Rice and Waterbirds: Science, Management, and Conservation

To be held at the 31st Annual Meeting of the Waterbird Society, Barcelona, Spain (see http://www.wbs2007.org/)

Wednesday 31st October 2007, 10:30-13:00 and 16:00-18:00

Conveners: Chris Elphick (chris.elphick@uconn.edu), Kathy Parsons, Lourdes Mugica, Mauro Fasola

Topic: Waterbird use of agricultural wetlands has increased as natural wetlands continue to decline worldwide. Rice fields occupy more of the world's land than any other wetland crop — over 1.5 million km^2 — and the crop is the primary source of calories for over half of the world's human population. In some cases, the use of rice habitats is considered to be essential to sustaining waterbird populations. In contrast, other situations exist where rice farming is seen as a threat to waterbird conservation. A large literature has begun to develop that documents the use of rice habitats by waterbirds throughout the world, however significant information gaps remain. Available information has never been comprehensively reviewed and analyzed at a global scale. This symposium will bring together researchers from around the world to synthesize existing research, discern management approaches for optimizing the rice-waterbirds relationship, and identify new areas for investigation.

Waterbirds in rice fields: introduction and global overview
Chris Elphick (University of Connecticut, USA)

Rice is one of the world's most important crops. It is grown in more than 110 countries, occupies over 150 million hectares of land annually, is a primary source of nutrition for over half the world's human population, and constitutes over a fifth of the global grain supply. Rice is unusual among crops in that it is generally grown under flooded conditions and, if managed appropriately, can provide important habitat for wetland species. Waterfowl, wading birds, shorebirds, and many other waterbirds use rice fields, foraging on a variety of prey, nesting in the crop and in fringing vegetation, and staging during migration. Conflicts also exist, with some cropping practices harmful to birds and some bird activity detrimental to yield production. Much of the early research on waterbirds in rice fields was conducted in Mediterranean Europe with only scattered work elsewhere. More recently, there has been a growing focus on the conservation value of rice fields, with detailed studies from most of the major regions where rice is grown. This body of research has included community studies of the range of birds that use rice fields; detailed studies of endangered species; behavioural studies of reproductive success, foraging ecology and movement; and applied studies of cropping techniques. As the world's natural wetlands diminish, researchers studying waterbirds in rice fields are working to globalize interactions with each other and seeking new ways to interact with rice growers, with a goal of maximizing the benefits of agricultural wetlands while minimizing the costs.

Rice fields and Birds in the Mediterranean Region

Violetta Longoni (Università di Pavia, Italy)

In Europe, rice represents one of the most important forms of agricultural production concentrated in the Mediterranean countries. The relationship between rice fields and bird presence has been well studied in some birds (e.g. colonial *Ardeidae* greatly depend on rice for breeding), while quantitative data are lacking for other more secretive species. Rice cultivation may play an important role in the conservation of some threatened birds (e.g. agricultural flooded areas in NW Italy support 25 % of the Italian population of Great Bittern *Botaurus stellaris*) although variation in farming techniques affects the suitability of fields for birds. Agricultural practices that benefit birds include avoidance of intermittent flooding or dry cultivation, stubble maintenance during winter, allowing persistence of some weed patches inside fields and along ditches, and conservation of natural vegetation in rice field areas. Additionally, biological and alternative methods to the conventional ones seems to provide better environmental conditions. In order to promote the environmental and conservation value of ricefields, BirdLife International presently coordinates a project throughout Europe aimed at expanding environment-friendly rice cultivation. In some European regions rice fields are the only habitat for wetland birds due to the scarcity or poor quality of natural wetlands. Despite the geographical closeness of European countries and great ornithological interest in African and Middle Eastern birds, knowledge of birds and rice cultivation relationships in these regions are poorly known. These regions are located along some of the most important migration routes in the Old World, however, allowing us to presume an intense use of the fields by wetland avifauna.

Use of rice fields by waterbirds in the Neotropics

Martín Acosta (Universidad de la Habana, Cuba), Lourdes Mugica, Daniel Blanco, Bernabé López-Lanús, and Rafael Antunes Dias

Rice fields of the Neotropics have a strong value as concentration areas for resident and migratory waterbirds. At least 116 species of non-passerine waterbirds belonging to 19 families have been recorded in rice fields of the region. The aim of this study is to evaluate waterbird use of rice paddies in Central and South América, and the West Indies. We compiled the available information on bird communities associated with rice paddies in Argentina, Brasil, Cuba, Uruguay, Costa Rica, Surinam and Trinidad and Tobago, and analyzed the different rice growing cycles and its influence on habitat use by waterbirds. In terms of species composition, Charadriiformes was the best represented group, followed by Ciconiiformes, Anseriformes and Gruiformes. The use of paddies by different groups depended on the rice growing cycle. Two conditions are crucial: the development of the rice plant and the water depth. In all countries, rice fields are considered important feeding areas and are heavily used as migratory stop-over sites and wintering sites. Our results highlight the role of the rice agroecosystem as alternative feeding, resting and breeding habitat for waterbirds. At the same time, this paper provides a call for attention from the conservation community, as rice field expansion is resulting in wetlands loss in some regions. Besides, rice cultivation involves the use of pesticides and other toxic chemicals, often with lethal and sub-lethal effects on waterbirds and other wildlife.

Bird use of rice fields in Korea and Japan

Masahiro Fujioka (University of Tsukuba, Japan), Sang Don Lee, Masayuki Kurechi, and Hoshiko Yoshida

Rice is planted in 55% and 36% of the cultivated land in the Republic of Korea and Japan, respectively. At least 10 of 59 threatened species listed by IUCN in these regions use rice fields. For example, the crested ibis *Nipponia nippon*, now restricted to China, was heavily dependent upon rice fields for foraging in Korea and Japan. Rice fields typically serve as foraging habitat for birds. In winter, geese, ducks, and cranes exploit rice grains after harvest as well as weeds and small animals. In summer, rails, plovers, sandpipers, herons, and the gray-faced buzzard-eagle *Butastur indicus* use agricultural paddies for food; these species seek small aquatic animals such as earthworms, frogs and fishes. Heavy use of chemicals and over-hunting used to be the main cause of declines for geese, cranes, and wading birds. Goose and crane populations have begun recovering, but their ranges have not expanded correspondingly. Reclamation and abandonment of rice paddies have caused a decline in aquatic animals and hence in their avian predators. In both countries, several studies are underway to improve waterbird-rice interactions. For example, winter flooding of fields is proved to increase the use of rice fields by herons in summer as well as by geese and ducks in winter. Other studies show that unplowed fields provide geese and cranes with much more food than do plowed fields, thus increasing field use for foraging. Financial support by the governments may be the key for the promotion of bird-friendly rice production.

Food resources for birds in rice fields worldwide

Joshua D. Stafford (Illinois Natural History Survey, USA), Richard M. Kaminski, and Kenneth J. Reinecke

Worldwide, flooded rice fields provide foraging habitats for many breeding, migrating, and wintering birds. Rice production typically involves periodic soil disturbance (i.e., discing, planting), seasonal flooding, and manipulation of stubble post-harvest, thereby providing a variety of microhabitats and potential foods for birds. Additionally, water management in rice fields may produce wetland conditions ranging from mud flats to shallow (<30 cm) water, thereby attracting different guilds of birds for foraging and other annual-cycle activities. Rice grain not collected during harvest (i.e., waste rice) is typically the most abundant food for birds in rice fields, with reported density estimates of 134–672 kg/ha in North America. However, published research indicated 71–79% of waste rice was lost in subtropical environments (e.g, the Mississippi Alluvial Valley) between harvest and late autumn. Natural seeds also provide food for birds in rice fields; North American studies reported seed densities of 12–44 kg/ha. Aquatic invertebrates are relatively abundant in flooded rice fields, with densities of 6.3–31.7 kg/ha reported in North America. Few abundance estimates exist for other avian foods in rice fields, most notably germinated waste rice, natural grass seeds, and vertebrate prey. Although rice is grown worldwide, sparse information exists on food resources for birds in rice fields outside North America, Europe, and Japan. Given inter-continental ranges of many avifauna, the state of knowledge regarding food values of rice fields for birds would benefit greatly from research estimating abundance and diversity of potential foods in other important rice-growing regions of the world.

Application of Biomarkers to Assess the Feeding Use of Rice Fields by Waterbirds

F.J. Ramírez, X. Ruiz (University of Barcelona, Spain), L. Jover, C. Sanpera, and J. Cotín

Most of the evidence on the feeding use of rice-fields by waterbirds relies either on observational data and/or traditional dietary analyses. However, such data suffer from a number of biases, the most important being that the information obtained just covers a brief period (hours) of feeding activity. In contrast, stable isotope signatures from animal tissues, give integrative estimates of the assimilated diet during the period of tissue formation, but do not allow detailed taxonomic knowledge of prey items in the diet. However, if one wishes to simply determine the degree of reliance on rice fields for feeding, it is only necessary to characterize the isotopic signature of rice fields to obtain a good picture of which species feed in them. Moreover, the resulting information is specific to individuals, allowing the recognition of different feeding strategies within populations. Sampling different tissues also permits the analysis of feeding habits over different periods of time. In this paper we present data on 11 species of waterbirds breeding at the Ebro delta. We analyzed the isotopic signatures ($\delta^{15}N$, $\delta^{13}C$) of eggs for all species and chick feathers from some of them. Rice fields in the Ebro delta are characterized by $\delta^{13}C$ ranging from -24 to -27‰ and $\delta^{15}N$ values ranging from 12 to 17‰ for a predator like a heron or a tern. Such enhanced $\delta^{15}N$ values are probably due to denitrification processes typical of rice fields and can also be used to discriminate which species feed there. We also present data on $\delta^{34}S$ for a subset of seabird species to illustrate further insights based on this isotope.

The quality of rice fields as feeding habitat for long-distance migratory waterbirds: spring-staging ecology of Black-tailed Godwit *Limosa limosa* at East Atlantic Flyway's rice fields

Auxiliadora Villegas (Universidad de Extremadura, Spain) et al.

Rice fields support important numbers of migratory waterbirds around world, and may a role in buffering for the natural wetland losses. However, studies about its role as refuelling areas for migratory waterbirds, especially compared to natural habitats, are lacking. We studied numbers, length of stay, diet (inferred from stable isotopes), and diel patterns of foraging activity and feeding rate of Black-tailed Godwits *Limosa limosa* staging at Extremadura's rice fields (inland Spain). We also analysed body condition and metabolite profiling of migrating Godwits at Extremadura's rice fields and coastal habitats (Cadiz Bay, SW Spain) to test the quality of rice fields as spring staging areas. More than 16% (28.000 birds) of total western European population *en route* to the breeding grounds stayed in the rice fields during February, showing a large percentage of Godwits long lengths of stay (38.9 ± 7.6 days). Although the potential food supply for shorebirds is composed of abundant macroinvertebrates and rice seeds, stable nitrogen isotope analysis ($\delta^{15}N$) showed that Godwits rely on rice seeds. Overall, Black-tailed Godwits were day-active in spring migration, with significant morning and evening peaks of foraging activity. Feeding rate also varied on a diel basis, with a distinct day-time peak in early morning and sunset. Lastly, body condition and plasma levels of triglycerides, glucose, and albumin were significantly higher in rice fields than in coastal areas in mid February. From meeting energy demand point of view, we suggested a high quality of rice fields as feeding habitats for Godwits and other waterbird species.

Audouin's Gull (Larus audouinii): from a pelagic foraging stress to an establishment of temporary terrestrial diet in Ebro delta rice paddies

Emma Guinart Patiño ('Generalitat of Catalonia, Spain) et al.

Although Audouin's Gull has been considered a pelagic species during many years compared to other gulls which has a wide foraging range and have adopted terrestrial habits, nowadays it is proven that under stress conditions as fish moratoriums Audouin's Gull temporary tends to take advantage of alternative terrestrial prey. This occurs in Ebro delta because of the closeness of a huge alternative half human and half natural habitat as rice paddies, the most important agriculture activity in that zone which occupies an area of approximately 20.500ha of the whole delta. But, is this behaviour only a response to stress periods as moratoriums or has become a new temporary continental diet? The importance of continental Ebro delta as a foraging habitat for this species seems to be clearly in relation to the introduction of the nearctic Red Swamp Crab *(Procambarus clarkii)*, which is mainly exploited under specific circumstances, mostly when rice paddies are flooded just before the starting of rice production cycle. Considering that this happens in middle April when most of the Audouin's Gulls have already laid some eggs, and this situation lasts until mid June when the hatching has started, a diet survey was carried out, which included vehicle line transects along rice paddies, line transects in the edge of rice paddies and a diet survey within the colony. The estimate of the population of Audouin's Gull that forage there and the high availability of Red Swamp Crab in rice paddies and the high presence of crab claw in nests has proven that this prey has become a competitive source of food which in the future can determine new breeding success.

Effects of pesticide use in rice fields on birds

Kathy Parsons (Manomet, USA), Pierre Mineau, and Michael Hooper

Waterbird use of agricultural wetlands has increased as natural wetlands continue to decline worldwide. The use of rice habitats by some waterbird groups (e.g. long-legged wading birds) is considered to be essential to sustaining populations. Although a large literature has begun to develop that documents the use of rice habitats by waterbirds throughout the world, little information is available concerning the potential risks faced by birds as a result of chemicals used in rice cultivation. Existing studies on exposure and effects of agrochemicals on birds have not been compiled and interpreted. The current study reviews and summarizes current understanding of the use and consequences to birds of pesticide applications in rice habitats. Organochlorine pesticides known to be applied for pest management in rice cultivation include DDT, aldrin, dieldrin, endrin, heptachlor epoxide, toxaphene, endosulfan and sodium pentachlorophenate. Cholinesterase-inhibiting insecticides include methyl parathion, monocrotophos, azinphos-methyl and carbofuran. In addition, a number of herbicides and molluscicides are used in rice cultivation. Several of these chemicals are highly toxic to birds. Because of the relatively large area under rice cultivation worldwide, the volume of pesticides applied to rice fields is significant. Recent innovations in rice production technology have increased pesticide use resulting in biodiversity losses in production areas and pollution of associated water resources. Identified better management practices to address adverse effects of pesticide use in rice fields include increased adoption of Integrated Pest Management principles and selection of less toxic products.

Negative effects of birds on rice production and options for minimizing/ mitigating crop depredations

Christophe Tourenq (WWF, UAE), María Elena Zaccagnini, and Francois Mesleard

Growing on 11% of the world's arable land, in all the continents except Antarctica, rice *Oryza sp.* is the most cultivated crop in the world, and 40% of the human population depends today on this primary food. Throughout the World, the loss of natural wetlands correlated with human population growth, urbanization and conversion of land to agriculture, made rice fields attractive for waterbird species of national or international conservation concern. In countries where rice fields cover large areas, crop damage by birds has been estimated at millions of dollars annually and huge efforts have been made to find solutions. Rice crops damage by birds has been particularly documented in Asia, Australia, Africa, South and North America where rice cultivation covers large areas and represents an important part of the economy and human populations' survival depends on it. In Europe, rice cultivation is restricted to parts of the Mediterranean region and this phenomenon has received less attention until the early 80s when flamingos started to feed in rice fields. Huge efforts have been made worldwide to minimize the damage on rice fields by birds, including non-lethal or lethal techniques, by a direct control (*e.g.* scaring, trapping, shooting, spraying aviacide and even bombing on roosts sites), or indirect control (*e.g.* water draining, delayed seeding, seed coating, chemical deterrent). However, because the lack of success in reducing damage often generated worse conditions for the conservation of biodiversity in rice fields, *e.g.* when toxics were employed, the whole philosophy of pest control needs to be changed. The effectiveness of these operations was shown to be conditioned by the behavior and the number of birds involved, and recently, the role of landscape features have been emphasized. Socio-cultural issues must be considered. Hunting in rice fields, either outside of the hunting season, was even allowed in some South American countries to reverse the status of some birds (mainly ducks) from pests to a resource for local people.

Best management practices for rice fields during the growing season

Carles Ibàñez Martí (Unitat d'Ecosistemes Aquàtics, Spain), I. Ripoll and C. Sánchez

A review of the effects of rice farming practices on bird populations during the growing season is carried out. The main factor affecting bird density and diversity were found to be water level, flooding period, rice plant structure and size, and use of pesticides. Surprisingly, most of the existing literature focuses on the non growing period, and there is little data about the real influence of management practices during the cultivation, a period in which the use of waterbirds for feeding and refuge is very important in qualitative and qualitative terms. Data concerning a case study in the Ebro delta is also presented, comparing three management schemes: organic, agri-environmental and non-organic. Bird density, biomass and diversity along the growing season were calculated in three consecutive years. Results show higher density, biomass and diversity in the organic rice fields, but diversity did not show statistically significant differences. Maximum mean biomass during the growing season was obtained in the organic plots (25,21 kg 10 ha^{-1}), whereas in agri-environmental and non-organic plots it was 8,14 kg 10 ha^{-1} and 14,03 kg 10 ha^{-1}, respectively. This higher biomass reflects the presence of a higher biomass of preys (fish, invertebrates and macrophytes) in the organic rice fields, due to the lack of pesticides and other factors related to water management.

Influence of the European agri-environment measures on rice fields for the Lapwing *Vanellus vanellus:* a wintering species in southern Europe.

Carles Barriocanal (Universitat de Girona, Spain), Joachim Camps, Daniel Burgas, and David Robson

In some regions natural wetlands have been replaced by rice fields that act as a huge artificial wetland attracting invertebrates, fish and amphibians as food for waterfowl which utilize them extensively. In Europe, rice production benefits from the European Union granting aids for production and indirect aids for the use of the agri-environment measures that means payments to farmers in return for a service to carry out agri-environmental commitments. One of these measures is flooding fields after harvest resulting in an opportunity of food resources for ducks and waterbirds and doing post-harvest ploughing (by tractors) of straw instead of burning, which reduces the need of nitrogen supplement for the next season. We have studied the rice field selection by the Lapwings *Vanellus vanellus* depending on the situation of post-harvest ploughing and the level of water, in the rice field area of Baix Ter (north-east Spain) where 700 hectares of paddy fields are cropped and agri-environment measures are being carried out. During the winters (December-March) of years 2005/2006 and 2006/2007 about 100 hectares of paddy fields have been monitored in search of Lapwings. From October to February rice fields contain plenty of water and the flood level depends on the filtration, the velocity of flow and precipitation. So, the level of water in the rice fields is variable and the number of ploughed fields increases throughout the season. During December and January between one to two thirds of fields are both ploughed and flooded and Lapwings significantly choose those (70-100% of the recorded Lapwings). In February, when the peak of Lapwings is recorded, all the fields are ploughed and flooded and Lapwings choose those fields with a water coverage of 10-20% where they feed extensively. In March the number of Lapwings is low, they return to their breeding areas and the rice fields are drained and set to be cultivated. Our data show the importance of the agri-environmental measures on rice fields as a key tool for wintering waterbirds management such as the Lapwing and contribute to the knowledge of their requirements to enhance the use of those public funds.

Effects of Landscape Characteristics on Waterbird Use of Rice Fields

Sammy L. King (USGS, Louisiana State University, USA), Chris S. Elphick, and Demetrio Guadagnin

Rice fields serve as important wintering, foraging, breeding, and migration habitats for many species of waterbirds. Few studies have explicitly quantified the effects of landscape characteristics on waterbird abundance in rice fields and the diverse temporal and spatial habitat needs of waterbirds makes broad generalizations difficult. Species-specific information is needed to evaluate the suitability of any given landscape for a particular waterbird species accurately. It is apparent, however, that the importance of rice fields to specific species of waterbirds depends upon many factors including their location relative to major migration corridors, distance from rookeries or breeding areas, distance to marsh or other natural wetlands, and interspersion with alternative habitats (e.g., irrigation ditches, other agricultural crops). The value of any specific rice field is also affected by local and landscape rice management practices, food availability, and the proportion of the area in rice and other wetland and non-wetland habitats. Some waterbird species are negatively affected

by rice agriculture, particularly when natural wetlands are converted to agricultural landscapes or when water is diverted away from natural wetlands to irrigate rice. The value of rice agriculture to waterbirds is strongly influenced by national farm policies as these policies often dictate management practices implemented on a given farm and across a broad region. Furthermore, concerns over greenhouse gas production, water use by rice agriculture, and poor economic conditions for rice production could reduce the value of rice for waterbirds in some regions by affecting the distribution, abundance, and management of flooded rice fields.

Spatial and temporal landscape complementation in rice paddy areas as habitats for bird species in Japan

Tatsuya Amano (National Institute for Agro-Environmental Science, Japan), Yoshinobu Kusumoto, Eun-Young Kim and Shori Yamamoto

Though rice fields provide important habitats for farmland birds all over the world, studies so far have rarely explored the effects of landscape heterogeneity on bird species in rice paddy areas. This study investigated the effects of habitat cover and landscape variables on the abundance of birds in rice paddy areas in Japan. Data on bird abundance and the environment were collected at 32 grid squares (1 × 1 km) in the Tone River basin. Grids with large areas of rice fields were favoured by agricultural wetland species in summer, when rice fields were irrigated for cultivation, and by agricultural land species in winter, when rice fields were drained for harvest. Edge species and woodland species selected landscapes not only with forest covers but also a high density of edge between forests and rice fields which is a representative landscape of rice paddy areas at the bottom of narrow valleys. Grassland species preferred landscapes with a high diversity of land covers including fallow fields and open water areas. This study illustrated the complementary roles of different landscapes as preferable habitats for bird species in rice paddy areas. Landscapes with a combination of rice fields, open water and fallow fields are important for agricultural species and grassland species. Landscapes with a mosaic of forests and rice fields provide high edge density and thus should be preserved for edge and woodland species. This information should be useful for developing appropriate methods of agricultural management in rice paddy areas on a landscape scale.

Global population trends are related to rice field use by waterbirds in South Spain

Gregorio M. Toral (Estación Biológica de Doñana, Spain) and Jordi Figuerola

Many species of waterbirds use rice fields for breeding or feeding depending on the conditions of the crop. We analysed the use of rice fields in relation to natural marshes based on bird counts in Doñana during the last 23 years. The aim of our study was to test the relationship between the use of an intensively man transformed habitat and population trends in Europe. No relationship was found between population trends in Europe and year-round use of rice fields. However, when analysing separately the autumn migration period and the spring breeding season, we found a positive correlation between global population trends and use of rice fields in autumn (October to December) but not during the breeding season. Several hundred-thousands birds feed in the rice fields of Doñana during and after the harvest season, and similar situations occur in the other rice-cultivation areas in southern Europe. Alternatively, species more able to cope with human activities may also benefit in other season/areas. How future changes in the Common Agriculture Policy in Europe may

affect habitat availability and population trends for these species merits further study, but reductions in rice-cultivated areas may have important effects on migratory waterbirds.

Effects of rice cultivation on waterbirds population size and dynamic. Mauro Fasola (Università di Pavia, Italy)

Waterbirds use rice fields extensively for foraging in various regions, yet it is difficult to evaluate the effects of this agricultural habitat on their populations. From data on prey exploitation, and on use of foraging habitats, by 6 species of herons and egrets in the five main areas of rice cultivation in Europe, we estimated that during the eighties, 54% of their food resources came from rice fields, albeit with a large regional variation from only 11% in S France to 92% in NE Italy. However, since the eighties the breeding populations in Italy have grown up to 3 or 6 times, probably due to factors other than food resources, warmer winter temperatures and lower human-related mortality, while rice cultivation and prey availability has not changed, suggesting that food resources were not critical. A proper estimate of the relevance of rice fields to populations would require limiting factors to be identified, a difficult task in natural populations. We are trying to assess the effect of rice fields on herons and egret populations by comparing the abundance of breeding herons, and their population trends, in areas with fields and areas with only natural habitats within N Italy.

Posters

Rice fields as foraging habitats for egrets and herons in sample areas of China and Pakistan
Mauro Fasola (Università di Pavia, Italy), et al.

The largest surfaces of rice fields, about 87% of the world total, occur in Asia yet very little is known on their use by birds, while the importance of this agricultural habitat for ardeids is well documented in Europe and in America. We describe the use of rice fields and of natural wetlands, in two study areas of Central China near Nanchang and Wuxi, and in four study areas of Pakistan near Karachi, Tounsa, Multan, and Lahore, that were surveyed during Juneof 1997 to 2007. *Bubulcus ibis, Egretta garzetta, Egretta intermedia, Egretta alba, Ardeola grayi, Ardeola bacchus*, and *Nycticorax nycticorax*, all used the rice fields in proportions that varied from <10% to 90% of the total foraging birds. The wide variations depended presumably on the stage of the rice cultivation and on the availability of other, natural foraging habitats. The density of foraging herons was always highly variable among the fields of an area, and it tracked the variability in prey abundance. Prey types included fish, amphibians, reptiles, crustaceans and insects. Total prey abundance in two of the sample areas was found to be of the same order of magnitude as in the rice fields in Europe.

Increased bird populations and (species) diversity in organic rice fields associated with restored natural habitats in the Ebro Delta (Tarragona, Spain)
Ignasi Ripoll (SEO/BirdLife, Spain) et al.

Bird community succession has been evaluated quantitatively during five years in the SEO/BirdLife's Reserva Natural de Riet Vell (Delta de l'Ebre, Tarragona, Spain). The Reserva Natural de Riet Vell is a rice farm that combines 44 ha of organic rice crops and 11

ha of lagoon, reedbed and marshland as natural habitats that were being restored along the period 2001-2007. Bird individuals counts and species richness are presented. The number of individuals and species raised significantly along this period. Diversity, which was evaluated using the heterogeneity Shannon-Weaver function, showed seasonal fluctuation and an important stability was soon obtained.

Associated activities:

Round table discussion: After the symposium we have planned a separate (lunch time or evening) round table discussion for all people interested in the topic, with a specific emphasis on identifying ways in which the global waterbird research community can advance the conservation of waterbirds in rice growing regions. (Organizer for the discussion: Jennifer Wheeler.)

Field trip: One of the conference field trips will be to the Ebro Delta, one of the main regions where waterbirds use rice fields in Europe.

Publication: Most of the speakers in this symposium are also contributing chapters to a publication that will provide a global review of the conservation issues relating to waterbirds in rice fields. (Editorial team consists of the symposium organizers.)