



## LASPEH “Low Adriatic SPECies and Habitat”

### D.T1.3.1 Concrete actions for habitat

## PP “Regional Natural Reserves of the Eastern Coast of Taranto”

Report ver. 1



## Index

<b>1</b>	<b><i>Introduction</i></b> .....	<b>3</b>
1.1	BIOLOGY OF BITTERN.....	3
1.2	SELECTION OF THE HABITAT .....	7
1.3	STATUS AND CONSERVATION .....	7
<b>2</b>	<b><i>SEARCH OF THE BITTERN IN THE REGIONAL NATURAL RESERVES OF THE EASTERN COAST OF TARANTO</i></b> .....	<b>9</b>
2.1	STUDY METHODS.....	9
2.2	MONITORING .....	2
2.3	MONITORING RESULTS .....	9
2.4	STRUCTURE OF THE REED AND PRESENCE OF THE BITTERN .....	15
<b>3</b>	<b><i>STUDY OF CRITICAL ISSUES AND RELATED MITIGATIONS</i></b> .....	<b>16</b>
3.1	ANTHROPIC DISORDER .....	16
3.2	NATURALISTIC PHOTOGRAPHERS .....	18
3.3	PATH CONTAINMENT FENCES .....	19
3.4	WATER LEVEL AND ORNITHIC PRESENCES .....	19
3.5	MAINTENANCE OF THE FUNCTIONALITY OF THE REED ENVIRONMENT .....	21
3.6	CONSTRUCTION OF VEGETABLE BANKS OR LOW WATER CANALS .....	22
3.7	MAINTENANCE OF THE WATER LEVEL IN THE REPRODUCTION SITES.....	22
3.8	CREATION OF GROOVES FOR THE MAINTENANCE OF WATER .....	22
3.9	ROUTES AND RELATIVE BRIDGES .....	23
3.10	INADVISABLE INTERVENTIONS.....	23
3.11	CONCLUSIONS .....	24
3.12	BIBLIOGRAFY .....	26

## 1 Introduction

### 1.1 BIOLOGY OF BITTERN

Bittern *Botaurus stellaris* Linnaeus, 1758.

*Inglese:* Bittern.

*Danese:* Rodrum.

*Tedesco:* Grosse rohrdommel.

*Olandese:* Roerdomp.

*Francese:* Butor étoilé.

*Spagnolo:* Avetoro comùn.

*Classification:* the Bittern is a vertebrate belonging to the Aves class, order Ciconiiformes, family Ardeidae, subfamily Botaurinae. The genus *Botaurus* includes 5 species distributed on all continents. In addition to the nominal form, *B. s. stellaris*, an African subspecies, *B. s. capensis* (Schlegel, 1863) (Cramp and Simmons 1980, Voisin 1991, Martínéz-Vilalta and Motis 1992). The Bittern in Italy is partially sedentary and breeding, wintering and regular migrant. Polygamous. Slender and compressed forms, straight and long beak, upper jaw often serrated and toothed at the apex, furrowed. Bare reins, elongated local tuft, feathers on the sides of the neck, areas of down on the chest and on the sides of the big group. Very long neck and "S" bent in flight. The tarsi are long and shielded on the front, external and median toe joined at the base by a short membrane. Combed middle finger nail. Eggs generally uniformly bluish. Nest offspring.

Dimensions and weight: very large, total length 69 - 81 cm, wingspan 100-130 cm, male wing 230-

350 mm, female 300-350 mm, tail 94-115, beak 65-75 mm, tarsus 90-100 mm. Weight 1050-1380 gr.

*Egg*: average dimensions 53 x 39 mm, (47-58 x 35-41), average shell weight 2.7 grams.

*Structure and coloring*: slightly slender forms, beak shorter than the tarsus, pointed, strong at the base and compressed at the sides, with finely serrated edges, essential for the grip and management of food. Long and slightly curved nails.

*Youth*: similar to adults; paler general colouration especially of the lower parts of the wing; brown streaks on the chin and throat less evident, on the chest more brown and fine.

*Chick*: feathers, rather sparse, especially below. Red-brown to chocolate-brown upper parts, whitish chin and throat, remaining reddish lower parts. Beak greenish yellow, brown-black at the tip and at the base. Paws pale green, yellow at the joints. The iris is yellow. In the chick beak green legs and feet.

*Egg*: olive brown in color, sometimes finely spotted at one pole, not shiny.

*Distinctive features*: large, yellow with black-brown stripes. When it is motionless, the beak is turned upwards, in flight broad wings barred with brown and black.

Verso: in flight it emits hoarse calls, a single or repeated 'graoh'. The song of the male is peculiar, it is audible from very far (km away) very low like a breath of air (vuum), repeated 3 - 5 times, similar to the wind, of a cattle, or to the acoustic signal of a ship ). Technically, in English since there is no equivalent in Italian, we indicate with the term 'boom' the single line, with "boom train" instead we indicate the singing sequence as a whole, often preceded by the inhalation phase, sometimes audible in different inspirations ("Pumps") and followed by a phase of silence; finally we indicate

with "booming" instead the activity of the male singer. The song is the only indication of the certain presence of the species in a territory and its detection is the only realistic way to establish the number of breeding bitterns. There seems to be no relationship between the characteristics of singing and reproductive success or the number of females included in the harem (Polak 2006). There is much less knowledge on the behavior of females, given the greater elusiveness and limited vocal emissions. The singing season is often characterized by two peaks of activity (Puglisi et al. 1997), which can be explained by the possible second nesting of the females (Mallord et al. 2000).

*Distribution and migration:* the species nests in central Asia, central southern Europe, northern and southern Africa. In Italy it is stationary and breeds in suitable locations; in step at the end of October and mid-December and from mid-February to mid-March. The species is decreasing due to the contraction of the suitable environment.

*Habitat:* natural wetlands with presence of marsh vegetation with reeds and rushes (*Phragmites australis*, *Thipa angustifolia*, *Scirpus* sp., *Carex* sp.), Vegetation banks in swamps, lagoons, ponds, rivers and agricultural areas with paddy fields.

*Food:* small water mammals, frogs, fish, eels, snakes, lizards, small birds, crustaceans, insects, mollusks, grasses and seeds, and marshes.

*Reproduction:* The nesting takes place almost exclusively in reeds of *Phragmites australis*, (Cramp and Simmons 1980, Voisin 1991, Martínéz-Vilalta and Motis 1992), partially flooded by non-acidic and scarcely polluted water (Tyler et al. 1998), with limited excursions level and with partially young vegetation where it can move easily. Its reproductive ecology and ethology is little studied due to the extreme difficulty of observation. The singing of the male, audible up to 2-5 km away, consists

of a repeated series of low frequency sounds (boom) emitted mainly at sunrise and sunset (Poulin and Lefebvre 2003) and it is hypothesized that it is aimed at both to attract females and to perform the function of territorial signal during the rearing of the young (Voisin 1991).

In the reeds on a bed of reeds, a reed nest is laid out covered with finer materials. Sometimes the previous year's nest can also be used. From April to May 3-4-5 up to a maximum of 7 eggs are laid at intervals of 2-3 days, to be incubated for 25-26 days. The young are fed only by the female, and are ready to leave after 2-3 weeks. The ability to lay replacement broods in case of first nesting failure has been documented (Dmitrenok et al 2005); sometimes the male mates with another or more female when the first begins to hatch.

*Behavior:* the Bittern is characterized by solitary and elusive habits, it keeps itself hidden especially during the day. It begins its activities with the twilight, managing to feed even among the dense marsh vegetation, preferring the young reeds that allow easier movement and hunting. If suspicious, it assumes the typical mimetic attitude with a vertical beak, the characteristic "reed" posture. This anti-predatory adaptation has evidently evolved in humid environments with dense vegetation. The behavior, reinforced by the cryptic colors of the plumage, makes it very difficult to identify.

Walk with your neck and head buried in your shoulders. Avoid when you can take flight which is low, slow and short. It climbs progressing through the reeds, sometimes it prefers to perch in trees. It is cleaned with a duvet and sprinkles the head and neck with the secretions of the uropygium. Its nature is not very sociable and aggressive, it meets in groups only occasionally to face the migration.

## 1.2 SELECTION OF THE HABITAT

The habitat that most attracts the Bittern is the reeds (especially fragmiteto) with a young and monospecific vegetation (Gilbert et al. 2005a, Puglisi et al. 2005) of a few years, of good extension (at least 15 ha), with a low water (no more than 30 cm), and as constant as possible, in the absence of pollution; reed beds with clear water inside and shallow channels that allow it to feed and move around while walking are widely used (Tyler et al. 1998). The presence of water represents both greater protection of the nest from predators and an insurance regarding the food supply. The trophic utility is satisfied by providing both an abundance of prey and allowing the female to forage in the immediate vicinity of the nest.

During the cold season this ardehyde is instead less selective and can move away from the reeds, its ideal habitat. It can rarely perch in trees.

## 1.3 STATUS AND CONSERVATION

The entire European population has suffered a numerical collapse and a reduction in the distribution area over the last century. In Europe, a population of 34 - 54,000 males is currently estimated, most of which (over 80%) are concentrated in European Russia, Poland and Romania (Newbery et al. 2000, BirdLife International 2004).

One of the reasons that prompted us to undertake this work is the real possibility of achieving positive results. In many of the nations, in fact, where conservation projects have been developed focused on the creation and management of environments suitable for the reproduction of the species, there have been good quantifiable results in the increase in the number of male singers present in the area (BirdLife International, 2004).

In Italy this species is partially sedentary and breeding, regular migratory, regular wintering dispersal with movements between mid-August, mid-December and mid-February and early May. In Italy, the number of territorial males is estimated to be around 50-70 individuals distributed mainly within the wetlands of the northern Adriatic coast, in Umbria and Tuscany (Newbery et al. 2000, Puglisi et al. 2003).

The status of the different bittern populations is difficult to assess due to the difficulty of observing the animals and the lack or lack of specific and standardized censuses at European level (Newbery et al. 2000).

In Puglia, the species is considered to be a regular migrant, winter visitor and breeder (Liuzzi, 2013). The cases of nesting have been identified for now only in the Foggia area, while in the whole Salento the reproduction is indicated as probable (P). The species is censable with greater regularity in the wetlands of Foggia, but has been reported only in a few suitable areas of Salento.

In particular in the Natural Reserves, object of our study, the Bittern is occasionally reported; moreover, its nesting has never been officially reported, even here considered as probable (P). Our monitoring study aims to identify its presence and hopefully nesting; in addition, with the data collected, they will contribute to achieving the goal of improving environmental conditions in order to effectively attract the species to stop and to reproduce.

The bittern is included in Annex I of the Birds Directive (79/409 EEC), i.e. evaluated as a species subject to special protection, in Appendix II of the Bern Convention, concerning strictly protected migratory fauna species, in the list of threatened species useful for the identification of wetlands of international importance in the Ramsar Convention. It was the subject of an action plan for the protection of the species drawn up by the European Commission (Newbery et al. 2000).

The definitive rules for the regulation of hunting and the protection of wildlife have also made the bittern definitively protected by Italian laws (already in 1992, with Law no. 157). Likewise, the protection status was recently confirmed by the L.R. of the Puglia Region n ° 57 of December 2017.

## 2 SEARCH OF THE BITTERN IN THE REGIONAL NATURAL RESERVES OF THE EASTERN COAST OF TARANTO

### 2.1 STUDY METHODS

To try to study the presence of the Bittern in the coastal sites of the Natural Reserves, we collected news from the locals, which probably indicate the presence of animals seen already killed by hunters.

From further contacts with locals, we were able to get hold of a small format photograph (5x7 cm), dated 1938, a reminder of the result of a hunting trip with certainty made in the wetlands near Torre Colimena. From a careful examination of the exposed game bag, there seems to be a specimen of Bittern in the center (Figure 1).



*Figure 1: Ancient hunting bag with wild animals taken from the wetlands currently included in the Natural Reserves, 1938. In the center, probably, a bittern*

In 2016, we were also notified of the presence of a person about one kilometer away, parked on a road axis between Torre Colimena and nearby Avetrana with obvious health problems.

We report the release of a Bittern in the Salina dei Monaci, on 26 April 2018, by the Regional Wildlife Observatory of the Puglia Region (Figure 2). The wetlands of the Nature Reserves were in fact considered suitable for the reintroduction of a perfectly recovered subject into nature by

the heads of the Veterinary Medicine Department of the University of Bari, with whom our Center for the First Reception of Wild Fauna Omeotherm of the NROLTO Reserves collaborates constantly.



*Figure 2: prof. A. Camarda, of the University of Bari before the release of the bittern.*

## 2.2 MONITORING

To look for the presence of the Bittern, we obviously carried out a bird census. The method of census through the listening technique was chosen because in most cases the booming is the only indication of certain presence of the species on the territory and is the only realistic way to establish the number of breeding bitterns (Gilbert et al . 1994, Tyler et al. 1998).

Its reproductive ecology and ethology is little studied due to the extreme difficulty of observation. The singing of the male, audible up to 2-5 km away, consists of a repeated series of

low frequency sounds (boom) emitted mainly at sunrise and sunset (Poulin and Lefebvre 2003) and it is hypothesized that it is aimed at both to attract females and to perform the function of territorial signal during the rearing of the young (Voisin 1991). The Bittern is not yet well known like many other species, just think that the courtship ritual was for the first time described in nature in recent times (Alessandria et al. 2003).

The calculations normally applied can often produce estimation errors, due to a serious defect, due to the different and difficult contactability of individuals.

Populations seem to have a fluctuating character linked in part to non-anthropogenic causes, such as the rigidity of winters and rainfall in spring (Gilbert et al. 2002). We recall that the monitoring of this species is one of the most difficult to put into practice. The daily peaks of activity are concentrated around dawn and, to a lesser extent, immediately after sunset. The time in which to carry out the census must therefore respect these characteristics of its ethogram. The optimal duration of a listening session, carried out in good weather conditions and in the period of maximum activity, should be 10 minutes in high density conditions and 20 minutes in low density conditions, in the latter case doubling the number of exits. The presence of wind and rain decreases or cancels the audibility of the vocalizations by the censor. Considering the rarity of the data on the presence of the Bittern in the area of the Nature Reserves object of this study, naturalist photographers, hunters and visitors to the area were consulted to gather useful information.

### **Study Area**

The Salina dei Monaci and the Palude del Conte, two of the four macro areas that form the

Oriented Regional Nature Reserve of the Eastern Tarantino, of about 1,100 ha, are humid areas behind the dunes of recognized value for both sedentary and migratory wildlife, including their neighbors and partially separated from the village of Torre Colimena, a hamlet of Manduria (Ta) (Figure 3).



Figure 3: Salina monaci, maquis, the village of Torre Colimena, its circular reservoir and the Palude del Conte

The Salina of the Benedictine Monks is the only salt pan on the Ionian coast of Puglia. The adjoining Palude del Conte has been the subject of incisive reclamation works consisting mainly of the construction of a basin and the related channels that connect them to each other and to the sea. Works that we find numerous for much of the Apulian Ionian coast. Their aim was to reduce swamping, which was the cause of malaria epidemics until the middle of the last century. The areas investigated are used by many species of birdlife, among which some of particular value stand out, such as the Flamingo, the rare Bittern, the Bittern, the Frattino, the Seagull, etc.

The 'birds directive' (79/409 / EEC) and the 'Habitat' directive indicate it as a Special Protection

Area (SPA) and the 'Habitat directive' (92/43 / EEC) instead indicates it as a Site of Community Importance ( SIC IT9130001). Inside we can find some habitats of community interest, such as the pioneer vegetation with glasswort, other annual species of muddy and sandy species (Salina dei Monaci site) and reeds (especially fragmeteto, in the Palude del Conte site).

## **Methods**

The method that has been followed is that already set out in the chapter 'Monitoring protocol of the "Botaurus stellaris" species of which we report the operational part.

For the census of the Bittern, considering what has just been said, on the basis of the direct knowledge of the places to be monitored and on the basis of our field experiences, we think that a valid monitoring protocol aimed at this species foresees the use of the 'mapping of territories' technique. through listening points' (which guarantees the best results); moreover, as we will see with much less reliable results, the 'counting on sight of wintering people over the area' can also be used.

**1 - Mapping of the territories through listening points:** the counts in the reproductive period are difficult, since the nests are dispersed, placed at a distance from each other, and are difficult to identify within the marsh vegetation. Numerical estimates of breeding bitterns in an area are only possible based on the location of the territorial males by listening to the song.

The listening points at which monitoring is carried out are selected on the basis of the most suitable environments for the species, just indicated in the introductory part. The probability of contacting a singing individual is density-dependent; the frequency of singing emission is in fact more frequent in areas where there are more males than where there is a single male. In areas

with more than one male singer, to establish the exact number, it is necessary that at least two operators, at the same time, alternate along the edges of the reeds making listening points every 400 meters and that they triangulate the position of the males, marking the direction the distance of origin of the different songs. The minimum distance that prevents us from counting the same subject twice is 200 meters. The repetition of the count in different periods makes us take into account the contactability of the species in different periods. For the use of the data, the highest value of the contacts recorded for each listening point is taken into account (Gibbons et al., 1996). To perform the same listening points in subsequent seasons, it is advisable to note the exact position using GPS location. For this species, nesting takes place mainly within natural or semi-natural wetlands. The species is mainly present in lowland areas.

**Typology.** This bittern monitoring study is of the direct passive type (MDP) and uses an absolute or exhaustive counting (CE) technique. With this technique, estimates on the relative abundance of the species are obtained, if it is integrated with the estimate of the distance, absolute density values can also be produced. Counting by listening points can therefore be practiced without estimating the distance of the individuals contacted by the researcher or with an exact measurement of the distance of each individual contacted from the listening point or by making the measurements fall into predetermined distance classes from the listening point. . Among the surveys made, it is also necessary to note the exact time of emission of the song and the number and characteristics of the booms, useful data to better define the singing activity and to identify the composition of each single boom sequence (boom train; Puglisi 1997) and to evaluate the possible interactions between vocalizers. At the beginning of the season, the number and types of emissions are limited; with the progress of the reproductive season the song diversifies, varies

and assumes various typologies (Pizzani, 2001).

Expected results: Evaluation of the presence / absence of the species in the survey area; estimate of the density of breeding males in the area.

**Periods, times and frequency.** Periods: the period for carrying out the counts in the reeds extends from the beginning of March to mid-May, with a peak in the first half of April, in which it is advisable to concentrate the surveys.

Timetables: listening sessions must be carried out in the two hours before sunrise. It is also possible to monitor at sunset (from half an hour before to one hour after sunset), if you choose this mode you must increase the number of outputs by two.

Frequency: in the most suitable period, the highest probability of contacting the greatest number of Bitterns present is to operate in two listening sessions lasting 10 minutes in areas where more males are known (high density) and four sessions to be 20 minutes in areas where there are single bitterns (low density). The listening time chosen is the result of some variables: the greater the listening time the greater the number of subjects contacted and the greater the possibility that the same subject will be counted twice. The outings did not have a fixed frequency because they had to take into account more limiting elements such as the peaks of summer tourism, bad weather, very rainy and / or windy days.

**Means and tools.** GPS to locate the listening points, compass to identify the direction of origin of the songs. Detailed map of the surveyed area (scale 1: 5,000, 1: 10,000). Voice recorder with unidirectional microphone in order to acquire additional information on songs, verses or vocalizations. For the census of the remaining aquatic birds, a telescope (20 x 60) with a tripod with a fluid head for video shooting, 10 x 50 binoculars and a video camera with 90 x zoom were

used, with the possibility of taking photographs. Also used a Sony camera mod. DSC-H400.

**2 - Counting on sight of wintering people on area:** during the wintering and periods affected by migratory movements, the bitterns are even more difficult to see due to their marked elusiveness and their preference for wetlands with abundant vegetation; therefore the individuals observed during the usual waterfowl census operations are absolutely underestimated.

**Tipology.** This waterfowl monitoring study, extended to all the birds present in the wetland, is of the direct passive type (MDP) and uses the absolute or exhaustive counting (CC) technique.

**Expected results.** Evaluation of the presence / absence of the species in the survey area in the winter and migration period. However, this type of counting does not guarantee a good chance of identifying the species and, in the case of reeds in good condition and extending over 5-10 hectares, the precautionary principle should still be used, not excluding the presence of the species. in case of negative findings.

**Periods, times and frequency.** Periods: it operates during the winter season (from November to February) and migratory (from February to the end of March and from August to October).

Hours: early hours after dawn.

Frequency: bi-weekly outings during the winter season and weekly in the periods affected by migration.

**Means and tools.** Binoculars. Detailed map of the surveyed area, GPS to locate the listening points, compass to identify the direction of origin of the songs. Voice recorder with unidirectional microphone in order to acquire additional information on songs, verses or vocalizations. For the

census of the remaining aquatic birds, a telescope (20 x 60) with a tripod with a fluid head for video shooting, 10 x 50 binoculars and a video camera with 90 x zoom were used, with the possibility of taking photographs. Also used a Sony camera (mod. DSC-H400).

Notes: the calculations must be carried out in good weather conditions, thus avoiding rainy days, even light ones, intense cloudiness and wind, all conditions that decrease or cancel both singing and traveling.

## 2.3 MONITORING RESULTS

Also in the light of personal knowledge of the places being researched, one of the first data that struck us is the constant presence of the ideal habitat for the bittern: the reeds. These typical marsh essences are present both in the Salina dei Monaci and in the Palude del Conte. In this last site are the most present essences; for the purposes of our research, their attractive potential for our target species is high, both because they represent the ideal habitat chosen by the bittern and because it corresponds to the area of the reserves where the anthropic pressure is lower, another essential element for the permanence of this species.

The monitoring work so far has not yet revealed the presence of the bittern. The results of the research were unfortunately heavily penalized by the SARS Covid-19 pandemic that is still ongoing. The blocking of all types of outdoor activities from the beginning of March 2020 until the beginning of May 2020, in fact deprived this monitoring of the data that could be obtained right in the period when the possibility of identifying it is highest. In this regard, a period of research is hoped for evidence that will formalize the presence and possible nesting of the Bittern in the Regional Reserves in question. During the monitoring work, however, we were able to record interesting data that better characterize the conservation value of the wetlands

monitored.

To our amazement we were able to note the constant and abundant presence of a small but important wader, the Fratingo (*Charadrius alexandrinus*). This bird, having entrusted its reproductive success only to mimicry (it lays its eggs on the sand in small depressions of the soil), has therefore linked its survival, in spring summer and in an inversely proportional way, to the human presence. The difficulties encountered by this species are only partially imaginable. We have identified the nests on the beaches of practically the entire territory falling within the Regional Reserves. We believe it is impossible to identify all the nests and their relative safety.



Figure 4: Fratingo recovered from the center of a human footprint on the coast



Figure 5: Fratingo's nest secured with a net and in any case plundered by a predator



Figure 6: *Fratino's nest perimetered on the beach in a classic way*



Figure 7: *chosen the concealment with local material. Result: the crowd of onlookers disappeared, the brood was completed*

Its reproduction is therefore endangered by bathing. In fact, if we think that the hatching period is almost superimposable to the summer period, and that this species prefers the coast to nest, it is easy to understand how high the fragility of the conservation of this species is.

The basin to the east of Salina Monaci, characterized by a very low water level, represents a welcoming site, due to its trophic potential, for many waders. The refectory in this breast feeds and reproduces, finding a very valid alternative to the coast, where the anthropic danger for its reproduction is very high. Although not very far from the bulky summer human presences, this area is able to guarantee a high success in terms of presences and reproductive success.

The census of this species has revealed its importance by making a census: 39 subjects on 25 June, 60 subjects on 29 July and 49 subjects on 9 August! These data are interesting if we consider the rarity of the species and the anthropic disturbance that is not entirely controllable.



Figure 8: Two important points of Salina Monaci: the small island and the south-east area, the first important for nesting and the second for all waders.

By virtue of these data and the abundance of birdlife on the east side of this salt pan, we consider it highly inadvisable to create visit routes on this side (we know for sure a similar idea has already been conceived and wisely blocked).

This stretch, together with the central islet, represent the areas with greater biodiversity and, not surprisingly, those with less human disturbance.

Another valuable species that has managed to reproduce here for the past decade is the Shelduck (*Tadorna tadorna*). For the second consecutive year, at the Omeoterma Wild Fauna First Reception Center, hosted in our Natural Reserves in the municipality of Manduria, and with the health management of the writer, we have welcomed specimens of young shelduck, just in conjunction with the beginning of the migration of broods reproduced in the salt pan.



*Figura 9: Reproduction of the Volpoca in the Salina dei Monaci.*

The breeding site (Figura 9), confirming the above, is almost exclusively the central islet. The small island is also home to a rare colony of about a hundred Fraticelli (*Sternula albifrons*). Despite its limited area, the islet can accommodate dozens of nests; this also because, in addition to the very low anthropogenic disturbance, the trophic areas are often elsewhere (in the case of the Fraticelli the very close sea).

The concept of the importance of limiting anthropogenic disturbance as low as possible for the purposes of safeguarding the wildlife heritage always returns. Shortly before the start of this research, as has been the case for several years, the Flamingos (*Phoenicopterus ruber*) held their courtship rites which in August 2014 produced the first case of nesting (data to be published). We surveyed at least 14 nests with hatching adults.



*Figura 10: Photo from the time of the nesting attempt, in 2016. Some hatching subjects can be seen.*

Considering the late date of spawning, July, this attempt to reproduce is one of the techniques used by flamingos to test the reliability of a new site for reproductive purposes; in fact, these are attempts made by especially young animals removed from the main colonies, as well as well studied by two talented authors (Johnson A. R. Cézilli F. 2007).

Another macro area of the regional natural reserves is represented by the Palude del Conte. This area mainly covered by reeds, and crossed on the outskirts by reclamation canals with steep edges, offers a suitable habitat for the presence of Little Bittern, Bittern, Falco and other species of high conservation value. It also represents an optimal hunting area for the Hawk (*Circus aeruginosus*), often visible in action in these places. The species that we have been able to observe

in this swamp are the Western Marsh Harrier, the Little Bittern, Common Moorhen, the Red-knobbed Coot.

This area, together with others adjacent to the south, is also used as an irreplaceable pre-migratory roost by Starlings (*Sturnus vulgaris*), reaching peaks of at least 20,000 specimens in some years (2018).

## 2.4 STRUCTURE OF THE REED AND PRESENCE OF THE BITTERN

The presence of reeds can be found in a large part of the Marsh del Conte. In the SCI of the Salina dei Monaci they are extremely small and inserted in the vegetation structure surrounding the perimeter area to the north, where the writer, despite the very small size, accidentally observed a subject in a typical 'cane' attitude, in March 2018.

The surface with pure reeds largely covers the site of the Palude del Conte. The reed bed in question has various areas where the vegetation is not young. The flooding of the fragmiteto not always being present represents a limiting factor for the use of the territory by the Bittern. We recall that the swamp in question is crossed by drainage channels, as we can see in the following photo.



Figura 11: Palude del Conte with indication of the water system built last century to avoid swamping and malaria.

Some sectors of the reed bed are at an advanced stage of aging, with abundant necromass. The implementation of a maintenance intervention in rotation, on the sectors that have more mature vegetation, would allow a gradual rejuvenation of the reeds and a qualitative and quantitative increase of the useful area for the bittern.

The reed bed, connecting via fairly steep banks to the drainage canals, does not constitute a useful functional unit for the trophism of this species. Much tighter margins would be useful. Even the depth of the channels (on average just under a meter) does not make it possible for the bittern to capture prey.

### 3 STUDY OF CRITICAL ISSUES AND RELATED MITIGATIONS

#### 3.1 ANTHROPIC DISORDER

It is undoubtedly one of the first problems we encountered in this study. Since the Palude del Conte beach is not easily accessible, it is often not very busy. Especially in spring it is not a nuisance for this area. The flow of visitors in periods of good weather is always high and continuous, thanks to the willingness of flamingos to be approached without major problems.

It should be noted that the strip of sandy land that separates the salt pan from the sea (once crossed by a busy asphalted road, then wisely torn up) can be covered on foot along its entire length; moreover, the beach side is much appreciated by bathers who often intersperse their presence with small excursions towards the salt pan. The maximum peak of human presences is reached during all weekends, in late spring and throughout the summer. The presence of an incomplete fence and the lack of civic sense mean that every day there are human presences in inappropriate places. For the containment of anthropogenic disturbance, we think that the completion of the fences is a valid invitation not to invent paths that are too close to the birdlife.

To confirm what has been said, we have observed that the already existing traits contain visitors well. If on the one hand it is right to contain visitors, on the other it is equally right to put them in a position to observe nature, we believe it is functional through a couple of widening of the path, in continuity with the fence. It is also desirable to arrange structures that allow you to enjoy birdwatching professionally, an increasingly widespread practice but still too often improvised. We think that at least two bulkheads, with a semicircular section, with lateral access, slide, are a good solution as they allow you to observe and photograph the animals from the appropriate slots (on several levels, to allow adults, children and individuals in a wheelchair). Considering the territory it would be desirable to place them on the route only on the pre-existing one, in the most sloping points. This location would make the structures more usable to everyone, less impactful and more resistant to winds.

Few clear and obvious signs clearly visible at the entrances certainly help visitors to behave more respectfully for the environment.

Another effective improvement proposal is the setting up of one / two central islets in the saline, not communicating with each other. Any increase in the number of the Fraticelli colony that already uses the islet for reproduction, would not be in contrast with a possible breeding colony of flamingos; moreover, their feeding, taking place exclusively in the sea, would not overload the saline with pasture animals. Having within this area, a better site suitable for reproduction, already tested in 2014, can increase the chances of having new attempts at reproduction.

The central islet present in the salt pan is home to numerous nesting sites of Little Terns, Black-winged Stilt, Pied Avocet and for once of Flamingos. The numerous nests are concentrated unevenly; they are almost absent on the north half and part of that and east. We noticed the

absence of nests that is caused by the type of margin. Soft and with little vegetation in the south, slightly steeper and with more vegetation in the north. From these data we point out the possibility and the usefulness of making the island margins more subdued by adding marginal material.

### 3.2 NATURALISTIC PHOTOGRAPHERS

The birdlife in the two monitored sites is the subject of relentless photographic hunting, thanks to the charisma exercised by some splendid birds and the small size of the two wetlands. The problem is less important in the Palude del Conte where the reeds, hindering an easy naturalistic photographic practice, are able to keep this type of human presence very low.

There are some photography enthusiasts who professionally practice their passion without disturbing the birds. Many others, Sunday photographers, come to photograph something at all costs. To give an idea of the phenomenon, it should be noted that simple cameras are used, even compact and cellular, so visitors easily tend to get very close, in a vain attempt to bring home some good images.

We find the problem more serious at the Salina dei Monaci than in the rest of the area studied. In the salt pan, photographers, often motivated by easy prey such as flamingos, orbit practically on every side of the wetland, with obvious and serious forms of disturbance to the fauna, especially during nesting. Unruly photographers, sometimes equipped with important cameras ... such as those who managed to repeatedly disturb the work during the I.W.C. of 2015!

To mitigate this aspect, the Reserves periodically activate didactic nature photography courses. A lookout tower has been set up in the salt pan to facilitate this hobby; we also think it is useful

that the Regional Reserves draw up a handbook of the good nature photographer, possibly to be put on the net between the various parks. Another initiative that we believe is useful is to set up paid 'photographic huts'. These are temporary movable mimetic structures which, under the supervision of professionals, organize moments of profitable and harmless stalking aimed at certain species for photographers. This would allow enthusiasts to be present at the right time, in the right place and in the right way to be able to 'embody' good shots, preventing safe forms of disturbance and thus educating to a correct use of the environment.

These initiatives can converge in periodic photographic exhibitions; these meetings, in addition to satisfying the commitment of the growing number of enthusiasts of this hobby, offer good opportunities for knowledge and education.

### 3.3 PATH CONTAINMENT FENCES

The pre-existing fences have proved to be effective containment systems, with a good environmental impact. In fact, the extravasation of visitors coincides with the sections where it is incomplete or only unilateral, as can even be found by viewing the area with Google. In the site of the Palude del Conte, thanks to the stone blocks placed at the entrance gates, it was possible to contain a copious human presence upstream.

It is hoped to always keep the gates to the Palude del Conte closed to cars and to complete the fences of the visit to the Salina dei Monaci.

### 3.4 WATER LEVEL AND ORNITHIC PRESENCES

It has been seen in the course of previous activities, and also confirmed in this monitoring study, that it makes sense to think of a relationship between water level and bird presence.

For the Bittern in particular, it has certainly been shown that if the swamp is constantly flooded by shallow waters (max 30 cm), favorable conditions are created for its stay, feeding and nesting. In the saline, on the other hand, observing the area over the years, we seem to understand that flamingos, in particular, decrease / abandon the saline even when the water level drops too much (30 cm). The high levels of water (max 80 cm, often in winter), on the contrary, do not seem to influence their presence, also because their long neck still guarantees them to feed. The concomitance of shallow water and abundant human presence does not make us understand, in the absence of studies such as quantities on zooplankton, to whom to charge for their decrease or total removal. To mitigate the criticality of the absence or the lack of water in the Palude del Conte, based on the knowledge of the peculiar characteristics of the territory, we hypothesized a possible closure, by occluding the stretch of the canal up to the point indicated by the arrow in the figure. Since this stretch of the channel is in a central position with respect to the marsh, the remaining channel, from the closure going towards the beach, is well suited as a foraging area for the Bittern.

This trunk of the canal by not allowing the water to flow will contribute to a moderate degree of swamping of the surrounding areas. If its bottom is too deep, it could partially fill with material that does not allow the vegetation to take root, thus transforming it into a clear water central to the swamp, an aspect that would greatly increase the possibility of nesting of our ardeide. The marsh harrier, which has similar reproductive needs, could also take advantage of it. Another use is to anchor barges, with soft edges, centrally in the other deeper channels. In this way, potential useful sites would be offered which are very attractive for a possible nesting. This would eliminate the obstacle that the drainage canals currently present, the too steep margins that allow the

trophic activity and nesting of the bittern with difficulty.

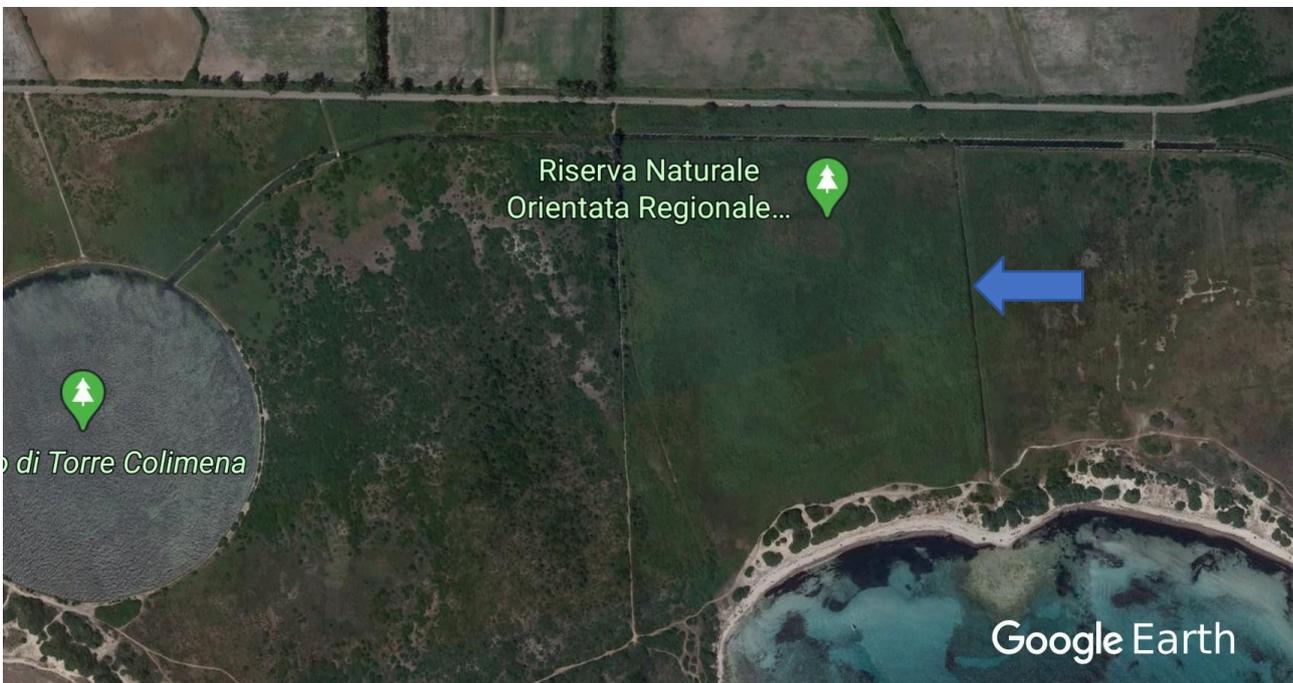


Figure 12

The regulation of the water level in the saline, on the other hand, could be remedied by the re-installation and use of a bulkhead, of which the ancient installation site remains, which combined with a simple hygrometric rod and the study of the tides, could rationalize the management of the body. salt water.

**3.5 MAINTENANCE OF THE FUNCTIONALITY OF THE REED ENVIRONMENT**

The interventions aimed at favoring the functionality of the fragmiteto, the active maintenance of a not advanced stage of ripening, the maintenance could favor the reproduction of the Bittern in reeds. The expansion of the reed bed sectors to sizes greater than 15/20 has continuous and in the most rounded shape possible can represent a decisive intervention for increasing the probability of nesting of the species. The interventions of extension and modeling of the shape of the reed bed sectors can also favor the nesting of the Marsh Harrier sensitive to the same

problem.

### 3.6 CONSTRUCTION OF VEGETABLE BANKS OR LOW WATER CANALS

The presence of vegetated banks that degrade towards the reference basins of the wetlands, as well as of low and clear water channels inside the reed bed sectors are essential elements to allow the foraging of the Bittern, which requires shielding conditions even in the phases of supply. The creation of these elements within reeds already of adequate size constitutes a major intervention to encourage the reproduction of the species. The planting of indigenous species such as *Typha angustifolia*, *Typha latifolia* or large sedges (eg *Carex elata*, *Carex pendula*, *Carex acutiformis*) in areas of connection between reed bed areas and perennially flooded areas could constitute a useful intervention to favor the foraging of the species. The presence of channels and clear internal to the reeds can also favor the presence of the Ferruginous Duck and other species of conservation interest. Furthermore, the creation of clear waters with low water adjacent to or inside the reeds and easily accessible canals are two of the most commonly used and successful measures in the management of wetlands to favor the presence of the bittern.

### 3.7 MAINTENANCE OF THE WATER LEVEL IN THE REPRODUCTION SITES

The ideal water level in the nesting sites should never be less than 5-10 cm and not exceed 30 cm. The plots surrounding the nest location should maintain, at least in rotation, a minimum level of flooding. Due to the canal built during the reclamation works, the site of the Palude del Conte does not always guarantee the minimum level of flooding. This is one of the reasons why in other regions rice fields are often chosen as a suitable habitat for nesting.

### 3.8 CREATION OF GROOVES FOR THE MAINTENANCE OF WATER

A technique used in the paddy field is the creation of large furrows (width > 1m and depth >

50cm) in the plots of areas with a high vocation for the reproduction of the Bittern. In that context it is a highly desirable intervention, as it guarantees the continuous availability of food (amphibians) during the breeding season. The realization of this typology of furrows also favors the numerous species of Ardeidae present in Annex 1 of the Birds Directive which can be better induced to nest in these areas.

The creation of the furrows must be done before the start of each breeding season. It is conceivable to extrapolate this technique and apply it to our swamps, reducing their depth.

The possible advantages of this technique are being able to reconstruct an environment useful for resting and foraging the Bittern, with a low-cost construction work.

### 3.9 ROUTES AND RELATIVE BRIDGES

The drainage channels are surmounted by bridges for vehicles equipped with sturdy masonry parapets. We think that by simply completing (in height and width) the parapets with suitable wooden structures equipped with slits of various heights, it is possible to obtain useful observation points for avifauna (bird watching) from which the drainage canals can be seen in their length. and therefore any fauna that they welcome, in total safety and respect for nature, that is, minimizing any disturbance that we may possibly cause to the environment that hosts us.

The structures can be made more functional if integrated by special systems, fixed or temporary, of video footage, usable by enthusiasts or scholars. We think it is not advisable to build classic watch towers since they could, with their presence, and in particular if built in the center of the Palude del Conte, certainly disturb the delicate habitat of this site.

### 3.10 INADVISABLE INTERVENTIONS

Thinking of the extension of the reed bed area as an element to favor the nesting of the Bittern,

it is useless to think of marginal strips of territory covered with these essences, in fact the reed bed borders, even of considerable length, are not useful for nesting.

Another scenario that would decrease the attractive potential for elusive species such as the Bittern is the encouragement of the viability of the entire site of the Conte Marsh, currently wisely preserved. Based on the data collected, in our opinion, it emerges that some possible initiatives, if ever planned, are to be considered absolutely inadvisable. A possible route-visit along the east side of the salt pan, consisting of intact Mediterranean scrub up to 3/4 meters high, even if not close to the edges and well camouflaged, we are sure that it would eliminate the vital buffer effect between the salt and the already near the inhabited center. In this case, what is currently one of the banks most frequented by birds, in addition to the islet, the one to the east would be compromised; in doing so, the site would be completely surrounded by visitors, from all sides, with the obvious consequences.

### 3.11 CONCLUSIONS

In conclusion, in this monitoring study, after discussing the best technique to be adopted for its monitoring, we have not proven the existence of the target species sought.

However, we have collected news and documents on the existence of the species in the past. The search for its presence is particularly laborious and, let us remember, it is recognized as one of the most demanding forms of monitoring that exist. Considering that the study has been deprived of censuses that can be carried out in the best period (from March onwards) due to the viral pandemic from Covid 19, it is hoped that the study period will be extended now that it is possible to do outdoor activities. In this work, moreover, in the light of the knowledge and further frequentation of the places, the territorial characteristics were assessed by evaluating their extent

or ways of strengthening them in order to make the wetlands of the R.O.L.T.O. more hospitable to host this rare important and elusive bird.

Few actions have also been indicated which according to our point of view, at present, are inadvisable or harmful.

### 3.12 BIBLIOGRAFY

Adamo, M.C., Puglisi, L., Baldaccini, N.E. 2004. Factors affecting Bittern *Botaurus stellaris* distribution in a Mediterranean wetland. *Bird Conserv. Int.* 14: 153-164.

Alessandria G, Carpegna F, Della Toffola M 2003. Vocalizations and courtship display of the Bittern *Botaurus stellaris*. *Bird Study* 50: 182-184.

Amat JA, Herrera CM 1978. Alimentación de la Garza Imperial (*Ardea purpurea*) en la marismas del Guadalquivir durante el periodo de nidificación. *Ardeola* 24: 95-104.

Baker K 1993. Identification Guide to European Non-Passerines: BTO Guide 24. Thetford, British Trust for Ornithology.

Bibby CJ, Burgess ND, Hill DA 1992. Bird census techniques. London, Academic Press. BirdLife International 2000. Threatened Birds of the World. Barcelona/Cambridge, Lynx Edicions/BirdLife International.

BirdLife International 2004. Birds in the European Union: a status assessment. Wageningen: BirdLife International.

Celada C, Bogliani G 1993. Breeding bird communities in fragmented wetlands. *Bollettino di Zoologia* 60: 73-80.

Cramp S, Simmons KEL (eds) 1980. The Birds of the Western Palearctic. Oxford, Oxford University Press.

Cramp, S., Simmons, K.E.L. (eds) 1980. The Birds of the Western Palearctic. Oxford: Oxford University Press.

Crawley MJ 1993. GLIM for Ecologists. Oxford, Blackwell Scientific Publications. Czech HA, Parson KC 2002. Agricultural wetlands and waterbirds: A review. *Waterbirds* 25: 56-65.

Dmitrenok M, Demongin L, Zhurauliov D, 2005. Three cases of replacement clutches in the Great Bittern *Botaurus stellaris*. *Ardea* 93: 271-274.

Elphick CS 2000. Functional equivalency between ricefields and semi-matural wetlands habitats. *Conservation Biology* 14: 181-191.

Erwin RM 1996. The relevance of the Mediterranean region to colonial waterbird conservation. *Colonial Waterbirds* 19: 1-11.

Fasola M, Alieri R 1992. Conservation of heronry (Ardeidae) sites in north Italian agricultural landscapes. *Biological Conservation* 62: 219-228.

Fasola M, Barbieri F 1978. Factors affecting the distribution of heronries in Northern Italy. *Ibis* 120: 337-340.

Fasola M, Canova L, Saino N 1996. Rice fields support a large portion of herons breeding in the Mediterranean region. *Colonial Waterbirds* 19 (Special Publication 1): 129-134.

Fasola M, Galeotti P, Dai N, Dong Y, Zhang Y In stampa. Large numbers of breeding egrets and herons in China. *Waterbirds*.

Fasola M, Ruiz X 1996. The value of ricefields as substitutes for natural wetlands for waterbirds in the Mediterranean region. *Colonial Waterbirds* 19 (Special Publication 1): 122-128.

Fasola M, Ruiz X 1997. Rice farming and waterbirds: integrated management in an artificial landscape. In Pain DJ, Pienkowski MW (eds). *Farming and Birds in Europe*. London, Academic Press. Pp 210-235.

Fasola, M., Alieri, R. 1992. Conservation of heronry (Ardeidae) sites in north Italian agricultural landscapes. *Biol. Conserv.* 62: 219-228.

Fasola, M., Ruiz, X. 1997. Rice farming and waterbirds: integrated management in an artificial landscape. In Pain, D.J., Pienkowski, M.W. (eds). *Farming and Birds in Europe*: 210-235. London: Academic Press.

Finlayson CM, Hollis GE, Davis TJ (eds) 1992. *Managing Mediterranean wetlands and their birds*. Slimbridge, International Waterfowl and Wetlands Research Bureau (Special Publication 20).

Fowler J, Cohen L 2002. *Statistica per ornitologi e naturalisti*. Padova, Franco Muzzio Editore.

Gaston KJ, Blackburn TM, Goldewijk KK 2003. Habitat conversion and global avian biodiversity loss. *Proceedings of the Royal Society of London B* 270: 1293-1300.

Géroutet P 1978. *Grand échassiers, gallinacés et râles d'Europe*. Neuchâtel, Delachaux et Niestlé.

Gibbs JP, Melvin SM 1993. Call-response survey for monitoring breeding waterbirds. *Journal of Wildlife Management* 57: 27-34.

Gibbons D. W., Hill D., Sutherland W. J., 1996. *Birds. In.: Sutherland W. J. (Eds.). Ecological census techniques: a handbook*. Cambridge University Press.

Gibbs JP, Melvin SM 1997. Power to detect trends in waterbird abundance with callresponse surveys. *Journal of Wildlife Management* 61: 1262-1267.

Gilbert G 2002. The status and habitat of Spotted Crakes *Porzana porzana* in Britain in 1999. *Bird Study* 49: 79-86.

Gilbert G, McGregor PK, Tyler G 1994. Vocal individuality as a census tool: practical consideration illustrated by a study of two rare species. *Journal of Field Ornithology* 65: 335-348.

Gilbert G, Tyler GA, Smith KW 2002. Local annual survival of booming male Great Bittern *Botaurus stellaris* in Britain, in the period 1990-1999. *Ibis* 144: 51-61.

Gilbert, G., Tyler, G.A., Dunn, C.J., Smith, K.W. 2005b. Nesting habitat selection by bitterns *Botaurus stellaris* in Britain and the implication for wetland management. *Biol. Conserv.* 124: 547-553.

Gilbert, G., Tyler, G.A., Smith, K.W. 2002. Local annual survival of booming male Great Bittern *Botaurus stellaris* in Britain, in the period 1990-1999. *Ibis* 144: 51-61.

Gilbert, G., Tyler, G.A., Smith, K.W. 2003. Nestling diet and fishing preferences of Bitterns *Botaurus stellaris* in Britain. *Ardea* 91: 35-44.

Gilbert, G., Tyler, G.A., Smith, K.W. 2005a. Behaviour, home range size and habitat use by male Great Bitterns *Botaurus stellaris* in Britain. *Ibis* 147: 533-543.

Jones J 2001. Habitat Selection Studies in Avian Ecology: A Critical Review. *Auk* 118: 557-562.

Johnson A. R. Cézilli F. 2007. The greayer Flamingo. T & A.D. Poyser: 1–328.

Jonsson L 1992. *Birds of Europe, with North Africa and the Middle East*. London, C Helm / A & C Black.

Kenward R., 1988. *Wildlife Radio Tagging. Equipment, Field Techniques and Data Analysis*.

Lansdown RV, Rajanathan R 1993. Some aspects of the ecology of *Ixobrychus* bitterns nesting in Malaysia ricefields. *Colonial Waterbirds* 16: 98-101.

Lefebvre G, Poulin B 2003. Accuracy of bittern location by acoustic triangulation. *Journal of Field Ornithology* 74: 305-311.

Liuzzi C., Mastropasqua F., Todisco S., 2013. Avifauna pugliese...130 anni dopo. Ed. Favia, Bari. Pp. 332

Longoni, V. 2004. Selezione dell'habitat nel tarabuso (*Botaurus stellaris*) nidificante in risaia. Università degli Studi di Pavia, Tesi di Laurea.

Mallord JW, Tyler GA, Gilbert G, Smith KW 2000. The first case of successful double brooding in the Great Bittern *Botaurus stellaris*. *Ibis* 142: 672-675.

Martínez-Vilalta A, Motis B 1992. Family Ardeidae (Hérons) In Del Hoyo J, Elliot A, Sargatal J (eds). Handbook of the Birds of the World, Volume I. Barcelona, Lynx Ediciones. Pp 376-429.

Newbery P, Schäffer N, Smith K 2000. European Union Species Action Plan. Bittern (*Botaurus stellaris*). Bruxelles, Birdlife International/European Commission.

Pain DJ, Dixon J 1997. Why Farming and Birds in Europe? In Pain DJ, Pienkowski MW (eds). Farming and Birds in Europe. London, Academic Press. Pp 1-24.

Pizzani M., Renzini F., B. Ragni. 2001, *Avocetta* 25: 235.

Polak M, 2006. Booming activity of male Bitterns *Botaurus stellaris* in relation to reproductive cycle and harem size. *Ornis Fennica* 83: 27-33.

Poulin B, Lefebvre G 2003. Optimal sampling of booming Bitterns *Botaurus stellaris*. *Ornis Fennica* 80: 11-20.

Poulin B, Lefebvre G, Mathevet R 2005. Habitat selection by booming bitterns *Botaurus stellaris* in French mediterranean reed-beds. *Oryx* 39: 265-274.

Puglisi L, Cima O, Baldaccini NE 1997. A study of the seasonal booming activity of the Bittern *Botaurus stellaris*; what is the biological significance of the booms? *Ibis* 139: 638- 645.

Puglisi, L., Adamo, M.C., Baldaccini, N.E. 2003a. Spatial behaviour of radio-tagged Eurasian bitterns *Botaurus stellaris*. *Avian Science*. 3: 133-143.

Puglisi, L., Adamo, M.C., Baldaccini, N.E. 2003b. Materiali per una strategia di conservazione del tarabuso *Botaurus stellaris* nidificante in Italia. *Avocetta* 27: 129.

Puglisi, L., Adamo, M.C., Baldaccini, N.E. 2005. Man-induced habitat changes and sensitive species: a GIS approach to the Eurasian Bittern (*Botaurus stellaris*) distribution in a mediterranean wetland. *Biodivers. Conserv.* 14: 1909-1922.

Puglisi L., Cima O., Baldaccini E. 1997. *Ibis*, 139: 638-645.

Ruiz X 1985. An analysis of the diet of cattle egrets in the Ebro Delta, Spain. *Ardea* 73: 49-60.

Self M 2005. A review of management for fish and bitterns, *Botaurus stellaris*, in wetland reserves. *Fisheries management and ecology* 12: 387-394.

Sergio F, Bogliani G 2000. Hobby nest-site selection and productivity in relation to intensive agriculture and forestry. *Journal of Wildlife Management* 64: 637-646.

Tourenq C, Bennetts RE, Kowalski H, Vialet E, Lucchesi JL, Kayser Y, Isenmann 2001.

Are ricefields a good alternative to natural marshes for waterbird communities in the

Camargue, southern France? *Biological Conservation* 100: 335-343.

Tourenq C, Sadoul N, Beck N, Mesléard F, Martin JL 2003. Effects of cropping practices on the use of rice fields by waterbirds in the Camargue, France. *Agriculture Ecosystem & Environment* 95: 543-549.

Tucker GM, Evans MI 1997. Habitats for birds in Europe: a conservation strategy for the wider environment. Cambridge, BirdLife International.

Tucker GM, Heat MF 1994. Birds in Europe: their conservation status. Cambridge, BirdLife International.

Tyler GA, Smith KW, Burges DJ 1998. Reedbed management and breeding bitterns *Botaurus stellaris* in the UK. *Biological Conservation* 86: 257-266.

Voisin C 1991. The herons of Europe. London, T&AD Poyser. Wilson EO 1988. Biodiversity. Washington, National Academic Press.

Wood PJ, Greenwood MT, Agnew MD 2003. Pond biodiversity and habitat loss in the UK. *Area* 35: 206-216.

Zhijun M, Bo L, Bin Z, Kai J, Shimi n T, Jiakuan C 2004. Are artificial wetlands good alternatives to natural wetlands for waterbirds? A case study on Chongming Island, China. *Biodiversity and Conservation* 13: 333-350.



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