

**AGRO-BIODIVERSITY INDICATORS FOR POLICY EVALUATION: THE  
EXPERIENCE OF EMILIA-ROMAGNA (ITALY)**

**Gianfranco De Geronimo<sup>1</sup>, Franco Marchesi<sup>1</sup>, Roberto Tinarelli<sup>1</sup>**

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<sup>1</sup> Emilia-Romagna Administrative Region, Italy.

## **Agro-biodiversity indicators for policy evaluation: the experience of Emilia-Romagna (Italy)**

Gianfranco De Geronimo, Franco Marchesi, Roberto Tinarelli

### **Abstract**

To act in agreement with the Regulation CE 746/96 a monitoring programme of Agri-environment regional measures started in 1996.

Environmental effects of the measures which foresee the conservation and the restoration of habitats for wild flora and fauna with particular attention for species reported by Directives 92/43 and 79/409 were studied by the CRPV (Centre for Agriculture Plant Production Research and Experimentation) for the Regional Administration.

The indicators to utilize were defined in according to the indication given by STAR Committee (cfr. Work Document VI/3872/97) and choosing those for which a reliable collection of data on the field was possible.

The indicators aimed to evaluate the biodiversity were:

- Plant communities conserved/restored
- Presence of threatened and/or rare vegetable species
- Bird diversity and bird counts (especially of breeding populations)
- Presence of bird species of community interest (Dir. 79/409/EEC)
- Breeding success (especially of birds)
- Presence of other animal and plant species of community interest (Dir. 92/43/EEC)

During the second year of monitoring activities, the indicators allowed the collection of useful and necessary data to improve the formalities of application of agri-environment measures followed by farmers. In the following year as further indicator was considered “the influence on animal and plant communities of the surrounding areas”.

This monitoring programme had been carried out for five years and produced a lot of informations which allowed to confirm and to improve two kinds of measures and to exclude a third one because not able to reach the fixed targets.

The experience carried out in Emilia-Romagna confirms the relevance of monitoring activities on the field for an effective evaluation of environmental effects of agri-environment regional measures. The interpretation of data given by indicators has been effective because the general targets of the agri-environment measures were clear and at the same time because the related indicators regarded specific targets.

### **Habitats for biodiversity conservation selected by the Regional Agri-environment Schemes**

Agri-environment measures aimed at the biodiversity conservation in Emilia Romagna (Northern Italy) by means of the involvement of farmers are focused on conservation and/or restoration of the habitats which were very widespread and more characteristic in the regional landscape in the plain until 1900.

Two main categories of habitat were considered in the framework of agri-environment measures aimed at the biodiversity conservation:

- natural habitat as permanent wetlands, marshy meadows, permanent meadows with scrub patches suitable for wild fauna and flora,
- typical countryside elements of the traditional rural landscape and of the agri-ecosystem.

In the second half of the XIX century there were about 188.000 hectares of wetlands in Emilia-Romagna , chiefly in the eastern provinces. Their drainage was made to obtain new land for cultivations between the end of 1800 and the first half of XX Century. At the present there are about 28.000 hectares of wetlands, mainly of dammed brackish

ponds and coastal lagoons; freshwater wetlands disappeared almost completely and were replaced by new kind of wetlands as fish farms, ponds for fishing and hunting, rice fields, ponds of sugar refineries .

The typical countryside elements as hedges, small woods, tree lines supporting vineyards, ponds, ponds for hemp fibre working were man-made and their origin is strictly correlated to the methods of cultivation carried on for centuries and sometimes for millennia as tree lines supporting vineyards. The destruction of the above semi natural elements happened mainly in the period 1950-1980 as a consequence of the agriculture intensification.

### **Measures for biodiversity conservation in the Regional Agri-environment Schemes**

The measures adopted by the Regional Agri-environment Schemes set up with the application of Regulation ECC No 2078/92 and the following Regulation EC No 1257/99 were aimed at:

- restoration of several kind of habitat, mainly freshwater wetlands, for wild fauna and flora on set aside fields for twenty years,
- conservation and restoration of the typical countryside natural and semi-natural elements.

In particular the above schemes foresee two measures for biodiversity conservation.

One, lasting 5 years, has been applied to about 3.500 hectares until 1999 and is aimed at the conservation (900 hectares) and/or the restoration (2.600 hectares) of natural and semi-natural habitats and features of the agri-ecosystem as hedges, small woods, ancient tree lines supporting vineyards, ponds, ponds for hemp fibre production; a total of 36.000 hectares of farms have been interested by the application of the measures

The second one, lasting 20 years, has been applied to about 4.200 hectares until 2000 and is aimed at the creation of habitats for the survival and the reproduction of wild flora and fauna. This measure in particular has already given good results from the ecological point of view; up to the period 2000-2001 the following habitat have been created:

- about 1.100 hectares of permanent wetlands (freshwater marshes having 75 % of their surface permanently submerged) allowing the presence of many waterfowl species, amphibians, reptiles as European pond *Emys orbicularis*, typical emergent and submerged vegetation;
- about 1.900 hectares of marshy meadows (including temporary and/or seasonal floodplains and meadows) where meadows and ponds flooded at least for 6 months every year and on 50 % of their surface allowing the presence of habitat particularly appreciated by geese and waders both breeding and migrants as Black-winged Stilt *Himantopus himantopus*, Ruff *Philomachus pugnax*, Green Sandpiper *Tringa glareola*, Golden Plover *Pluvialis apricaria* and Black - tailed Godwit *Limosa limosa*;
- about 1.200 hectares of permanent meadows with scrub patches set in rows or like the spots on a leopard; this kind of habitat is created often closed to marshy meadows and/or permanent wetlands and is complementary to the formers from the ecological point of view.

In all the above kind of habitat, the management of vegetation may be carried out only after 10 August until 28 February to permit the breeding success.

Both measures have mainly been applied on the plain where suitable habitats for wild flora and fauna were very scarce. The creation ex novo on the plain of about 2.300 hectares of hedges, small woods and ponds, 3.000 hectares of permanent wetlands and marshy meadows and 800 hectares of permanent meadows with scrub patches allowed the

establishment and the increase of ecological networks and the acquisition of knowledge on suitable and better methods to create and manage habitat for wild flora and fauna by farmers.

The targets of the measure aimed at the conservation and/or the restoration of typical countryside elements of the traditional rural landscape and of the agri-ecosystem are:

- to encourage the conservation and restoration of the 'key features' of the traditional agricultural landscape and of those features of the agri-ecosystem which are of primary importance for wild fauna and essential for the migration, geographical distribution and genetic exchange of wild species;
- to contribute to the protection of the soil from erosion and reduce the washing out and leaching of nitrates;
- to contribute to the application of the Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora by means of conservation or restoration of habitats, promoting in particular the management of those features of the landscape which are of primary importance for wild fauna and flora;
- to contribute to the application of the Directive 79/409/EEC on the Conservation of wild birds by means of preservation, conservation or restoration of a sufficient variety and area of habitat for all species of wild birds.

The targets of the measure aimed at the restoration of natural habitat as permanent wetlands, marshy meadows, permanent meadows with scrub patches suitable for wild fauna and flora on set aside fields for twenty years are:

- the creation and subsequent conservation of biotopes which can constitute the habitat of species of wild flora and fauna;
- the restoration of wetlands, in particular in those areas which are morphologically depressed position;
- the creation of habitats which contribute to the conservation and the protection of water quality;
- to achieve the aims of Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora by means of conservation or restoration of habitats, promoting in particular the management of those features of the landscape which are of primary importance for wild fauna and flora;
- to achieve the aims of Directive 79/409/EEC concerning the adoption of measures aimed at restoring destroyed biotopes and creating biotopes, particularly those suitable to guarantee survival and breeding of birds species reported in Annex I to the above-mentioned Directive.

### **Monitoring programme to evaluate environmental effects of the measures aimed at biodiversity conservation**

Since the third year (1996) of application in Emilia-Romagna of the Regulation EEC No 2078/92, a monitoring programme to evaluate environmental effects of the above mentioned measures was carried out in compliance with the terms of Art. 16 of Regulation EEC No 746/96, which laid down that Member States (the Regions in Italy) shall be responsible to evaluate agri-environment measures in order to “facilitate, if necessary, the adjustment of the agri-environment measures on the basis of the needs that come to light during the implementation”; it also laid down that this evaluation must be related to the socio-economic, agricultural and environmental aspects and be defined on the basis of trends and features of the area of application. Member States are required to inform the Commission about plans, methods and results of monitoring and evaluation activities carried out for the agri-environment measures.

In particular, concerning the measures laid down for the conservation and the restoration of habitat suitable for wild flora and fauna with particular attention to species of community interest, the monitoring activities have been carried out by the CRPV (Centre for Agriculture Plant Production Research and Experimentation) for the Agriculture Councilor. So the Regional Administration give timely application at the Art. 16 of Regulation EEC No 746/96.

The **indicators** aimed to evaluate the biodiversity conservation were determined according to the targets fixed by each measure and to the information reported in Part A (Monitoring and Evaluation) of Working Paper VI/3872/97 of the STAR Committee on the state of implementation of EEC Regulations 2078/92 and 746/96.

The indicators aimed to evaluate the biodiversity conservation are:

- Plant communities conserved/restored
- Presence of threatened and/or rare vegetable species
- Bird diversity and bird counts (especially of breeding populations)
- Presence of bird species of community interest (Dir. 79/409/CEE)
- Breeding success (especially of birds)
- Presence of other animal and plant species of community interest (Dir. 92/43/CEE)
- Influence on animal and plant communities of the surrounding areas (indicator introduced from 1998)

Useful information to make a choice of the biotic and abiotic aspects on which to focus the attention during environmental monitoring activities are also provided by Directives EEC/43/92 (better known as the “Habitat Directive”) and EEC/409/79 (Directive on the Conservation of Wild Birds), which represent the important legislative strongholds of the European Union in environmental matters.

Among the animal and plant species listed in the Annexes to the above mentioned Directives, what resulted more favoured by the habitat selected with the measures of the Agri-environment Schemes are the birds, and these are accordingly the biotic component on which the attention is primarily to be focused to verify that the targets of Community environmental legislation have been achieved.

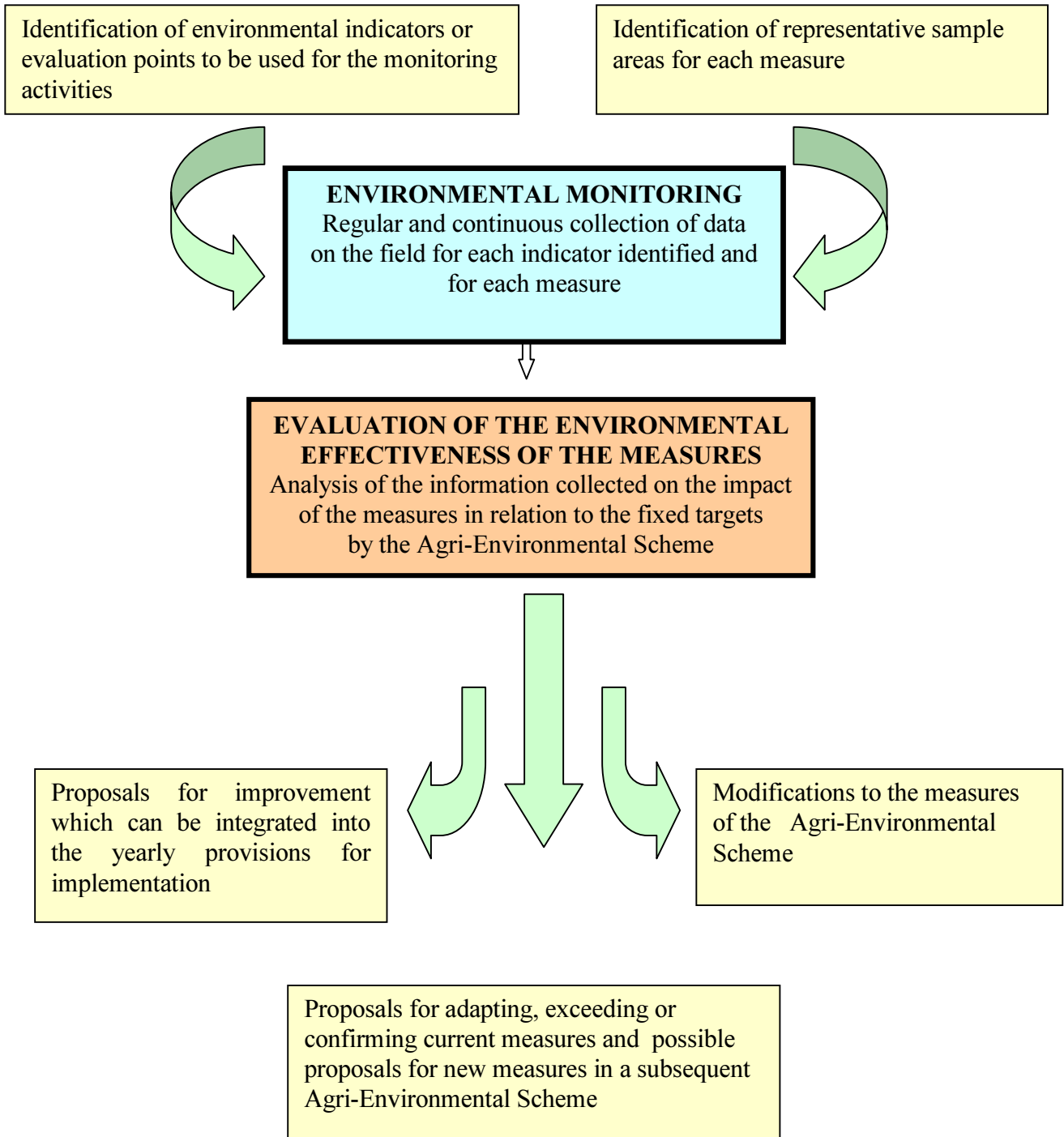
It is well known in the case of birds that they are an useful model in the applied ecology to study composition, structure and functions of animal and plant communities because:

- (1) they are homoeothermic vertebrates able to occupy any trophic level;
- (2) by means of their great capacity to perceive habitat variations, they are able, through their mobility, to react instantly to any change in the environment;
- (3) their size and way of life make them accessible to researchers who, using so-called ‘field experience,’ can determine their presence and count them more easily than other classes of vertebrates such as amphibians, reptiles and mammals.

It should also be pointed out that the community of **breeding birds**, made up of species which carry on a vital part of their biological cycle in a specific environment and have an exclusive, and particularly significant relationship in ecological terms with it, is considered one of the most powerful indicators vis-à-vis other communities composed of winter, summer or migrating species which can visit the same area for shorter periods and/or do not depend exclusively on a particular Habitat.

The indicator “influence on animal and plant communities of the surrounding areas” has been introduced in 1998 and has been assessed by means of species inventories and population counts (mainly birds) of the species present in the surrounding areas.

# ORGANIZATION AND AIMS OF MONITORING AND EVALUATION ACTIVITIES OF ENVIRONMENTAL EFFECTS OF AGRI-ENVIRONMENT MEASURES



## Methods

For each sample area the coverage and the development of different kinds of vegetation (grasses, shrubs, trees) has been studied according to the different methods to realize and to manage the habitat foreseen by the agri-environment measures, with particular attention to the protection and to the increasing of wild fauna.

For every sample area have been produced:

- the list of vertebrates animal species recorded during the year, with particular attention to the bird reported in the Annex I of the 79/409/EEC Directive and to the species of Community interest reported in Annex II and Annex IV of the 92/43/EEC Directive;
- the list of some taxa of plant species including species of Community interest reported in Annex II and Annex IV of the 92/43/EEC Directive and species rare and/or threatened in Emilia-Romagna;
- the population census of the different bird species which use the sample areas to feed, to breed, to roost, with particular attention to the raptors and to the species whose presence gives information about desired habitat features;
- the diversity index of bird species breeding in wetlands;
- the breeding success (evaluated as positive or negative according to the presence of acceptable numbers of fledged young for each species) recorded in every sample areas for birds, herps and amphibians;
- the evaluation of recorded animal species and spontaneous plants according to different kind of created habitat, management measures, elapsed time after habitat creation, already existing biotopes close to the created habitat.

The data collected for every indicator in each sample area have been compared with the situation before the application of the measures. Useful indications have also been obtained by means of comparison of the data of different sample areas.

It is important to highlight that:

- there were not bibliographical references and former values as species richness, individual and breeding pairs density per hectare etc., useful for comparison with the collected data because in the Po plain habitats similar to those created or restored disappeared many decades ago or are very few and with different management methods and economic functions;
- to assess the richness of all animal and plant species in every sample area would be very expensive and scarcely significant because the presence of many taxa in restored habitats (e.g. aquatic plants and amphibians) depends on factors (location, extent, distance from already existing biotopes etc..) not correlated with the methods of creation and management of habitats;
- the chosen indicators resulted cheap and easy to apply in a standardized way in large and numerous sample areas.

## **The most relevant results of the monitoring activities**

The most relevant results of the monitoring activities regarding birds.

### **Measure aimed at the conservation and/or the restoration of typical countryside elements of the traditional rural landscape and of the agri-ecosystem**

Among bird species of community interest, found in the sample areas where the target of the agri-environment measure was the conservation of hedges and tree lines both in plain and in hill-mountain, the only one is the Red-backed Shrike *Lanius collurio* that turned out as present and breeding in almost all the sample areas. For the protection and the increase of this species, in strong decrease in all Europe, the application on wide scale of the agri-environment measure foreseen by the Regional Schemes would be very important, since several researches have evidenced that the decrease of the population in years '60 and '70 depended on the hedges destruction mainly.

Concerning the conservation of rare and/or threatened plant species, the application of the measure has allowed to the safeguard in nearly all the sample areas of arboreal and shrubby native specimens of species become rare in plain like *Frangula alnus*, *Rhamnus catharticus*, *Quercus robur*, *Fraxinus angustifolia*.

Moreover the application of the measure resulted of fundamental importance in order to arrest the landscape degradation in the plain zones characterized by a progressive destruction of the traditional natural and semi-natural elements of the rural landscape (ponds, tree lines supporting vineyards, hedges and ponds for hemp fibre working in particular). Instead the application of the measure resulted useful but not determining for the biodiversity conservation and the safeguard of the rural landscape in hill and mountain still characterized by a sufficient dissemination of natural elements as hedges and small woods.

It was clear also that the possibility to achieve meaningful results is correlated to the duration of the measure commitments taken by farmers that therefore should be at least ten years.

### **Measure aimed at the restoration of natural habitat as permanent wetlands, marshy meadows, permanent meadows with scrub patches suitable for wild fauna and flora on set aside fields for twenty years**

All three kinds of natural habitats whose measure foresee the restoration gave good results for the biodiversity conservation giving consequently application to 92/43/EEC and 79/409/EEC Directives.

In particular data collected with monitoring activities confirm the fundamental role of restored permanent wetlands and marshy meadows for a fast and effective increase of biodiversity in plain, favouring rare and threatened animal and plant species.

Concerning Sites of Community Importance (SCI) and Special Protection Areas (SPA) designed respectively by 92/43/EEC and 79/409/EEC Directives, habitat restored on set aside fields for twenty years interested almost all SCI and SPA of Emilia-Romagna plain with cultivated areas and contribute to enlarge already existing biotopes.

The most relevant results of the monitoring activities carried on this measure regard birds, waterfowl in particular. The most interesting results about birds recorded in restored wetlands with the Agri environment Schemes are summarized in tables 1 and 2. Many species of community interest (reported in Annex I of 79/409/EEC Directive) have been regularly recorded, some of them breeding too, in restored habitats.

For 13 waterfowl species the population breeding in restored wetlands range between 20% and 100% of the total population breeding in Emilia-Romagna Region; in the case of Collared pratincoles and Black-tailed godwits, the wet-

lands created through Regional Agri-environment Schemes constitute, indeed, the only regional breeding sites and some of the few Italian breeding sites.

In 2000 about 40% of the total surface of permanent wetlands and marshy meadows has been monitored.

Concerning aquatic plants and some animal species as amphibians and reptiles which have a lower capability to spread over the territory, if compared to birds and that disappeared in huge areas, their natural colonization of the restored wetlands is affected by the scarcity of ecological corridors and thus it is important that the duration of the measure commitments taken by farmers remain twenty years.

For the restored wetlands it is important to underline also the functions as natural water quality improvement and storage for storm or flood waters they may have.

Restored wetlands close or contiguous to existing biotopes generated often complementary habitat conditions (e.g. marshy meadows with low water level close to permanent marshes with high water level ) increasing the overall number of breeding birds.

The methods of establishing habitats resulted important but even more so the observance of suitable periods of time and methods of managing vegetation and water levels. In fact restored wetlands in hunting areas resulted to have an higher number of breeding bird species than restored wetlands within protected areas due to the usually lower level of management practices in the last one.

The factors which more influence richness, density, and therefore the diversity of species in wetlands are rather the extent, adjacency to already existing biotopes and location in general.

TAB. 1 – Number of pairs and/or nests of waterfowl breeding in wetlands created through Regional Agri-environment Schemes; the species included in Annex I of the Directive 79/409/EEC are shown in bold type

YEAR	1996	1997	1998	1999	2000
AREA MONITORED	846 ha	986 ha	976 ha	1191 ha	1253 ha
GREAT-CRESTED GREBE	24-25	21	29	50-52	83
LITTLE GREBE	70-72	53-63	109-116	154-155	138
<b>LITTLE BITTERN</b>	<b>11</b>	<b>3</b>	<b>10-11</b>	<b>15</b>	<b>24</b>
<b>BITTERN</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>GREAT WHITE HERON</b>	<b>3e</b>	0	<b>2e</b>	<b>1</b>	<b>4e</b>
<b>PURPLE HERON</b>	<b>10</b>	<b>18</b>	<b>10-11</b>	<b>20-24</b>	<b>22-24</b>
<b>CATTLE EGRET</b>	0	<b>1e</b>	0	<b>2e</b>	<b>3e</b>
<b>SPOONBILL</b>	0	0	0	<b>2e</b>	<b>2e</b>
GADWALL	12	12	16-18	13-14	25-26
MALLARD	396-459	443-494	518-583	423-466	695-765
GARGANEY	62	50	52-58	53-55	76-77
SHOVELER	12	8	9	22-24	36
<b>FERRUGINOUS DUCK</b>	0	0	0	<b>1</b>	<b>8</b>
POCHARD	0	1	1	2	4
RED-CRESTED POCHARD	0	0	0	1	1
SHELDUCK	1	2	2	6	3
GREYLAG GOOSE	0	0	1e	3	19
<b>MARSH HARRIER</b>	<b>4 + 6e</b>	<b>8 + 1e</b>	<b>4 + 2e</b>	<b>5 + 3e</b>	<b>6 + 2e</b>
<b>MONTAGU'S HARRIER</b>	<b>2 + 2e</b>	<b>3 + 1e</b>	<b>1 + 1e</b>	<b>2 + 1e</b>	<b>1 + 1e</b>
MOORHEN	n.c.	n.c.	900-1000 estimate	1000-1100 estimate	1100-1300 estimate
WATER RAIL	0	0	0	0	3
COOT	362-373	486-515	546-560	659-674	722-728
LAPWING	64 + 62e	116 + 112e	229-254+4e	184	332-335
LITTLE RINGED PLOVER	10+3e	23-28	20-23	13-14	9
KENTISH PLOVER	2-3	13	5-6	1	1
BLACK-TAILED GODWIT	3	5	0	2-3	2
REDSHANK	1	2	0	0	1
<b>BLACK-WINGED STILT</b>	<b>361-405</b>	<b>463-486</b>	<b>440-468</b>	<b>562-577</b>	<b>755-764</b>
<b>AVOCET</b>	<b>1</b>	<b>2</b>	0	0	0
<b>PRATINCOLE</b>	<b>15</b>	<b>18</b>	<b>12-18e</b>	<b>8</b>	<b>25-26</b>
MEDIT. HERRING GULL	0	1	2	4-5	3
BLACK-HEADED GULL	0	1	3	0	0
<b>COMMON TERN</b>	<b>38</b>	<b>51-54</b>	<b>7-9 + 1e</b>	<b>60</b>	<b>50</b>
<b>LITTLE TERN</b>	0	<b>49-50</b>	<b>28 +10e</b>	<b>6</b>	<b>2</b>
<b>WHISKERED TERN</b>	<b>74</b>	<b>121-126</b>	<b>212</b>	<b>353</b>	<b>233</b>
<b>KINGFISHER</b>	<b>6</b>	<b>6</b>	<b>5</b>	<b>9 + e</b>	<b>8</b>

e = species nesting in adjacent biotopes and feeding in monitored areas; n.c. = species not counted with accuracy

TAB. 2 – Bird species of conservation and management interest breeding with populations of considerable consistence at regional level in wetlands created through the Agri-environment Schemes; the species reported in Annex I of the Directive 79/409/EEC are shown in bold type.

SPECIES	ESTIMATE OF REGIONAL POPULATIONS (number of pairs)	percentage of population in restored wetlands compared with the regional population	MAX. DENSITY PER SITE (number of pairs/hectare)
BLACK-TAILED GODWIT	2-3	100 %	0,07
<b>COLLARED PRATINCOLE</b>	<b>25-26</b>	<b>100 %</b>	<b>0,18</b>
<b>WHISKERED TERN</b>	<b>403</b>	<b>58 %</b>	<b>4,83</b>
<b>BLACK-WINGED STILT</b>	<b>1500-1600</b>	<b>70 %</b>	<b>5,60</b>
GADWALL	50-60	50 %	0,46
LAPWING	700-800	60 %	2,34
SHOVELER	100	40 %	0,57
COOT	2200-2800	40 %	2,33
GARGANEY	250-300	40 %	1,1
GREAT-CRESTED GREBE	300-400	30 %	0,38
<b>FERRUGINOUS DUCK</b>	<b>30-40</b>	<b>25 %</b>	<b>0,06</b>
<b>MARSH HARRIER</b>	<b>42-50</b>	<b>20 %</b>	<b>0,15</b>
MALLARD	5000	25 %	6,07

### The case of Collared pratincole

Since 1996 the Collared pratincole *Glareola pratincola*, a wader with a breeding population in Italy of about 100 pairs, started to breed with success in Emilia-Romagna.

This has been possible thanks to special measures aimed at favouring this species in marshy meadows created on set aside fields for twenty years between Argenta and Comacchio, a reclaimed area where Collared pratincole bred until '80 years. This species prefers for breeding wet ground with little or no vegetation in May/June.

In 1996 inside fields engaged with Regulation 2078/92 EEC to restore habitat for wild fauna and flora some breeding pairs have been recorded in early May in a surface just scraped, and so without vegetation, to complete the creation of marshy meadows. This fact induced the decision to carry on every year in the same site and in the same period (end of April- early May) top-works to remove the herbaceous vegetation on about 2 hectares to have suitable breeding sites for Collared pratincole. In those sites Collared pratincole bred in following years until 2001 (25-26 pairs in 2000 and 2001).

This event is of great importance in conservation terms, because the breeding population in fields engaged with Agri-environment Schemes is at least 10% of the national population. The only other breeding sites in Italy are in Sardinia, Sicily and Apulia.

## **How the Regional Administration used the information obtained with monitoring activities**

Already with the second year of monitoring activities, the indicators allowed the collection of useful and necessary data to improve the formalities of application of agri-environment measures followed by farmers.

In particular the collected data allowed:

- to confirm literature indication about the fact that selected habitat are able to achieve the targets foreseen by the Agri-environment Schemes,
- to verify if application formalities (methods of habitat creation and above all management measures) followed by farmers fulfil the fixed targets,
- to define formalities of creation and management of new habitats for very rare and or threatened species as done for Collared pratincole,
- to collect data on species and habitat available as reference for further environmental evaluations.

The monitoring activities of environmental effects allowed to introduce timely improvements of the formalities of application of the agri-environment measures to be integrated into the yearly provisions for implementation (e.g. it was necessary to modify time and methods of vegetation and water level management and the modification resulted very important to fulfil the targets fixed by the agri-environment measures).

In 1998 the same modifications, together with other indications becoming from monitoring activities carried out have been introduced in the Agri-environment Scheme that has been approved by the Commission.

A measure aimed at the cultivation of species as maize, mile, panic, sunflower, left on the fields for the autumn and the winter, has been repealed in 1998 because monitoring activities showed that birds of community interest (the main target of the measure) were not favoured.