pairs), 0.30 on Scoglietto di Portoferraio (15 from 50 pairs) and 0.12 on Scola di Pianosa (10 from 80 pairs). Our impression that breeding success was much higher in the past, so that 2007 could be regarded as a poor year, was not confirmed by checking old unpublished data from 1991-1994 years, when the breeding success on Argentarola varied from a min. of 0.20 juvs./pair in 1992 to a max. of 0.66 in 1994, and when a value grater than 1 juv./pair, also on other small Tuscan islets, was recorded just once at Formica Grande di Grosseto (113 juvs. from da c. 100 pairs, in 1991). Less than one juv./pair are usually recorded elsewhere across the range of the Yellow-legged Gull, either. Other demographic parameters (longevity, etc.), therefore, must have a key role in determining the observed increase of the Tuscan breeding population.

6.2. Audouin's Gull

6.2.1. Population size and trend. The earliest quantified record of an Audouin's Gull colony in Tuscany, on Capraia, dates back to 1977. It followed almost on century of 'probable' reports. Since this year, the list of recorded colonies increased up to involving eight different islands, plus Giannutri where a group had been observed and counted in the early 50ies, being posteriorly re-evaluated as a real breeding colony (Baccetti 2002). Positive data that are now available refer, actually, to all Tuscan islands, apart from Cerboli and some minor rocks (Tab. 1). The 'first year' shown in the table, of course, almost never is the year of first occupation of a given island, even within the 30 years of relatively continuous observations. Only for Pianosa can colonies be excluded in the two years prior to the discovery of a colony in 2000.

isola	I anno	coppie	rilevatori
(Giannutri)	1953	c. 10	Toschi
Capraia	1977	75	Arcamone, Mainardi, Meschini
Palmaiola	1979	51	Brichetti, Cambi, Di Capi
Giglio	1984	25	Lambertini
Gorgona	1988	60	Lambertini
Is. Topi	1988	90	Lambertini
Montecristo	1989	8	Baccetti, Roselli

Elba	1999	56	Baccetti, Serra, Sposimo
Pianosa	2000	52	Baccetti, Melega, Sposimo

Tab. 1. Steps in the discovery of Audouin's Gull colonies in the Tuscan islands. For Giannutri, see text.

In all the other cases, for many years, annual monitoring was carried out mainly on island known to have been occupied in previous years. Hence the possibility of anterior presence om most islands where breeding was recorded for the 'first' time. In the period 1977 -1983, in particular, there were still entire sectors of the archipelago where breeding had never been reported, nor specific surveys had been carried out. In 1984-1988, instead, data – mainly collected by M. Lambertini – are complete enough to allow a comparison with the present situation, but again for the whole next decade (up to 1998) not all existing data were made available, so that the overall population size in those years cannot be calculated.

From 1999 on, monitoring of Audouin's Gulls has been exaustive, nearly all islands being purposely circumnavigated every year, some of them more than once. Population size (Fig. 5) varied between 158 and 210 pairs in the 9 years (mean 175), apparently showing a slightly decreasing trend that is close to statistic significance and opposite to the trend of the global population. Local comparison with previous years (selected according to completeness of coverage (1984, 96 pairs on Capraia, Palmaiola and Giglio; 1988, 185 coppie on Gorgona, Capraia and Topi, with confirmed absence on Giglio) seems to suggest fluctuations around totals not different from the present ones.

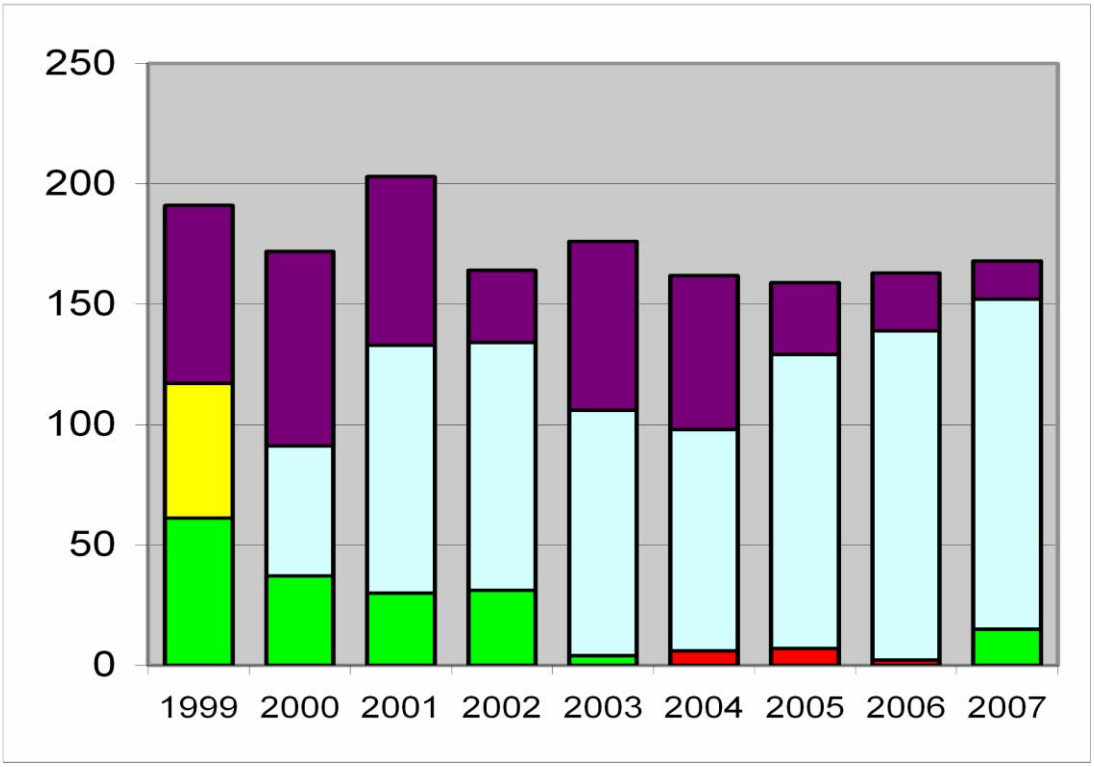

Fig. 35. Population size of the Audouin's Gull in Tuscany in the last nine years. Yellow: Elba; green: Capraia; light blue: Pianosa; dark blue: Giglio; red: Gorgona. On Giglio, two or more sites (more than 100 m apart) were occupied in 2003 (3 subcolonies), 2006 (3 subcolonies) and 2007 (2 subcolonies); this happened also on Pianosa in 2001 (2 colonies at the opposite ends of the island). Otherwise, a single colony per island and year was recorded.

Fig. 36. Audouni's Gulls on Pianosa, during early phases of colony site selection. The dense groupings of this species are highly attractive for other colonial species (here, a Little Egret) which may happen to pass on the area. Photo Baccetti.

6.2.2. Distribution and population sizes on the islands. Besides the overall trend, Fig. 5, confirms – or at least does not exclude – some already known aspects (Lambertini 1993): that there are often important interannual variations in the existence, size and position of a colony on each island, and that Audouin's Gulls are usually distributed in three different settlements (north, south and centre of the Archipelago). One colony has always been present, in the last nine years, in each of these three geographic sectors, and within any of them the choice of the island has always been mutually exclusive. During our study period, we assisted – in the northern sector – to a steady decrease of the Capraia colony (Fig. 7), to its moving for three years at Gorgona, and to the recent return on Capraia. In the central sector, after an unprecedented occupation of Elba (nr. Marciana Marina: cf. Balducci, 1912, for historical records just near this village) in 1999, the colony has always been firmly settled at Pianosa, the only island which in these hears has markedly increased in relative importance (max. 84% of the Tuscan total in 2006). Finally, in the southern sector of the Archipelago, the colony has always been present on Giglio, where it has shown a decreasing trend after 2001 (when it stopped using its traditional site in the southernmost point) and a tendency to fragmenting into small sub-colonies, usually featured by poor breeding success (cf. next).

Fig. 37. The last Capraia colony of Audouin's Gull, before the move to Gorgona in 2004. The four pairs had settled in the harbour bay, just a few metres from S. Francesco tower and adjacent town. Choosing man-inhabited breeding places, that is possibly triggered by high densities of Yellow-legged Gulls at traditional sites, is a rare event in this species, but it does sometimes occur (e.g. in Corsica). Photo Arcamone.

6.2.3. Breeding success. Total failure of a colony with abandonment of the site (usually prior to egg-laying) was recorded in 22% of 18 settlements monitored in the central and southern sectors of the Archipelago: in 3 years on Giglio (2001, 2005, 2007) and in 1999 on Elba. A likely cause for these event, on Giglio at least, might be connected to food availability, as no local perturbations were apparent; in the case of Elba, total predation or excessive disturbance cannot be excluded, considering the high level of human presence on this large island and the presence of several alien predator species (wild boar, in particular). In the remaining 14 colonies, breeding auccess varied between 0.05 juvs./pair (2004: almost complete predation by feral cata and Peregrine Falcons) and a max. of 0.69 (2005: confirmed predation by Peregrine, eventually contained by use of a scarecrow); on Giglio, successful colonies resulted in 0.20 (2002: possible predazione by Raven and Peregrine) to 0.58 (2006). In several cases (Pianosa 2000, 2002, 2003; Giglio 1999, 2000, 2003) available data only indicate a breeding success greater than zero, without any precise information. In the northern sector of the Archipelago, excluding the total failure is the best information we could obtain (Capraia 1999, 2000; Gorgona 2006), otherwise any indication is lacking (Capraia 2001, 2002, 2003; Gorgona 2004, 2005): but, for 2007, a case of complete failure (after egg-laying) was recorded on Capraia.

A mean of 0.42 fledged juvs./pair out of three successful years on Giglio and that of 0.35 out of five on Pianosa are indicative of a very high egg/chick mortality, because on the same islands the mean clutch size was almost always composed of two eggs (Fig. 8), as it is typical in this species.

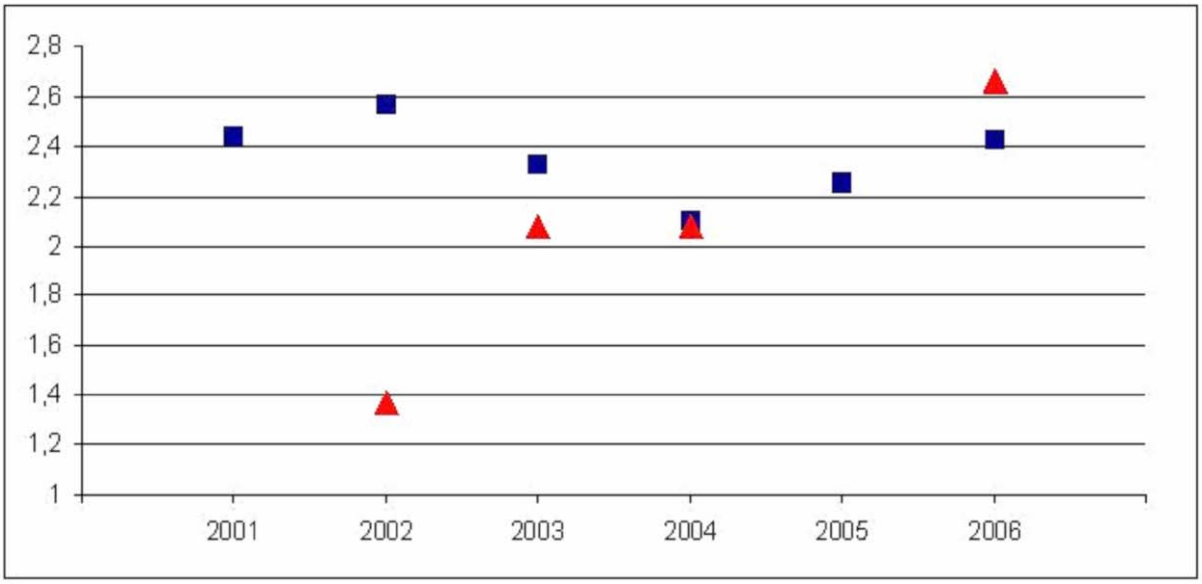

Fig. 38. Clutch size (mean number of eggs/nest at advanced stages of incubation) in Audouin's Gull colonies of Pianosa (squares) and Giglio (triangles). Nests were checked between 3 and 23 May; empty nests were not included in the means if hatching had already started.

Mortality was mainly due to regular predation, either on eggs (by Raven on Giglio and Capraia, Hooded Crow on Pianosa), or on adults or chicks older than 7-10 days (by Peregrine Falcon, on Pianosa and Giglio: Fig. 9). Impact by corvids was never in alarming proportions (max. on Giglio in 2004, by a team-playing pair of ravens: in that very year, however, a number of chicks close to average fledged). Impact by falcons, instead, although fully natural, is worrying. Both in 2005 and in 2006, daily captures by juvelile falcons only ceased after a very obvious scarecrow was built, a few tens of meters from the Pianosa colony site, and allowed fledging of the survivors (Fig. 10). This tool was not so helpful in 2007 due to unclear reasons, possibli connected to unsuitable positioning..

Predation, along with mass abandonment of the colonies, were recorded in this decade at a rate which suggests not many Tuscan-born birds will have been locally recruited by the breeding population. However, nothing really indicates that this did not occur in the past. It is possible, therefore, that the relative stability of the current population size is mantained thanks to the recruitment of outsiders and /or to a demographic strategy featured by a very high adult survival, buffering every year the small number of local recruits. This latter possibility has been confirmed for this species in Spain, but also the influx of individuals of different origin, which have now become faithfull to the unfavourable Tuscan colonies, is proven by several repeated controls of 'foreigners' breeding on Pianosa (12 Sardinians, one Corsican and one Spanish birds), Giglio (two Corsicans, one Sardinian and one Spanish bird: Fig. 11) and even in the tiny Gorgona colony of 2006 (one Sardinian bird which had previously bred on nearby Corsica, and that moved to Pianosa in 2007).

Fig. 39. Adult Audouin's Gull in the Giglio colony, with a 25-days old chick: at this age chich are most vulnerable to Peregrine Falcons which, by landing in the colony, calm the alarmed reaction of adults and then kill preys *ad libitum*, but consume them very partially. Foto Baccetti.

Fig. 40. The scarecrow built against Pianosa falcons, at its first installation in June 2005. This island, 1000 ha large, hosts every year up to 7 breeding pairs of Peregrine. Photo Baccetti.

Fig. 41. Adult ringed AAUT, originating from the Ebro Delta (Spain), breeding on Giglio in 2004. Photo Baccetti.

References

ARCAMONE E., BACCETTI N., LEONE L., MELEGA L., MESCHINI E. & SPOSIMO P. 2001 – Consistenza ed evoluzione della popolazione di Gabbiano reale *Larus cachinnans michahellis* nidificante nell'Arcipelago Toscano. Avocetta 25: 142.

ARCAMONE E., LAMBERTINI M. & MESCHINI E. 1986 - Il Gabbiano corso *Larus audouinii* Payr. nidificante all'Elba e a Capraia (Arcipelago Toscano): 1977-1983. Quaderni Mus. St. Nat. Livorno, 7: 93-98.

ARRIGONI DEGLI ODDI E. 1911 – Il *Larus audouini* a Montecristo. Riv. ital. Ornit. 1 (1): 91-92.

BACCETTI N. 1994 – Uccelli marini nidificanti sull'Isola di Montecristo (Arcipelago Toscano). Quad. Mus. St. Nat. Livorno 13: 23-29.

BACCETTI N. 2002 – La distribuzione riproduttiva storica del Gabbiano corso, *Larus audouinii*, in Italia, quale fonte di informazioni utili per la conservazione della specie. Riv. ital. Ornit. 71: 103-113.

BACCETTI N., DALL'ANTONIA L., MAGNANI A., SERRA L. 2000 – Foraging routes of Audouin's Gull *Larus audouinii* from two Sardinian colonies. In: Yésou P. & Sultana J. (eds) Proceedings 5th Medmaravis Symposium, Env. Prot. Dept., Malta, 150-158.

BALDUCCI E. 1912 – La cattura di un *Larus audouinii* Payr. a Marciana Marina. Riv. ital. Ornit. 2 (1): 34-35.

BRICHETTI P., CAMBI D. 1979. Studio preliminare di una colonia di *Larus audouinii* Payraudeau (Gabbiano corso) nell'Arcipelago Toscano. Riv. Ital. Orn. 49:277-281).

DAMIANI G. 1901 – Nuove catture del *Larus audouinii* Payr. all'Isola d'Elba. Avicula 5 (37-38):

FASOLA M. (ed) 1986 – Distribuzione e popolazione dei Laridi e Sternidi nidificanti in Italia. Suppl. Ric. Biol. Selv. 11, 177 pp.

LAMBERTINI M. 1993 – The ecology and conservation of Audouin's Gull (*Larus audouinii*) at the northern limit of its breeding range. In: Aguilar J.S., Monbailliu X., Paterson A.M. (eds), Status and conservation of Seabirds, SEO, Madrid: 261-272.

LILFORD, Lord 1875 – Cruise of the 'Zara', R.Y.S., in the Mediterranean. Ibis ser. 3, 5: 1-35.

LILFORD, Lord 1887 – Notes on Mediterranean Ornithology. Ibis ser. 5, 5: 261-283.

MESCHINI E. , ARCAMONE E. & MAINARDI R. 1977 - Una colonia di Gabbiano corso (*Larus audouinii*) nell'isola di Capraia (Arcipelago Toscano). Avocetta 3: 47-49.

MESCHINI E. & SCHENK H. 1986 – Gabbiano corso. In: Distribuzione e popolazione dei Laridi e Sternidi nidificanti in Italia. Suppl. Ric. Biol. Selv. 11: 41-51.

PICCHI C. 1910 – Sulla comparsa nell'Adriatico del *Larus audouini* Payr. ed ulteriori notizie sull'habitat e sui caratteri giovanili di questo gebbiano. Avicula 14: 41-48.

SERRA G., MELEGA L. & BACCETTI N. 2001 – Piano di azione nazionale per il Gabbiano corso (*Larus audouinii*). Quaderni di Conservazione della natura, 6, Ministero dell'Ambiente e Istituto Nazionale per la Fauna Selvatica.

SERRA L., ZENATELLO M., BACCETTI N., DALL'ANTONIA L. 1999 – Caratteristiche distributive ed ecologiche delle colonie italiane di Gabbiano corso *Larus audouinii*. Avocetta 23: 83.

TOSCHI A. 1953 – Osservazioni ornitologiche nell'Isola di Giannutri. Ricerche Zool. appl. Caccia 22: 1-20.

7. CONSERVATION PLAN FOR POTENTIAL BREEDING SITES FOR THE AUDOUIN'S GULL (LARUS AUDOUINII)

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7.1 INTRODUCTION

The conservation status of the Audouin's Gull (*Larus audouinii*), endemic species of the Mediterranean, is *'Near Threatened'* and at the same time – for the past 30 years – there is a trend towards the increase of its global population: this apparent paradox is due to the strong concentration of the population itself. More than half of the birds live in a single colony on the Ebro Delta, and more than 80% in a single Country, Spain. The general situation was recently examined (2006) and questioned whether it were opportune to reduce the 'Risk category' of the species. However, once again the theory that such a concentrated population is in danger and is so vulnerable to natural stochastic events prevailed and above all it is strongly depending on conservation and management actions of habitat components used by the species.

Fig. 42 – Audouin’s Gull (photo De Faveri)

In the Tuscan Archipelago, usually three colonies are found, one in the north, one in the centre and one in the south, with inter-annual fluctuations and frequent moves; from 1998 to 2005, there was an average presence of 160 couples, equivalent to 21% of the total population registered in Italy. In the

colonies we find a dense group of birds in only a few square meters on the coast: the density is visibly greater than in the *Larus michahellis'* colonies, the other species of Laridae present on the Mediterranean islands, for this reason the colony's reproductive system can be disturbed even by accidental actions.
The nomadic habits of the breeding colonies of the Audouin's Gull make the protection of reproductive sites extremely difficult, either by founding protected areas *ad hoc*, or by integrating the existing environment with specific measures of conservation. A rather expensive survey done at the beginning of the breeding period is, so far, the only method to preserve areas annually used by gull colonies. In Tuscany, in the past, different types of installation sites were used, not only for geographic characteristics but also for the micro-habitat parameters such as exposure, substratum, vegetation etc (Lambertini 1993); however until now there are no specific qualities which give us a guarantee of nesting sites in the future.

7.2 PURPOSE

This document, containing the results of a study done using GIS tools, is an effort to define the geographical position of the Tuscan colonies, using wider environmental categories than those used in the past (natural and anthropic), as now there is the availability of past and present information on sites occupied by this species. Three are the objectives, which are all inter-connected:
1 - identification of the potential areas for the settlement of the colonies
2 – identification of impacts connected directly or indirectly to human activities
3 - definition of the necessary conservation measures and of the relative accomplishment methods.

Here we have not examined the impacts of possible reductions in trophic resources due to the impoverishment of fish stocks (this threat, on the AT, could have important consequences on the species) and the impact of "natural" predators (Raven *Corvus corax* and above all Peregrine Falcon *Falco peregrinus*); however specific actions for these problems were considered.

7. 3 IDENTIFICATION OF SUITABLE AREAS FOR NEST-BUILDING

The Audouin's gull usually breeds in environments close to the sea (sheltered from big waves), but different in the vegetation and slope. It prefers the ecotone (borders, clearings) to the thick Mediterranean maquis taller than 1,5 m. We can also find it in relatively bare rocky areas, in small flat spaces on cliffs and generally in accessible positions characterized by the absence of medium/big terrestrial predators (dogs, foxes, wild boars etc.).

Fig. 43 – Observations of the Audouin's Gull's colony in Punta del Grottone, Pianosa (photo Sposimo)

Sometimes the colonies can settle in artificial sites located on the border of areas with intense anthropic disturbances, in appearance entirely inhospitable but suitable because of human presence that prevents the existence of predators and competitors (Yellow-legged Gull). This is proven by the long time established presence of more than 30 couples on the breakwater of a military dock near Ajaccio (Recorbet 2007) and by the attempt of 2-3 couples to breed (we don't know if they succeeded) near the tower overlooking the port, close to the border with the village on Capraia Island.
As to determinate the potential suitable areas for the installation of colonies in the Tuscan Archipelago, we chose not to consider the sporadic cases of installation in anthropic sites, since those are not predictable and marginal for the maintenance of the local meta-population.
The parameters used to appraise the suitability of the coasts of the Tuscan Archipelago for the *Larus audouinii* are described below.

7.3.1 Anthropic disturbance by land

The presence/absence of a meaningful level of anthropic disturbances in the coastal areas reachable by land, seem to be a relevant element for the distribution of the natural sites used up by the Audouin's Gull. In fact, the coastal areas where anthropic presence is regular (coastal inhabited stretches or adjoining settlement to the road net, beaches or attainable coves from the road or from brief paths, etc.) have never been occupied by colonies. We note that the period of colony settlement (March-April) does not coincide with the peak season of summer tourism: therefore this species avoids nesting in areas that will be likely disturbed in such weeks. On the island of Elba, the "low anthropic disturbance areas" were determined only in an indicative way as on the island there are probably high levels of disturbance for the Gull; in fact the many coastal roads would require a deeper analysis than this one.

7.3.2 Presence of Yellow-legged Gull *Larus michahellis* colonies

The Yellow-legged Gull - in many cases - share the same breeding areas as the Audouin's Gull, and its reproductive time is about a month earlier (Serra et al., 2001). The two species co-exist, especially on middle to small islands, and therefore there is a territorial competition, clearly in favour of the most abundant and precocious species, thus preventing the other from creating big colonies. In some cases it has become clepto-parasite and the Yellow-legged Gull can also turn into an Audouin's Gull predator.

In Sardinia it was observed that the Audouin's Gull does not settle on all the available small islands, if 12 couples of Yellow-legged Gull per 100 m of coast are present (G. Serra ined.). Comparing the distribution of the Audouin's Gull's colonies on the Tuscan Archipelago from 1978 to 2007, and the abundance of Yellow-legged Gull (Fig. 45), we can deduce that the colonies fill up zones occupied by less than 20 couples of Yellow-legged Gull's per 100 m, with the only exception of the "historical" colony of Capraia (1978), however in a time when the couples of Yellow-legged Gull were different from the present ones. It is important to underline that on the islands where the presence of Yellow-legged Gull is smaller than 20 cp/100s m (Giglio, Pianosa), the colonies of Audouin's Gull settle along stretches where the con-genus species is more numerous. This confirms that the environmental preferences are similar.

7.3.3 Disturbance caused by recreational boats

The presence and above all the prolonged parking bay of boats in the immediate proximities of the Audouin's Gull's colonies, can prevent the installation or cause the abandonment (particularly during the first phases of the reproductive period) or even reduce the reproductive success of the Gull (Serra et al., 2001). The coastal areas characterized by an intense presence of boats, for middle or long term, may be completely unsuitable for this species (also being appropriate for Yellow-legged Gull whose reproductive cycle is anticipated by 30-45 days and therefore it overlaps less with the tourist high season).

Fig. 44 - disturbance caused by boats in Giannutri (photo Sposimo)

In order to appraise the intensity of the disturbance caused by nautical tourism, we did in this LIFE Project, a proper study concerning Capraia, Giglio, Cerboli, Palmaiola and two short stretches on Elba island (one of whose including the site filled up in 1999). Giannutri and most of the Elba's coasts (for

this one cf. beyond) were not examined because, for different reasons, they are not considered suitable for the Audouin's Gull. Obviously we don't examined the islands where navigation is not allowed. The stretches of coast examined in the summer period are the same as those used for the ordinary census of the Yellow-legged Gull (sometimes longer than 1 km); the collected data seem to be sufficient to evaluate the real entity of the anthropic disturbance and its correlation with Audouin's Gull settlement. The different "intensity of the nautical tourism" is not a discriminating factor for the location of the Audouin's Gull's colonies on the AT. However, always a possibility, that some sites (Isola dei Topi, Palmaiola) might have been abandoned in the past because of the increasing nautical disturbance. In addition a middle-high level of disturbance can have effects on the behaviour of the Audouin's Gull, creating nomads (Giglio), causing fragmentation of the colonies (Giglio), partial installations at the beginning of the breeding season (Capraia, Giglio), abandonment (Giglio) and/or failure of nest-building (Capraia, Giglio). Said events are attributable to the nautical disturbance and the increase of the Yellow-legged Gulls.

The classification of the coastal stretches, effected by the described parameters, can bring, with a synthetic approach, to define zones of great suitability for the Audouin's Gull or rather those where we can more probably expect the settlement of colonies in the future. These areas arise from the carrying out of the following operations:

1. Exclusion of the unsuitable stretches of coast for the great anthropic disturbance: towns, areas with scattered houses or with roads next to the coast (except Pianosa, where also along coastal roads, disturbance is very low and the roads are no more than paths), ports, beaches and other areas with strong tourism pressure;
2. Exclusion of the stretches characterized by breeding Yellow-legged Gulls over than 20 pairs/100s m of coast (data belonging to census 2007) (cfr. Fig. 1);
3. The remaining coastal stretches - potentially suitable - have been divided, on the basis of intensity of disturbance caused by the recreation boats, in the followings three categories:
    a) absence of criticity due to nautical tourism;
    b) low criticity due to nautical tourism;
    c) medium or elevated criticity due to nautical tourism

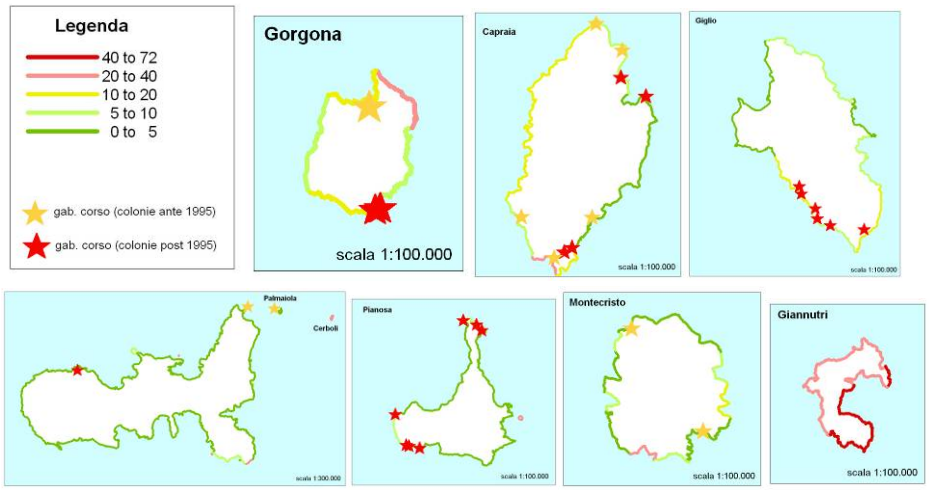

Fig. 45 – Density of Yellow-legged Gull breeding on the AT islands

This analysis shows that on AT's islands are around 134 km of coast (48% of the whole coastal development) that potentially have suitable characteristics for the Audouin's Gull. As above mentioned, in a good part of Elba's "suitable" coasts, the anthropic territorial disturbance could actually be excessive for the settling of colonies. Besides, regarding Elba there is also another variable to be considered, that of an abundant population of wild boar (*Sus scropha*), till recent years found only in the western sectors of the island now present almost everywhere. All areas that are more or less regularly frequented by wild boars are in practice unusable for the gulls, so they can successfully reproduce only on cliffs or on very steep areas. Therefore concerning this island, the really appropriate areas for the Audouin's Gull are probably very few and all very limited in size, but to describe their individualization we would need a deeper analysis (detailed examination of the road net, selections of the steepest stretches, etc.)

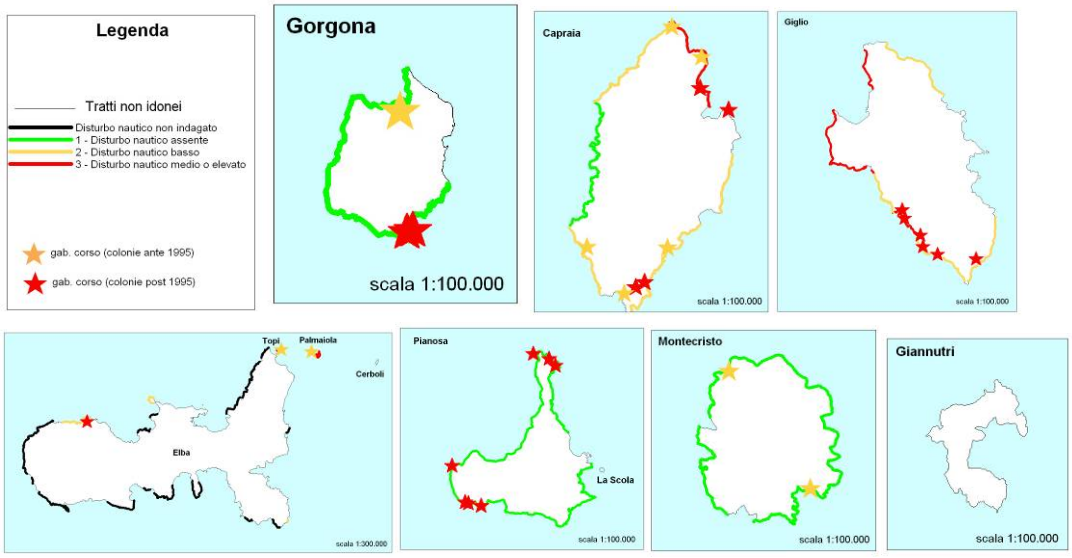

Fig. 46 – Suitable areas for the Audouin's Gull in the Tuscan Archipelago

Excluding Elba, the suitable coasts for the reproduction of the Audouin's Gull are around 85 km long. Of which 44 km (52% of the suitable stretches) don't show any criticity concerning anthropic disturbance (free navigation is forbidden on the basis of protection laws of the National Park of The Tuscan Archipelago or due to other restrictions such as those existing on the penal colony islands), 28 km (33% of the suitable stretches) have a lower level of criticity because not very frequented for different reasons (i.e. critical mooring zones, difficult landing, etc.), 13 km (15% of the suitable stretches) instead seem to show a meaningful level of criticity in relation to recreational boat disturbance.

Altogether, excluding Elba, 94% of the suitable coastal stretches where the Audouin's Gull lays are in the territory of the National Park of Tuscan Archipelago (PNAT), while 76% of the relating sea lines lay inside sea protection areas of the PNAT itself, or in areas where free navigation is restricted because of penal colonies.

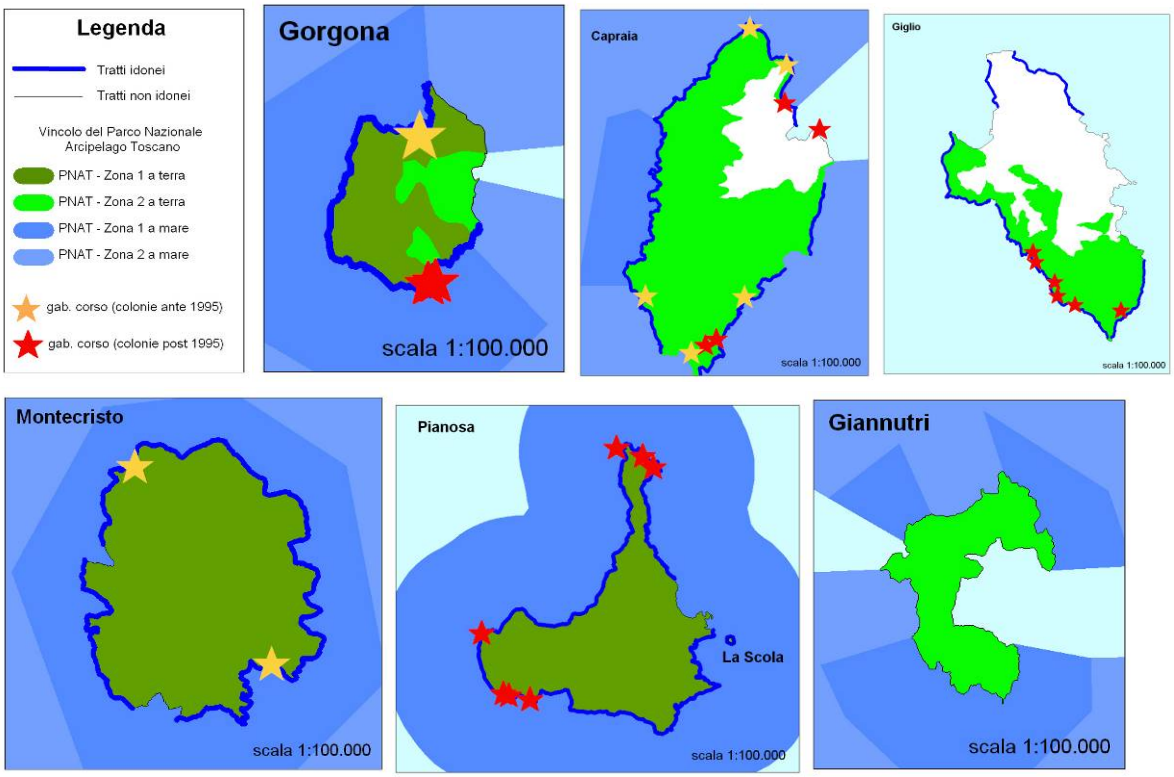

Fig. 47 –Ratio of suitable areas for the Audouin's Gull and protection means of PNAT (NB. Elba has been excluded)

7.4 MANAGERIAL POINTS AND DIRECT ACTIONS

Measures of maintenance to be adopted for the protection of the Audouin's Gull on the AT are listed and shortly described below; a great many of these measures have been put into practice by the Park. Concerning the first action, consisting in planning or ruling indications, its enforcement is not entirely pertaining to the AT Park and it needs the involvement of local and central authorities.

7.5 POINTS FOR GENERAL PLANNING / REGULATION OF THE TERRITORY

Regarding the settlement of the colonies we have come to the following points for AT's coastline:

1. Inclusion *in toto* in the terrestrial perimeter of the PNAT;
2. For coastal stretches, up to a least a distance of 300 m, including the Protected Area of the Marine Park (AMP) probably shortly established; the Giglio's coast stretch that has often sheltered colonies in the past years (Cala del Corvo zone) should be classified as zone "1", maximum protection level, while for the other stretches it seems to be enough to action a temporary sailing prohibition (April – mid July) if colonies would settle.

7.6 SEARCH OF ANNUALLY INHABITED SITES BY THE AUDOUIN'S GULL COLONIES, CENSUS AND APPRAISAL OF REPRODUCTIVE SUCCESS

Carrying out by boat in April research on all suitable areas for settlement of the species. Once the colonies are located, they are examined by sea during mid May for an accurate census of the nests and for harvesting the first part of useful data for the appraisal of reproductive success. This is calculated on

the basis of results of a third investigation effected in the second part of June and, only because of the numerous colonies, a further investigation in July.
The research must carry on indefinitely, except for necessary changes due to unexpected events.

7.7 CENSUS OF YELLOW-LEGGED GULL POPULATION

This activity is similar to the first part of the research related to the Audouin's Gull (boat investigation) but must be expounds on the whole AT's coastal development and not every year: initially a biennial cadency is foreseen.
The research must carry on indefinitely, except for necessary changes due to unexpected events.

7.8 INSTITUTION OF TEMPORARY ACCESS / LANDING PROHIBITIONS

Temporary prohibitions of access/unloading in the areas occupied by the Audouin's Gull (only in if necessary) will be combined - only regarding land access - with installation of special descriptive posters and with the placement of movable barriers / obstacles, backing the function of the posters; such actions must be carried out during April, as soon as the monitored results are available of the first phase of colonies.
The research must carry on indefinitely, except for necessary changes due to unexpected events.

7.9 SIGNAL OF CRITICAL AREAS TO STOP CHARTER BOATS AND TOURIST NAVAL OPERATORS

This action will be carried out annually, at the same time of implementing the prohibition of access / landing; special informative (leaflets to be reproduced by the Park Agency -Ente Parco- itself) material will be used too.
The research must carry on indefinitely, except for necessary changes due to unexpected events.

7.10 OBSERVATION SESSIONS UNA TANTUM TO MONITOR REPRODUCTIVE SUCCESS

Looking at the recent and not episodic mass failures of reproduction in the Tuscan colonies of the Audouin's Gull, it is foreseen to do u*na tantum* sessions of prolonged observation, useful however to obtain biological or demographic data but above all necessary to notice the presence of disturbing factors that can be the cause or a part-cause of failures. If video – supervisory systems are not available, which possible installation is currently at a study stage, control requires the permanence of a voluntary "detector", carrying out 5 days of distance observation in a selected colony during the hatching phase (end of May) and 5 days at the beginning of the breeding period (June).
However the action must be developed in one year.

7.11 PERMANENT TRANSIT PROHIBITION OF MOTOR VEHICLES ON A SECTION OF COASTAL ROAD IN PIANOSA

Permanent transit prohibition of motor vehicles on a brief section of coastal road (1,1 km), which are almost inaccessible, in the south-western zone of Pianosa; the closing, that can simply be done by

obstructing the access, does not affect the activity of service-vehicles since the parallel road – located only a few dozen meters away– will always be accessible. The aim of this is to make an ample section of coast suitable for reproduction, adjoining to other sites already utilized and a great deal suitable for its own characteristics, that currently doesn't shelter gulls presumably because of the infrequent transit of motor vehicles on a track a few meters from the sea.

7.12 DETAILED ANALYSIS TO LOCATE ELBA'S COAST STRETCHES POTENTIALLY SUITABLE FOR THE SETTLEMENT OF COLONIES

As previously illustrated, the presence of wild boar and the capillary road network make a big part of Elba's coast unsuitable for colonies with the exception of a small part of the high coast. As for some of these sections it might be necessary to identify specific conservation measures (including a possible inclusion in the oncoming **Sea Protection Area** of coastal stretches), it appears necessary to carry out a detailed analysis for their individualization.

7.13 CARRYING OUT / EXPERIMENTATION OF DISSUASION ACTIONS TO REDUCE STALKING BY PEREGRIN FALCON

Beginning from the reproductive season of 2005, when the chicks of the Pianosa colony were constant prey for the Peregrin falcon, a scarecrow was made, like a "bogeyman", that apparently lead to the immediate stop of being prey. The intervention was repeated in 2006, apparently with success, and then in 2007, but this time with a negative result (reproductive success almost void), perhaps because a scarecrow was not used when the predators started to attack.

In the following years, the repetition of intervention is foreseen in the colony of Pianosa, this time with 2 scarecrows (one handmade and a "professional" one), and, if video – supervisory systems are not available, the carrying out of some inspections of the chicks during the breeding period, to verify the effectiveness and therefore to place them within the colony.

The professional scarecrow (rag doll that inflates and deflates at intervals) could be also experimented for actions aimed to prevent / reduce settlement of Yellow-legged Gull in suitable sites for the Audouin's Gull, to be used before this species reaches the island (January-February).

7.14 CONTINUATION OF INVESTIGATIONS ON THE DIET

Since 2003 Audouin's Gull droppings have been collected in order to identify its diet within the checked area, but at present this data is still insufficient. Therefore, when the proper conditions will be verified (numerous colonies with good productivity, set in sites where the possible capture of chicks does not show risk for their safety) further harvests of droppings are foreseen, to combine with tagging the chicks with long distant readable rings. The collected information will be submitted for examination by experienced fish experts.