

BRETAGNE VIVANTE

# *The Aquatic Warbler*

*a global threatened species*



*The Aquatic Warbler, a global threatened species*



Proceedings of the Life Seminar



### **The Aquatic Warbler, a global threatened species**

**Proceedings of the Life seminar «Conservation of the Aquatic Warbler in Brittany »,  
January 2004 - April 2009, LIFE 04NAT/FR/000086REV**

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## Opening

**So shy, so fragile, so motivating**

**B** Because of its immoderate liking of dense and wet habitats and of its all-purpose markings, it has long remained an unknown traveller, escaping the eye of even the most aware of naturalists.

It took a lot of obstinacy to detail the habits of the bird in Brittany—a bird whose very French name (phragmite aquatique) may lead to confusion: is it referring to a plant or a bird?

Fifty years ago, a clumsy individual let itself be caught in a Japanese net stretched by the pioneers<sup>1</sup> of ornithology in Brittany at the famous Ouessant ringing camps: one bird out of 2,391, as is mentioned in the methodological report by Albert Lucas. That tells us how unobtrusive the *Acrocephalus paludicola* could be.

But, the discretion of an animal species may be explained by various factors: in this case, by its sense of adaptation and its frequenting of closed environments almost exclusively. And by its limited population which, unfortunately, may still undergo a strong decline.

Thus, in the eighties, when the regular presence of an annual contingent of aquatic warblers was detected thanks to the ringing campaigns undertaken in the reed beds of the Bay of Audierne, interest in the bird rose, all the more so since the ornithologists from central and eastern Europe mentioned its increasing decline in terms of geography and population numbers.

The situation is alarming: the Aquatic Warbler is one of the rare endemic birds in Europe.

Could the ringing of a few dozens of warblers each year at the end of the summer in southwestern Brittany play a role in raising awareness on the precariousness, not to say the extinction, of the species?

The Life<sup>2</sup> contract in favour of the Aquatic Warbler which has been run by Bretagne Vivante - SEPNEB since 2003 is coming to an end. And, to answer the question above, we may claim that we made a significant contribution.

Of the five years of this large scale project attributed by the European Union, we will retain in priority a few strong images which symbolise the enthusiastic support of diverse and sometimes unexpected supporters and partners: an end of project

scientific colloquium gathering biologists and natural area managers coming from Senegal, the Baltic States, Poland and Russia among other countries, participation in fruitful international research missions on the wintering areas in sahelian Africa, the pleasure many times expressed, during the land transactions, by the owners of the marshes bordering the Aulne river at the thought of partaking in the protection of this unknown gem, a film « Wodniczka, the charmer of the marshes » which was awarded a prize at the Ménigoute film festival, etc.

The fact that, following this Life project, France promises to launch the drafting of a national restoration plan in favour of the Aquatic Warbler and to sign the memorandum of international agreement established in 2003 within the framework of the Bonn convention, finally validates the work which has been accomplished. Regarding Bretagne Vivante - SEPNEB, this can also be seen as an acknowledgement of its capacity to remain a credible actor of biodiversity protection. As we celebrate the 50<sup>th</sup> birthday of the association, the aquatic warbler is, for us, a bird of good omen.

**Alain THOMAS**

*Bretagne Vivante's volunteers*

- 1 Ouessant's camps from 1955 to 1958. Albert LUCAS (*Penn ar Bed* n°15)
- 2 Life is a financial tool used by the European Commission to support environmental projects (Life Environment) and nature protection projects (Life Nature). Their aim is to apply and to develop the environmental policy of the European Union by financing specific actions.

I have the honour of speaking to open this seminar since the Secretary of State, Mrs Kosciusko-Morizet sent you her apologies, Mr President, and since the Regional Director for the Environment, Mrs Françoise Noars, is detained in Paris.

This seminar on the Aquatic Warbler relates to conservation and biodiversity. The conservation of biodiversity is one of the major issues which we face. This is an issue which is often difficult to understand, its perception being so complex and its field being so large: the number of known species is superior to 1,500,000 and yet, that number only represents a minority of the existing species.

The richness of biodiversity is at once a life balance factor and a source of countless benefits for mankind.

It is an issue whose economic weight we start to assess, since an estimation which could be used as a benchmark estimates the cost of biodiversity loss around 3,000 billion dollars a year. Now, the scientists estimate that man accelerated the species extinction rhythm by a factor of 100 in comparison to the natural rhythm of extinction.

These conclusions, shared by part of the population and of the decision-makers, led to various national and international engagements in favour of biodiversity conservation. It first started with the Bonn Convention on the migratory species conservation signed in 1979, a text to which France adhered in 1990. The Aquatic Warbler is registered in it. At European level, there was the « Birds » Directive in 1979 which is at the basis of Natura 2000. The Aquatic Warbler is registered in it.

Then came the Convention on Biological Diversity (CDB) signed in 1992 at the Rio United Nations Conference.

But during the eighties and the nineties, the effects of these engagements remained limited, the word « biodiversity » did not exist then.

In September 2002, in Johannesburg, at the world summit on sustainable development, the French President, Jacques Chirac, started his speech stating « our house is burning down and we are blind to it. Nature, mutilated and overexploited, can no longer regenerate itself and we refuse to admit it ».

In February 2004, France adopted its national strategy for biodiversity, which set the ambitious goal of stopping biodiversity loss by 2010. This strategy is made up of 10 action plans.

In 2005, the Charter on Environment, introduced by constitutional law, stated « that the future and the very existence of humanity are inseparable from its natural environment ».

In 2007, France organised the « Grenelle de l'environnement » which held one of its meetings in Brest on the 16<sup>th</sup> of October, thus making it possible to gather all the concerned actors around one table: associations, farmers, public authorities, etc. At the end of these consultations, 268 engagements were retained and a law whose title II reads « biodiversity

and natural environments » is currently being debated.

These few references show that biodiversity conservation has become a major concern within a few years.

Currently, France prepares the signature of the memorandum on an international agreement in favour of the Aquatic Warbler, established in 2003 within the framework of the Bonn Convention. We are currently consulting with the various ministerial departments. This consultation should be completed soon.

Which tools can be mobilised to contribute to the conservation of the Aquatic Warbler? I will only mention two, which are major for the state.

First of all, there is the Natura 2000 network — the three sites on which Bretagne Vivante is working are included in the SPAs (Special Protection Area). The Life programme organised by Bretagne Vivante, this seminar being one of its actions, contributes to the implementation of Natura 2000. The Natura 2000 network is all the more adapted since

the Aquatic Warbler ignores the administrative borders and thus confirms that biodiversity is by nature international. Natura 2000 is a tool whose management is shared with local actors: the implementation of Natura 2000 in Brittany — a network of sites defined on the basis of scientific knowledge — relied from the start on a strong partnership with the local authorities. This orientation has later on been reinforced by national regulation.

The ministry in charge of ecology has a specific tool: the restoration plan. Because of the responsibility of France in the conservation of the Aquatic Warbler — France being its main post-nuptial migratory route —, the ministry in charge of ecology launches here and now the drafting of a national restoration plan in favour of this species. The elaboration and implementation of this plan will be coordinated by the DIREN Brittany. Further explanations on that subject will be given in this seminar by Sabine Moraud from the ministry in charge of ecology.

Lastly, I wish to mention the actors without whom this small bird would probably be unknown and would face an even greater danger regarding its future. The main actor is the Bretagne Vivante association. I want to compliment you, Mr President, because this seminar, the Life project and the greater consideration the Aquatic Warbler gets are the result of a considerable work, inscribed in time, which you have carried out with perseverance together with your team, volunteers, the employees of your association and your partners. In certain years, we have not been able to bring you a support equal to the issue, this admission of failure only adds to your merit. Today, we can rely on your work of quality, broaching both scientific knowledge and management, to take stronger steps in that direction. Then come the scientists, since, in that field, knowledge is our first essential tool. We will get involved in this approach in a combined effort with the Regional Council and the General Council, as our intervention means are complementary.

We took the habit, with the Regional Council, to exchange views on our goals, to coordinate or even combine our actions.

This seminar is the concrete expression of an outstanding work. I wish that it will be successful, enlightening and fruitful.

**Michel BACLE**  
*Deputy director of the environmental  
regional agency in Brittany  
(Ministry of Ecology)*

**T**his congress organised by Bretagne Vivante - SEPNB on the Aquatic Warbler constitutes a very good opportunity to talk about biodiversity management at the scale of a territory like that of Quimper.

Our municipality is made up of 8,500 ha and is, in fact, greater than Paris. It includes about 80 agricultural holdings. Being at the tip of Brittany, near the sea, we have to deal with an important real estate pressure. And like all small « capital towns » of a small area, we want to play an active role in the creation and maintaining of employment. All this causes a permanent conflict regarding land use. It is thus the responsibility of the municipality, which controls the urbanism, to position itself appropriately in order to achieve a balanced, reasonable, sustainable development of its territory. We cannot go on consuming the square meters like we did for the last 30 years, as it is obvious that urbanisation is mainly done on agricultural land, wetlands, meadows and woodlands. This is the direction that I personally wish to give to the « eco-neighbourhoods » that the town of Quimper wants to develop. To place some solar panels on the roofs of the houses to be built at the periphery of town, even if it is a good thing, will not be enough to achieve sustainable development. It will also be necessary to reduce the size of the lots to achieve some quality collective work. We will have to rehabilitate older constructions at the heart of Quimper to reduce our impact on ecology related to transport. However, one issue will remain, which I come across every day and which will gain more and more importance: how do we manage the areas that we refuse to urbanise, in the name of nature protection, but that the farmers abandon more and more out of sheer economic realism? The town does not have the means to hire hundreds of gardeners to take care of them. We are trying to start to broach that issue through pastoral management, we already have three municipal cows, but it is obvious that this will not be sufficient. Of course, we could sign contracts with associations like Bretagne Vivante - SEPNB or Eau et Rivières de Bretagne, but here again the limits of volunteer work would soon appear.

Our world is in mutation. The countryside is emptying, the cities are expanding. And, in the meantime, awareness regarding biodiversity is progressively spreading. For my part, I do not have an instant solution to address this paradoxical situation. But, I do know that we will have to broach it, because the existence of a tightened urbanisation forbids us to state that nature can reclaim its rights on the outside. Man's presence is strong on our territories. He has an impact on nature and sometimes finds himself under its influence. He will therefore have to take his responsibilities, it is the future of the planet which is at stake, and this little « Casanova » of the marshes comes just at the right time to remind us of that.

**Daniel LE BIGOT**

*Deputy mayor in charge of urbanism  
for the town of Quimper*

If Quimper has been chosen for this international seminar because of its central location in relation to the three sites of the Life programme, the choice of the Orangery of Lanniron is particularly fortunate when one considers the quality of its environment and its proximity to one of the most beautiful rivers in France...

It is with great pleasure that I accepted your invitation, all the more so since I am very familiar with this area, but my delegation also gives me the opportunity to travel regularly throughout Brittany and to see that it enjoys an extremely rich natural patrimony: an exceptional littoral, but sought-after and fragile, outstanding inland area (moors and mires), quality and authentic landscapes which forge the regional identity as much as the cultural, maritime and architectural patrimonies do. But as nothing is ever perfect, its water quality is in need of improvement... And we work towards that goal with a lot of energy. This patrimony constitutes an important attraction factor from an economic point of view, for instance, regarding tourism. And it also contributes to the quality of life of the people living here.

Many of these large emblematic areas have been preserved thanks to regulatory and/or contractual protection tools set up by the state, territorial authorities or environmental protection associations. The latter managed to draw the attention of public authorities early on and played an essential role in spreading awareness among citizens regarding the whole environmental field. I seize the opportunity to pay tribute to Bretagne Vivante - SEPNEB which has done a lot in that direction. But maintaining this richness is not an easy task: the pressures for urban development, the growing artificiality and triviality of the environment increase the weaknesses of these areas, hence the will to preserve, protect and valorise. This will resulted in the directives of our Regional Plan for Natural Patrimony and Biodiversity, approved in February 2007 and corresponding to the following European and national goals:

- It is a pedagogical and strategic tool, a reference framework for the action of the Regional Council, a coherence framework for public action.
- It puts the emphasis on two priority axes: to improve knowledge – to know better in order to manage better – and to protect areas and species.
- It comes as a complement to the actions set up by all competent partners.
- It makes it possible to identify the great issues regarding nature in Brittany, among which the necessity for public policies to give greater regard to the marine environments and the wetlands.
- It reinforces the regional policies: Regional Nature Parks, Regional Nature Reserves labelled « Outstanding Areas of Brittany » (« Espaces Remarquables de Bretagne »), Nature Contracts, all tools of innovation, of experimentation and of an exemplary environmental approach concerned with the rehabilitation and valorisation of the areas (the wetlands, for instance).

Within the framework of this plan, many actions have been considered, the first one being implemented as early as 2007 with the creation of an Observatory of the Nature Park and (of) Biodiversity, linked to the Public Interest Group « Bretagne Environnement ».

Besides, it materializes the engagements of the Regional Council concerning a better integration of the natural patrimony in its various policies:

- Hence, the new territorial policy regarding water—defined in our regional strategic directives adopted in 2006, inscribed in the State-Region Planning Contract—which is based on the Water Management and Planning Plans and which has one clear political goal: to see to it that a maximum of water bodies and aquatic environments will reach the acceptable ecological state set by the Water Framework Directive by 2015.

- Hence, the Charter for the Coastal Areas of Brittany (« Charte des espaces côtiers bretons ») adopted in December 2007 in which water and aquatic environments protection – coastal waters included – is at the heart of priorities.
- Hence, the Regional Land Planning and Development Agency (Etablissement Public Foncier Régional) (hopefully soon to be established): serving land policies, its field of action will include the conservation of natural, coastal and agricultural areas with a view to encourage the maintaining of a more environmentally friendly agriculture which observes natural balances, a key element for habitat management.
- Hence, the regional Eco-Faur plan, which, via a yearly call for projects, accompanies the local authorities in their reflection on future planning, financially supports their investments (buildings, public areas among which the rehabilitation of wetlands, new neighbourhoods) while meeting the requirements of sustainable urbanism.
- Hence the support to the Coastal Protection Agency (Conservatoire du Littoral), within the framework of a pluri-annual convention.

In contributing together with its partners to the conservation of the network of Aquatic Warblers' staging areas in Brittany, the Region plays a particularly important role in the survival of the Warbler and could set the example at national level. In 2007, it thus accompanied, via a Nature Contract signed with Bretagne Vivante -SEPNB, the execution of ecological engineering works in the Pen Mané Marsh, an outstanding natural environment which is part of the « European sites of interest for the hosting of avifauna ». Owner of the site, the Region wishes to put the Coastal Protection Agency (Conservatoire du Littoral) in charge of its management.

Brittany is the driving force in France for the conservation of the most endangered passerine in Europe (this Life programme is the first and only conservation initiative in favour of the species in France) and it may indeed host 50 % of the world population in its staging areas.

Not so long ago, flower and small birds lovers were thought of as dreamers, described as « eco-freaks » disconnected from economic reality...

Today, the environment is at the heart of international summits, of numerous European directives, of charters and people talk about ZNIEFF (natural areas which are of particular interest in terms of ecology or wildlife), IBA (Important Bird Area), biotopes, corridors, blue and green belts and about biodiversity.

We went from a secondary importance to a priority, from the trivial to a scientific reality, from irony to a cultural revolution which commits, in several aspects, the future of humanity: What a victory!

This is, without doubt, a collective victory, but which was made possible thanks to the obstinacy, pugnacity and courage of pioneers who anticipated the evolution of our societies.

Despite these advances of which we can be proud, there are still a lot of people and decision-makers to convince of the fact that environment is not a constraint, but an investment for the future.

**G rard M VEL**

*Vice-President of the Regional Council of Brittany  
Responsible for quality of life, water, natural areas and landscapes*

# Workshop **A**

## **The Aquatic Warbler in 2008: assessment of knowledge**

▶ **Current distribution, population trends and threat status of the Aquatic Warbler**

Martin FLADE

▶ **Identifying autumn migration routes for the globally threatened Aquatic Warbler**

Romain JULLIARD, Bruno BARGAIN, Alice DUBOS & Frédéric JIGUET

▶ **The importance of Brittany in the Aquatic Warbler's migration as brought to light by the Bay of Audierne ringing station**

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▶ **Research on Aquatic Warbler at Biebrza Valley**

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▶ **Habitat analysis of Aquatic Warbler wintering grounds: first field period 2008**

Cosima TEGETMEYER

▶ **Specificity of the Aquatic Warbler's diet during its migratory stop-overs**

Christian KERBIRIOU & Bruno BARGAIN



# Current distribution, population trends and threat status of the Aquatic Warbler

Martin FLADE



The Aquatic Warbler is the rarest migratory songbird of Europe, and the only globally threatened passerine bird found in mainland Europe. The species is classified as Vulnerable at global level and is listed as Vulnerable in the IUCN Red List of Globally Threatened Species. At the European level it is classified as Endangered, for the European Union it is a SPEC I species. It is also included into Annex I of the European Union Wild Birds Directive, in Appendix II of the Bern Convention and in Appendix I of the Bonn Convention.

Once widespread and numerous in fen mires and wet meadows throughout Europe, the Aquatic Warbler has disappeared from most of its former range. Nowadays, the Aquatic Warbler breeds regularly in Belarus, Germany, Hungary, Lithuania, Poland and Ukraine (irregularly in Russia and Latvia), with major populations in Belarus, Ukraine, and Poland. The species became extinct in Western Europe during the 20th century and has declined dramatically in central Europe. It formerly bred in France, Belgium, Netherlands, former West Germany, former Czechoslovakia, former Yugoslavia, Austria and Italy.

This paper summarises latest figures on the global distribution and population size, as well as current threat factors, collected by the members of the Aquatic Warbler Conservation Team (AWCT). It is a shortened version of the « factual part » of the Aquatic Warbler Species Action Plan, which is prepared by BirdLife International on behalf of the European Commission in 2008 (Flade & Lachmann, *in prep.*)



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## The BirdLife International Aquatic Warbler Conservation Team (AWCT)

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The Aquatic Warbler Conservation Team was officially founded in 1998 at Brodowin / Germany and acts under the auspices of BirdLife International and is an informal association of researchers and conservationists working on the Aquatic Warbler, coming from all breeding range states and some stopover countries.

The AWCT has undertaken 14 field expeditions to different parts of W-Siberia (1999-2005), Belarus, Ukraine, Latvia, Lithuania, European Russia (Smolensk, Tver and Ryazan Regions, W-Ural, Kaliningrad Region), Poland, Hungary, and – currently – Senegal and Mauritania. In course of this expeditions, the AWCT has explored nearly the entire former central and East-European as well as Siberian range of the AW in search for remaining breeding populations and fen mires, has discovered a major wintering site, has exchanged knowledge among people and countries, has taken DNA and feather samples of most of the AW subpopulations and wintering birds, has developed joint standard methods for monitoring, habitat description and field research, and has initiated the Aquatic Warbler Memorandum of Understanding under the CMS (2003, Minsk) and a ongoing LIFE-Nature Project in Poland and Germany.

The AWCT receives regular financial and technical support from the RSPB (as the British BirdLife partner) and was also supported by the German Ornithological Society (DO-G) and the Michael Otto Foundation for Environmental Protection, the Deutsche Forschungsgemeinschaft (DFG), the British Government, the Deutsche Bundesstiftung Umwelt (DBU), the MAVA Foundation.

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### Habitat requirements of the Aquatic Warbler

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The Aquatic Warbler is a habitat specialist. During the breeding season it occurs mainly in sedge fen mires and similarly structured marshy habitats with a preferred water depth of 1–10 cm. In primeval landscapes it depends probably

on mesotrophic or slightly eutrophic floodplain fen mires which stay open because of their surface oscillating with the river water table.

Recently, it has been recorded in:

- Rich floodplain marshes in river valleys, comprising open sedge marshes with medium and large tuft-forming and scattered sedge *Carex* (e.g. Biebrza and lower Oder river marshes in Poland, upper Ukrainian Pripjat), partly with taller *Molinia caerulea* grass or scattered, low stems of *Phragmites australis*, and often also scattered bushes, which all serve as singing posts for the males; this type of habitat depends more or less on human management (cutting or burning);
- Mesotrophic or poor eutrophic open sedge fen mires, the ground covered by green mosses; the grassy vegetation is dominated by low or medium, partly tuftforming sedges (mainly *Carex elata*, *C. diandra*, *C. rostrata*, *C. omskiana*, *C. juncella*, *C. appropinquata*, *C. lasiocarpa*) and cotton grasses (*Eriophorum angustifolium*, *E. gracilis*), shallow water or wet pillows of mosses (Dikoe and Yaselda, Zvanets and upper Pripjat marshes, Uday, Supoy, Biebrza, Zuvintas); avoids too poor mire tracts with Sphagnum mosses and *Eriophorum vaginatum*, as well as parts with too deep water, too dense and high bushes or reeds, or too high sedge tussocks;
- Calcareous marshes with *Cladium mariscus* (Chelm marshes, Poland);
- Seasonally flooded brackish marshes of the Baltic Sea coast characterised by very weak and low reed stands 80–120 cm high in summer (in Germany, Swina river mouth in Poland, along the Curonian lagoon – Nemunas/Neman river delta in Lithuania);
- Wet marshy grasslands covered by high grass and clumps of sedge (in Hungary and in the Narew valley in Poland);
- Wet meadows of *Phalaris arundinacea* and *Alopecurus pratensis* cut once or twice a year, with sedge patches mainly of *Carex gracilis*, *C. nigra*, and *C. disticha* (Narew valley and lower Odra and Warta floodplains in Germany and Poland, Nemunas Delta in Lithuania).

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### Threats

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The Aquatic Warbler has suffered a very severe decline in western and central Europe due to habitat loss. These losses were caused mainly by drainage measures in fen mires and floodplains in



### ***Different Aquatic Warblers habitats in breeding grounds.***

order to enable or to intensify agricultural use, and for peat extraction. Also changes in the hydrological regime of the landscape (like channeling and deepening of river beds, pumping stations etc.) had a severe impact. Other habitat changes like agricultural abandonment and uncontrolled burning became important only after fundamental changes of the general hydrological regime of suitable wetland habitats, but play a major role today.

The most important threats at the breeding sites are in priority order:

#### **Change in hydrological regime in key sites**

Most Aquatic Warbler breeding sites suffer to various degrees under unfavorable man-made changes in the hydrological regime. This can lead for example to (1) lack of water, leading to reduced breeding success and population decline, (2) summer flooding with destruction of nests and (3) vegetation succession and loss of Aquatic Warbler habitat. In Ukraine, recently the deepening of parts of the upper Pripyat river channel resulted in a lower water table in the adjacent floodplain sedge mires and abandonment of Aquatic Warbler breeding sites.

#### **Breeding habitat changes due to abandonment**

This is an important factor in Poland (Biebrza and Lublin marshes, NW-Poland), Lithuania, Russia (Kaliningrad region), Belarus (Zvanets, Sporova), Ukraine (huge areas in the upper Pripyat region) and Germany (lower Oder valley) where, if cutting of vegetation and/or burning (or in some places grazing) ceases, succession takes place and the habitat becomes unsuitable due to

overgrowing by dominant sedges /grasses, high reeds, willow bushes or succession forests of birch or alder. In the past, reeds used to be occasionally harvested with scythes in the Biebrza and Zvanets mires, and along Yaselda, Stochid and upper Pripyat rivers for use on floors and for thatching, etc., together with the more important harvesting of sedges as poor quality hay and the active elimination of bushes. These traditions have now stopped at many places.

#### **Loss of breeding habitat through drainage, river bed deepening and peat extraction**

This threat is responsible for the dramatic historical decline of the species. The rate of active destruction of breeding sites through drainage and peat extraction has slowed considerably in the past 15 years, so that this threat is now localised, but critical where it occurs. This is usually related to drainage for agriculture or peat extraction/excavation, damming of floodplains (Pripyat, Yaselda) and also unfavourable water management (e.g. water extraction or drainage of adjacent areas) and canalisation of rivers. Currently there are problems at several sites in Poland, Belarus and Ukraine with drainage amelioration and peat extraction affecting adjacent sedge fens (upper Pripyat, Zvanets, Dikoe, Sporova) and also direct destruction still of fen mires in Ukraine (Volyn and Rivne regions). At the upper Ukrainian Pripyat, a large part of the Aquatic Warbler population is affected by current river bed deepening works, causing deterioration of adjacent sedge fens through drainage.

#### **Breeding habitat changes due to uncontrolled burning**

Burning is often used as a management

tool in pastoral agriculture. Uncontrolled fires, especially in spring and summer and if the mire is very dry, cause severe habitat destruction by burning out of the upper peat layer. In Biebrza there was in 1994 a 3,000 ha fire which caused a great deal of soil mineralisation, but uncontrolled burning is more often a direct threat, especially (to birds and nests) during the breeding season. Big spring and summer fires happened also in the Zvanets and Yaselda mires in Belarus. In Hungary, burned areas of suitable habitat were reoccupied by Aquatic Warblers only 5-6 years after fire. But controlled burning in winter or early spring during appropriate water or snow levels can be an appropriate management technique for maintaining the habitat quality.

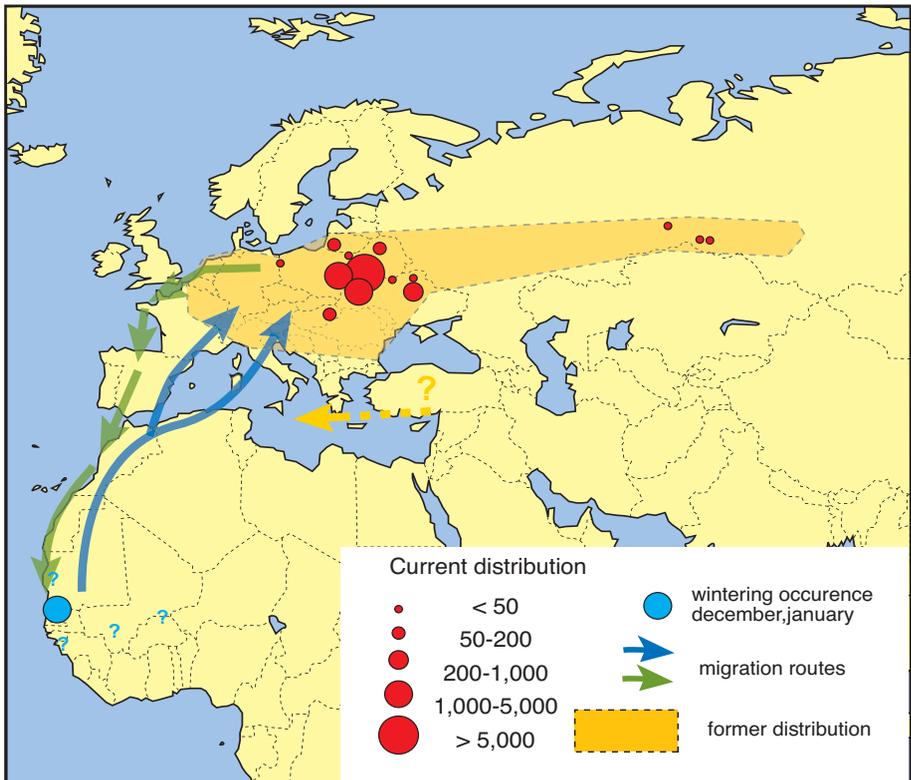
### Eutrophication

Eutrophication of floodplain fen mires from city waste water and fish breeding ponds, by inundation with polluted river water, leading to changes in vegetation structure and species composition and speeding up the rate of vegetation succession, was observed in the Yaselda

floodplain downstream of Berioza (Belarus) and in parts of the Rozwarowo Mire in NW-Poland. Mineralisation of mires due to lowered water levels leads to minerals being washed downstream to flooded Aquatic Warbler areas, thus speeding up the rate of vegetation succession. This could be an important factor (Yaselda incl. Sporova mires, Belarus; several areas in the upper Pripyat region, Ukraine). Eutrophication from atmospheric nitrogen deposition and increased CO<sub>2</sub> concentration in the atmosphere in general also contribute to the problem of accelerated vegetation succession.

## Current breeding population status of the Aquatic Warbler

The (historical) breeding range is restricted to the western Palearctic between 47° and 59°N. Currently, breeding occurs regularly in Germany,



[1] *Historical and current range of the Aquatic Warbler.*

Poland, Hungary, Lithuania, Belarus, and Ukraine, and probably irregularly in Russia and Latvia [1]. Possible breeding in Romania and Bulgaria has not been confirmed for the last 40 years. Population figures are given in [2].

The breeding distribution is fragmented because of habitat constraints. The species became extinct in Western Europe during the 20<sup>th</sup> century and has declined dramatically in central Europe. It formerly bred in France, Belgium, Netherlands, former West Germany, former Czechoslovakia, former Yugoslavia, Austria and Italy.

Considering the geographical isolation of subpopulations and the results of the DNA studies of Giessing (2002), the following biogeographic populations can be separated:

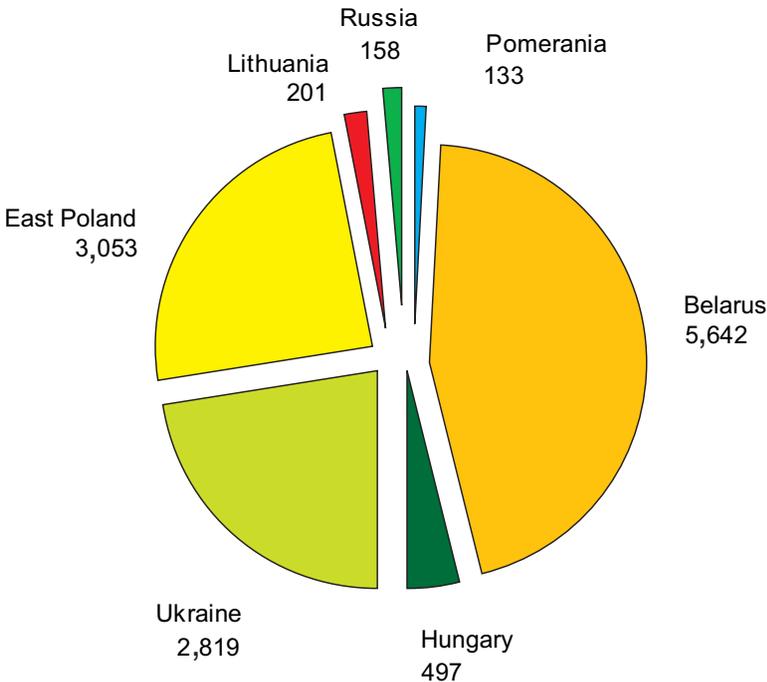
- the central European core population, including Belarus, E-Poland, Ukraine and Lithuania (c. 12,000 males);
- the isolated Hungarian population (60-700 males);
- the Pomeranian population, including the NW-Polish and the German

population (c. 80 males); this subpopulation shows first signs of inbreeding depression (increased occurrence of homozygosity; Giessing, 2002);

- the W-Siberian population, which is isolated from the core population by 4,000 km distance (population estimate from the year 2001: 50-500 males).

Recent studies on genetics and on stable isotopes in Aquatic Warbler feathers show that the Pomeranian population is genetically separate from all other studied populations (Giessing, 2002), and that it has most probably a different, very restricted and more northerly wintering area than the other central and east European populations (Pain *et al.*, 2004 and unpublished).

This sub-population is sharply declining, and is thought to be the last remnant of the formerly huge north German population. The west Siberian population is geographically completely separate and is probably headed for extinction. In respect of these two sub-populations therefore it is likely that there will be a partial extinction of genetic variability within the species.



[2] Distribution of the global Aquatic Warbler population according to subpopulations (geometric mean of the period 1996-2007).

## **Belarus**

Systematic surveys in the whole of Belarus in 1995-2007 showed, that Belarus holds nearly half of the known world population of Aquatic Warbler, altogether 3,900 – 6,300 singing males distributed at 8 scattered major breeding sites; it is estimated from retrospective analysis of open fen mire areas, that since the 1960s suitable habitat area and population size of Aquatic Warbler must have suffered a decline of more than 90 % within the last 30 years, mainly due to drainage, land reclamation and peat extraction (Kozulin & Flade 1999). Nearly 15,000 km<sup>2</sup> of fen mires have been drained since 1960; the open fen mire area decreased from c. 3,800 km<sup>2</sup> in the mid-1970s to c. 440 km<sup>2</sup> in 1995/96.

The most important remaining breeding site is the Zvanets mire (190 km<sup>2</sup>) near Kobryn, Brest region, with 3,600–5,000 singing males registered here (yearly changes according to water table fluctuations). Other important mires are Dikoe (Yaselda and Narew spring, Brest region, 81 km<sup>2</sup>) with c.150- 400 singing males and the mires along the Yaselda river between Berioza and Sporova lake (50 km<sup>2</sup>, c. 570-2,400 singing males). All major breeding sites are included in protected areas (national park, national zakaznik), management plans were elaborated and partly implemented. Large-scale restoration and management measures have been especially implemented at Zvanets.

## **Ukraine**

Extensive surveys in 1996 - 1998 by A. Poluda and co-workers in central and north-west Ukraine, and Flade, Gorban, Kozulin, Tishechkin and co-workers along the upper Ukrainian Pripyat in Volyn region, revealed a total population of 2,400 - 3,400 singing males, which are mainly concentrated at the following sites:

- The Pripyat population group: Upper Pripyat and tributaries (Volyn and Rivne regions) 1,850-2,500 males, with bigger subpopulations along the Pripyat between Ratno and Cyr mouth (1,120-1,450), Vizhery mire, lower Turiya (250), Stochid valley (200-300), and the Styr valley (150).
- The Desna-Dniepr population group: Kyiv and Chernigiv regions c. 500 - 580 males, with bigger subpopulations in the Uday valley (250 - 270) and the Supoy valley (180 - 200).

Despite of the lack of reliable reference data one can assume, that the Aquatic Warbler must have suffered a dramatic

decline due to habitat loss in the whole Ukraine during the past decades. Nevertheless, the actual situation of the two sub-populations seems to be very different: The Uday and Supoy populations seem to be not actually threatened. In contrast, parts of the upper Pripyat population are threatened. On one hand, drainage work for agriculture and peat excavation has destroyed huge fen mire areas even during the past 5-10 years and is still continuing; the amount of direct habitat loss is difficult to assess, but is likely to exceed 80% within 30 years. On the other hand, the remaining fen mires are heavily impacted by vegetation succession due to alterations of hydroregime and ceasing of traditional land use practices. The most suitable and stable (but also declining) habitats have survived very close to the Pripyat river, where regular flooding and high water table restrains vegetation succession and in some areas, where still hay making takes place, but more than the half of these floodplain mires are overgrown by willow shrubs in the meanwhile. Without large-scale habitat management the Aquatic Warbler populations are likely to become extinct within the next 20 - 30 years.

Recently, a severe new threat has arisen at the upper Pripyat: parts of the Pripyat river channel have been cleaned deepened. As a consequence, the water table of adjacent floodplain sedge mire declined and several (smaller) breeding sites were abandoned in 2006 and 2007.

## **Poland**

A survey in 1997 resulted in an estimated total population of ca. 2,900-2,950 singing males in Poland distributed in 13 sites; in 1989-1995 the population was estimated at c. 3,200-4,450 males (Kloskowski & Krogulec, 1999), 3,410-3,530 males in 2003, and then declined to 2,670-2,724 in 2007. There are three main subpopulations:

- Biebrza is the most important breeding area, with more than 2,000 males. A population decline due to overgrowing by reed-beds and willow-birch communities occurred, caused by lowering of the water table and cessation of cutting and grazing. A National Park was established in 1993. There has been no further decline – rather a current increase – at the main site (Bagno Lawki) due to excellent habitat management by the National Park administration.

- Chelm is part of the Lublin marshes, and the Aquatic Warbler is present in four neighbouring blocks, totalling 15 km<sup>2</sup> and

holding 300-480 males in total. A management plan has been produced by OTOP and two specific management actions have been undertaken: cutting of scrub to create more open habitat and promote colonisation by the Aquatic Warbler and cutting of trees to clear the habitat.

• In Western Pomerania (lower Oder valley, Oder and Swina estuary) the number of recorded singing males has heavily declined since 1991 [3]. The largest Pomeranian breeding site of Aquatic Warblers, holding > 50% of the Pomeranian population in recent years, is located at the Rozwarowo Marshes near Wolin, a Natura 2000 site that is used for winter reed cutting.

### Lithuania

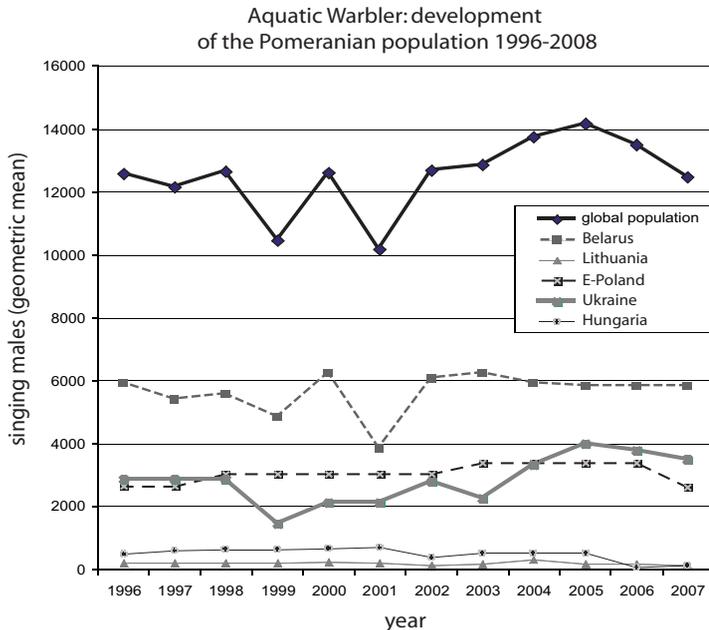
A systematic survey in 1995-1997 (Z. Preiska, unpublished report) in the central and western parts of the country revealed eight localities with 225-280 singing males in total, with main breeding sites along the Curonian Lagoon, especially in the Sakuciai - Dreverna area (200-300 singing males), the Nemunas/Neman delta Regional Park (c. 50 males) and Zuvintas Biosphere Reserve (decrease from c. 25 in 1986 to 10-15 males in 2000-2002). The total population reached a peak in 2004 (309 males), but then declined to only 150 males in 2007. Altogether, habitat changes related to vegetation succession

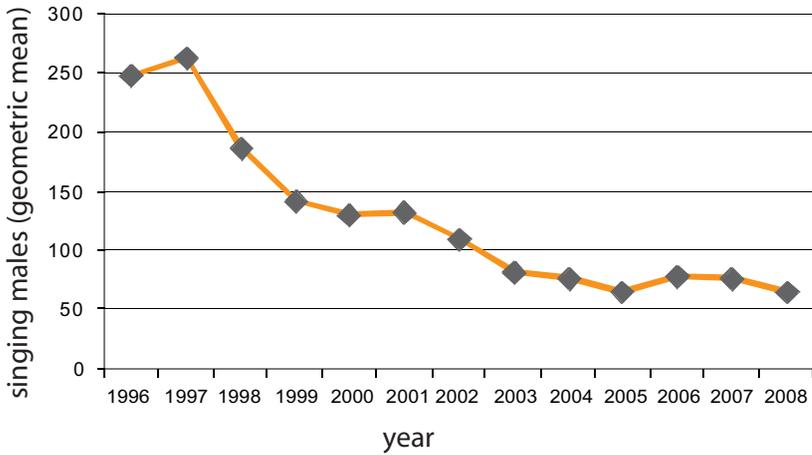
due to cessation of cutting (or other appropriate management like controlled burning) is the most important threat (Zuvintas), followed by changes in water table (Nemunas/Neman delta). Cutting of vegetation in the breeding season has been identified as a problem for Aquatic Warblers in the Nemunas/Neman delta Regional Park (P. Mierauskas, Z. Preiska, *pers. comm.*). An action plan for the species and a management plan for Nemunas/Neman delta Regional Park have recently been prepared and now need implementation.

### Latvia

There are 36 confirmed records since 1940 (mostly captures at Lake Pape and Lake Liepaja, A. Celmins, *unpublished data*) and further unconfirmed records, but only one proof of breeding in 1940 at Lake Babite (Roms, 1942). Special searches for breeding populations of the species in 1997 at the ten most promising sites in the whole country remained unsuccessful (O. Keiss, *unpublished report*), despite some suitable habitat areas being found. However, in 2000-2002, 1-3 singing males were observed at Lake Liepaja (A. Celmins, *unpublished data*). In the following years up to 2007 the site was not occupied. Thus the breeding occurrence of Aquatic Warbler in Latvia has to be classified as irregular and sporadic.

[3] *Population development of the global Aquatic Warbler population according to the AWCT data base (Flade & Lachmann in prep.).*





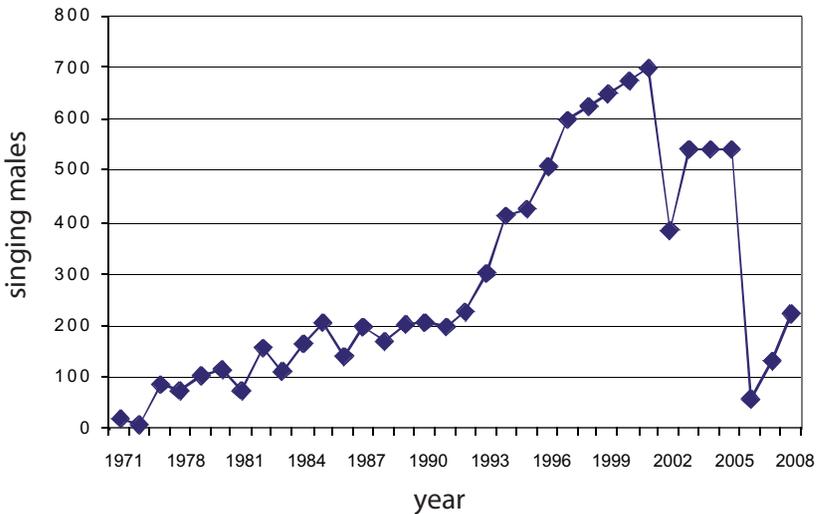
**[4] Population development of the isolated Pomeranian Aquatic Warbler population.**

**Hungary**

The only breeding population is in the Hortobágy National Park, where it has increased from 19 singing males in 1971 to 700 singing males in 2001 (Kovacs & Vegvari 1999, Vegvari, *pers. comm.*). Following a serious drought in 2002 and the burning of 30% of Aquatic Warbler habitats, only 386 singing males were recorded in that year. In 2006, after a big long-lasting and high spring flood, the population crashed down to only 60 males, but recovered slightly to 132 males in 2007 and 230 males in 2008.

**Germany**

The breeding population is the westernmost and smallest of all the European countries. Since 1999 there has been only one isolated site, the Lower Oder valley National Park in the north-east corner of Germany close to the Polish border (Tannenberger *et al.*, 2008). The national park administration tries to improve management since 2007, and habitat restoration measures have been started in the lower Peene valley in course of the running Polish-German EU Life project. The remaining German



**[5] Population development of the Hungarian Aquatic Warbler population (notice the crashes after fire and late spring floods in 2002 and 2006 (Zsolt Vegvari, pers. comm.).**



***Zvanets, one of the most important breeding sites in Belarus.***

population is only 4-15 singing males in total (in 2007: 10 males).

### **Western Siberia**

Four Aquatic Warbler Conservation Team expeditions to W-Siberia in 1999-2002 could not find any Aquatic Warblers in Tomsk - Barabinsk - Novosibirsk region, despite large areas of suitable structured habitats occur here. In the Shegarka mire W Tomsk, where Ravkin (1973) reported a big population in 1967, the species was definitely absent in 1999. In 2000, very small numbers of singing males (11-15 in total) were found near Tyumen and at two sites in northern Omsk oblast. The total West Siberian population is estimated at 50-500 males maximum, and it is believed that this is

the last remnant of a former large population, now going extinct. There are large areas of suitable fen mires, but the population is probably too isolated and small to survive in this region of sub-optimal climate at a great distance from the probable wintering sites. ■

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# Identifying autumn migration routes for the globally threatened Aquatic Warbler

Romain JULLIARD, Bruno BARGAIN,  
Alice DUBOS & Frédéric JIGUET



The migration strategy of the globally threatened Aquatic Warbler *Acrocephalus paludicola* needs to be known to ensure that effective action is taken to conserve the principal stopover sites. Using data from ringing stations during the autumn migration of reedbed warblers, we developed an index that allowed countries and sites to be compared in terms of their numeric importance to migrating Aquatic Warblers. According to this index, there was no significant decline in the number of Aquatic Warblers migrating through Europe during the 1990s. France appears to receive the largest numbers of this species in autumn compared with other European countries. Within France, only coastal regions are visited by the species (but not in the Mediterranean) with the largest numbers occurring in Normandy and Loire, while Brittany receives large numbers in some years but not in others.

In order to migrate successfully, birds usually need to divide their migration into several flights separated by stopovers (Bairlein 1985; Biebach *et al.*, 1986). The migration strategy of a species is defined by the succession of flights and stopovers as well as gains in body mass during stops (Ellegren, 1991). Studying a stopover system within a country is a demanding task, but is achievable for some habitats-specialists such as reedbed passerines. Such species use wetland habitats, especially in coastal areas and estuaries, allowing the study of migrating individuals. Among reedbed warblers, the Aquatic Warbler *Acrocephalus paludicola* seems to make use of traditional stopover sites where many migrants gather (Atienza *et al.*, 2001). Defining which potential stopover sites are important for this species (i.e. those that receive high numbers during migration), is therefore achievable by ringing at potential stopover sites along sea coasts.

The Aquatic Warbler is a globally threatened species (Collar *et al.*, 1994), which occurs in western Europe as an uncommon but regular passage migrant, and is the focus of a European Action Plan (Heredia, 1996). Breeding populations are reported as declining (Aquatic Warbler Conservation Team, 1999; Kozulin & Flade, 1999; Birdlife International, 2004), mainly because of habitat loss (Dyrce & Zdunek, 1993; Kozulin *et al.*, 2004). This species is one of the most habitat specialized reedbed warbler in Europe, inhabiting rich, flooded fen mires that are globally threatened by agriculture intensification and drainage. The species has now disappeared from previous breeding ground in France, Belgium, The Netherlands and Austria (Bargain, 1999). In western Europe, the breeding range is now confined to Germany, with populations further east in Poland, Hungary, the Baltic States, Belarus, Ukraine and, to a lesser extent, Russia (5-50 pairs). Only 12-15



**Migration bird study by ringing.**

pairs breed in Germany and 250-310 pairs in Latvia and Lithuania, while the Hungarian population has recently risen to 350-700 pairs after the first breeding record in 1971 (Kovács & Végvári, 1999; Birdlife International, 2004). Poland, Belarus and Ukraine constitute the breeding strongholds of the species (Heredia, 1993; Kozulin & Flade, 1999; Birdlife International, 2004). The northern populations migrate westerly through Western Europe during autumn, visiting marshes in The Netherlands, Belgium, France and the United Kingdom (de By, 1990). The wintering grounds, somewhere in tropical Africa, have yet to be identified precisely. There are a few records from Senegal, Mali and Ghana (Heredia, 1993). Stable isotope signatures from wintergrown feathers of different populations suggest a strong relationship between European breeding and African winter moulting latitudes, but did not help in localizing the wintering sites (Pain *et al.*, 2004). For such a globally-threatened passerine, identifying the system of stopover sites in each country crossed during migration is a high conservation priority. The stopover system of the Aquatic Warbler cannot be derived from what is known from congeners, as species of a genus can practice different migration strategies (Bibby & Green, 1981), and as Aquatic Warblers breeding in Europe do indeed take a different, indirect,

route for their post-nuptial migration from those taken by other *Acrocephalus* species (de By, 1990; Sutherland, 1998). Understanding the stopover sites system in Europe should allow defining site-based conservation priorities to aid further the conservation of the species.

In this study, we have three main objectives. The first is to use ringing data to describe any annual trend in the abundance of migrating Aquatic Warblers in France during the last decade, and to relate this to annual patterns observed in most European countries. The second objective is to define the importance of French stopover sites for migrating Aquatic Warblers, compared with other European countries. Finally, a third objective was to study more precisely the system of stopover sites of the species at a regional level in France, during two years of intense and standardized monitoring (i.e. ringing) of potential stopover sites.

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## Methods

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**Using ringing data to develop indices**  
 We used data obtained from ringing programmes of reedbed warblers across various sites and countries, collected between 1990 and 2001. Yearly data from

Country (number of years)	Acrola index
Poland (11; 1497)	2.286 ± 1.834
France (12; 240)	0.184 ± 0.097
Morocco (4; 3)	0.160 ± 0.376
The Netherlands (9; 136)	0.079 ± 0.026
Belgium (12; 476)	0.055 ± 0.025
United-Kingdom (11; 284)	0.049 ± 0.030
Lithuania (12; 22)	0.048 ± 0.125
Spain (9; 76)	0.047 ± 0.044
Denmark (12; 8)	0.036 ± 0.041
Germany & Austria (12; 60)	0.032 ± 0.030
Switzerland (12; 4)	0.019 ± 0.037
Italy (5; 4)	0.014 ± 0.034
Sweden (12; 6)	0.003 ± 0.003
Estonia (11; 1)	0.001 ± 0.003

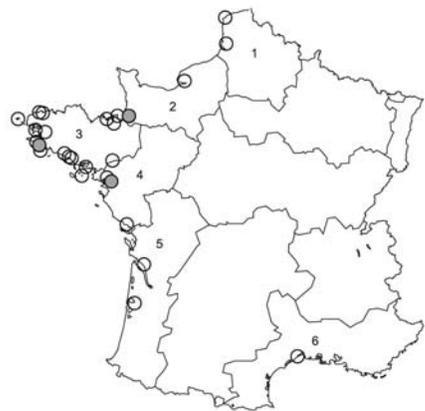
**[1] Values ( $\pm$  s.e.) of mean Acrola index (see method for details) for countries considered in this study (period 1990-2001). The yearly Acrola index is defined as the proportion of Aquatic Warblers captured among all *Acrocephalus* warblers (in %). The number of years for which data on ringed *Acrocephalus* warblers was available for calculating the index as well as the total number of Aquatic Warblers reported) are given in brackets for each country.**

the different countries were provided by the corresponding national ringing centres. These countries are among those visited by the Aquatic Warbler during the post-nuptial migration, and are listed in [1] (from Poland and Baltic states to Morocco). In each country, ringing was achieved by mist-netting without tape-luring, except at Tréogat / Baie d'Audierne in France and at some Spanish sites in 1999, 2000 and 2001. In France, yearly totals of ringed Aquatic Warblers varied from 51 to 166 for the period 1990–2001 (mean and median, 97).

A second sampling method has been carried out at Tréogat, France, from 1990 to 2003, and was extended to 28 other French sites in 2002 [1] and nine sites in 2003. It comprised tape-luring during capture sessions and a standardized spatial design of mist-nets. The latter was placed as mist-net lines perpendicular to the sea-coast (most sites were next to the sea or large open water area), with lines 50 m apart from each other. The territorial

song of Aquatic Warbler was played back at the centrally-positioned mist-net line during the whole capture session, but never at night. Any day of capture started at dawn and stopped usually at noon, but most captures are concentrated in the first couple of hours.

In order to investigate annual, seasonal and spatial variations in Aquatic Warbler numbers, we developed an index, called « Acrola », defined as the total number of Aquatic Warblers captured divided by the total number of *Acrocephalus* warblers captured (in %). This index allowed biases caused by heterogeneous capture effort between countries or sites to be accommodated. The rationale of such an index is that the actual spatial variation in Aquatic Warbler numbers is of greater magnitude than the variation in the total number of *Acrocephalus* warblers. This is probable because other *Acrocephalus* come from very large populations (tens of millions of individuals), and at any location, populations from very large areas are mixing (from Ireland to Finland in various proportions). Hence, any potential stopover site receives a very large number of reedbed warblers, among which are a few Aquatic Warblers. Indeed, the Acrola index varies greatly, ranging from less than 0.01 to 1% (see results). Such an order of



**[2] Location of French ringing sites (29) where a standardized mist-netting methodology (including tape-luring) was set up in July-September 2002 in order to capture migrating Aquatic Warblers. The three reference sites are represented by grey dots (from north to south: Genêts, Tréogat / Baie d'Audierne and Frossay). We defined 10 regions grouping adjacent administrative regions on biogeographic criteria. Labels 1-6 refer to the regions listed in [8].**

magnitude cannot be due to variation in number of *Acrocephalus* only. A second index was developed for French sites surveyed in 2002 and 2003 with the standardized methodology, as the mean number of Aquatic Warblers captured for 100 m of mist-nets and per day.

### **Comparing trends in indices between countries, 1990-2001**

We first compared national indices obtained each year across various countries, excluding data obtained from sites using tape-luring in France and Spain [1]. Spatial and temporal variation in the Acrola index was modelled using standard General Linear Models for such data, assuming a binomial error distribution and using a logit link. In case of over-dispersion (residual deviance > residual df), we used the F-statistic rather than the default chi-square statistics. We looked for possible annual trends in this index over Europe from 1990 to 2001. The linear model considered effects of year (continuous) and country (factor). The presence of a non-linear trend was assessed with non-parametric GAM model implemented in the S-plus software. We tested further whether trends obtained in France differed from those in other European countries (interaction year x country in the linear model), and if the index was higher in France than in other European countries (ANOVA, country effect as France or non-France, after adjusting the index for any year effect).

### **Comparing indices between French sites, 1993-2001**

We calculated the Acrola index for each year between 1993 and 2001 using ringing totals obtained in 10 French administrative regions (see [1] for delimitation of these regions) and at two well-surveyed sites using tape-luring (Tréogat / Baie d'Audierne, Brittany, and Genêts, Manche, the latter for 1999-2001 only). We compared the index values obtained in these ten regions with ANOVA (region effect adjusted to a year effect). We further compared annual trends in the index obtained at Tréogat (using tape-luring throughout the period) and at all other French sites (without tape-luring during the period).

### **Comparing indices between French sites, 2002 and 2003**

In 2002, 29 French ringing sites used a standardized method to catch reedbed warblers, using tape-luring and a standardized spatial distribution of mist-nets. Three of these sites have been almost constantly monitored during the

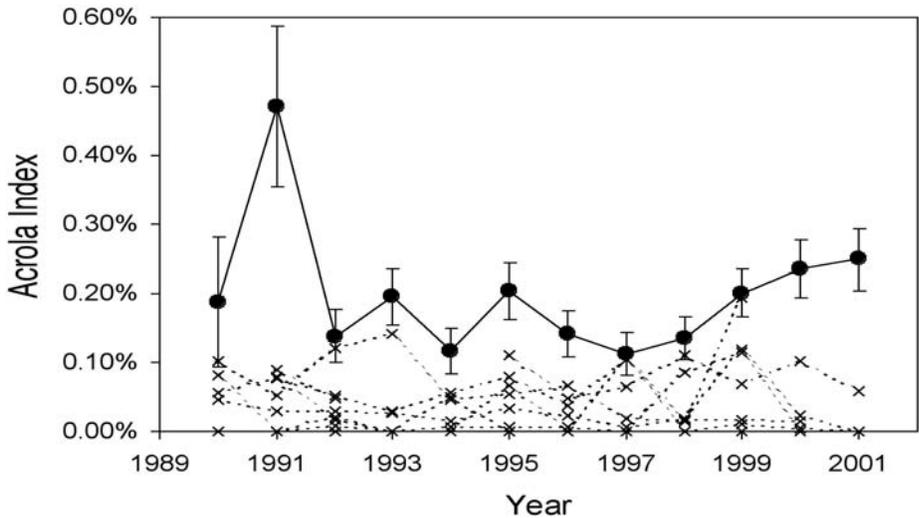
post-nuptial migration (from 15 July to 30 September). These are Tréogat / Baie d'Audierne (Brittany; 75 trapping days), Genêts (Normandy; 40 trapping days from 22 July to 15 September) and Frossay (Loire estuary; 83 trapping days), hereafter called reference sites. Twenty-six additional sites were sampled during a shorter period within the post-nuptial migration (2–11 consecutive days for a total of 134 trapping days). Among-site variation in age ratio was examined by the use of a chi-square test. In 2003, ten sites again employed the standardized method to catch Aquatic Warblers. In both years, the Acrola index was calculated for each site, and for six regional areas. The latter are (names of corresponding administrative departments or regions in brackets): North (Nord, Pas de Calais; two sites in 2002, 1 site in 2003), Normandy (Basse and Haute Normandie; two sites in 2002 and 2003), Brittany (Bretagne; 17 sites in 2002, one in 2003), Loire (Loire-Atlantique, Vendée; five sites in 2002, four in 2003), Atlantic Coast (Charente-Maritime and Gironde; two sites in 2002 and 2003) and South (Hérault; one site in 2002).

Daily ringing records obtained in the three reference sites in 2002 were used to plot the daily captures of Aquatic Warblers in France during the post-nuptial migration, from mid-July to the end of September. We looked especially for seasonal trends in Aquatic Warblers caught in France during autumn 2002, to identify the peak migration period of the species in the country. We further compared the Acrola index values obtained in different sites or regions during the period identified as the migration peak. We also compared values of the second index we retained (number of Aquatic Warbler captured for 100 m of net per day) between sites and regions.

For 2003, we calculated the Acrola index for each site during the peak migration period before aggregating the indices to obtain a mean value for each of the six coastal regions.

### **Body mass: mean, variance and gain**

Most birds captured in 2002 were weighed with a Pesola spring balance to the nearest 0.5g. Variation in body mass was analysed with standard ANOVA. The mean and variance of body mass were further compared between the four main regions with Aquatic Warblers. Variance was compared by use of the F-test (Snedecor & Cochran, 1980). We estimated the body mass gain (in g. per day) for individuals recaptured after one or more days using



[3] Annual variation of the Acrola index for 13 countries listed in [1] (period 1990-2001), excluding Poland where many ringed Aquatic Warblers are breeders, not migrants. Black dot plain line: France with vertical bars:  $\pm 1$  S.E.; cross dotted line: other countries.

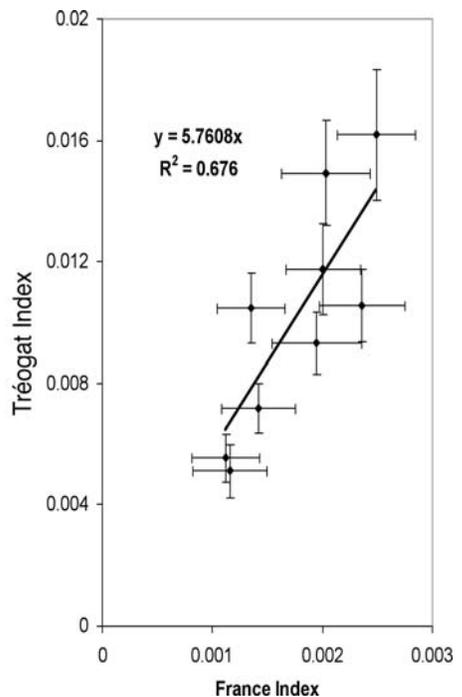
data for the period 1993–2002. We tested the linearity and non-linearity of the trend, for the 54 birds involved (using generalized linear and additive models).

All statistical analyses were performed using the S-PLUS package (MathSoft 1999). Results were considered significant for  $P < 0.05$ .

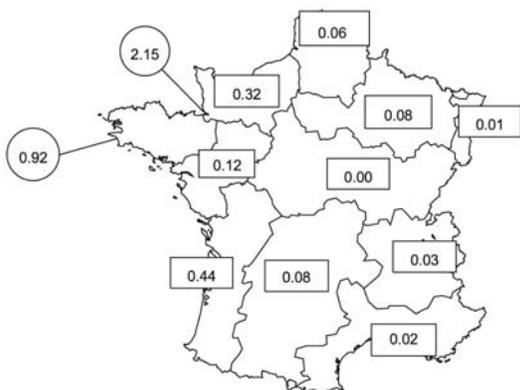
## Results

### Comparing indices between countries, 1990-2001

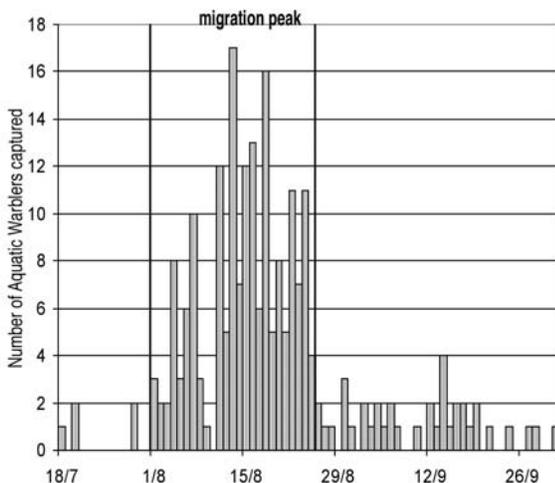
We detected no significant annual linear trend in the Acrola index at a European scale from 1990 to 2001 ( $F_{1,99} = 1.02$ ,  $P > 0.3$ ; [3]), when excluding data obtained in Poland (which includes birds ringed on breeding grounds) or obtained by tape-luring. We found no significant difference between linear trends obtained for France and for all other European countries when excluding Poland ( $F_{1,98} = 0.98$ ,  $P > 0.3$ ). Non-parametric GAM modelling did not detect any non-linear trend ( $F_{3,96} = 0.68$ ,  $P > 0.5$ ; see [3]). When comparing the Acrola index of France with those for all other countries combined, the French index appeared to be higher than other European ones ([1];  $F_{1,100} = 7.76$ ,  $P = 0.006$ ). A negative linear trend obtained for Poland differed only slightly, but significantly, from that obtained for all other European countries ( $F_{1,109} = 4.02$ ,  $P = 0.047$ ).



[4] Comparisons of yearly Acrola indices obtained at Tréogat / Baie d'Audieme (using tape-luring) and all other French ringing sites (without tape-luring) for the period 1993-2001.



[5] Variations in mean Acrola index across 10 regions in France for the period 1993-2001. Two sites (circles) surveyed during the period using tape-luring are isolated in Normandy (Genêts) and Brittany (Tréogat / Baie d'Audierne).



[6] Daily number of Aquatic Warblers captured for three French reference sites (Tréogat / Baie d'Audierne, Genêts and Frossay), from 18 July to 30 September 2002.

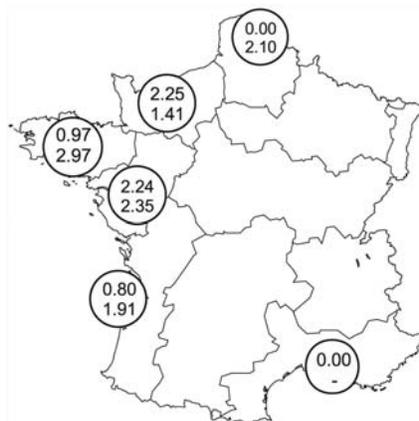
### Comparing indices between French sites, 1993-2001

Tape-luring had a considerable effect on the Acrola index which was thus increased c. six-fold [4]. Among-year variations in the Acrola index were highly significant for Tréogat / Baie d'Audierne and all other sites (Likelihood ratio test,  $P < 0.001$ ), but were very similar between Tréogat / Baie d'Audierne and all other sites (same model, site-year effect,  $\chi^2$  test,  $P = 0.37$ ; correlation between yearly indices for Tréogat / Baie d'Audierne and all other sites,  $r = 0.822$ ,  $n = 9$ ,  $P < 0.001$ ; [4]). We found significant variation in the index across the ten regions ( $F_{9,305} = 2.35$ ,  $P = 0.014$ ), but no annual trend ( $F_{1,306} = 2.18$ ,  $P = 0.14$ ). The regions with the highest index values, in decreasing order, were: Atlantic Coast, Normandy and Brittany [5].

### Comparing French sites with a standardized method, 2002 & 2003

In total, 277 migrant Aquatic Warblers were caught in France in 2002. We found no significant difference in the distributions of juveniles and adults between the different sites ( $\chi^2$  test,  $n = 274$  individuals,  $P = 0.8$ ). We measured the numbers of Aquatic Warblers captured during days of migration for the three reference sites [6]. The migration peak of Aquatic Warblers in France could be derived from [6] as occurring between 1 and 25 August. Within

that period, the Acrola index showed no trend (LRT for a linear trend  $\chi^2=0.12$ , 1 df,  $P=0.7$ ; non-linear trend  $\chi^2=4.12$ , 3 df,  $P=0.19$ ). The Acrola indices were compared for the period 1–25 August only [8]. Frossay and Genêts were equivalent and seemed to be the most frequented sites with an Acrola index four times greater



[7] Variations in mean Acrola index across six regions in France in 2002 (top) and 2003 (bottom), for sites surveyed with a similar standardized mist-netting methodology and between 1 and 25 August.

than that at Tréogat / Baie d'Audierne in 2002. At a regional scale, Normandy and Loire were equivalent and seemed to be the most frequented region with an Acrola index three times greater than those of Brittany and the Atlantic Coast [7].

Similarly, the number of Aquatic Warblers captured per 100 m of net per day was higher in Loire, than in Normandy, Brittany and Atlantic Coast [8], and appeared to be successful at distinguishing the geographical areas and the reference sites from each other. The index was double at Frossay than at Genêts, with the latter's index being also twice bigger than at Tréogat / Baie d'Audierne [8].

In total, 426, migrant Aquatic Warblers were caught in France in 2003. That year, the index was three times higher in Brittany (Tréogat) than it had been in 2002 [7]. It was also higher than in 2002 for North and Atlantic Coast, almost similar to 2002 for Loire, but lower for Normandy. Overall, spatial variations of the index among regions were less marked than in 2002.

**Body mass: mean, variance and gain**  
Body mass did not vary with date of capture (linear trend;  $F_{1,257}=0.13$ ;  $P>0.7$ ; non linear trend estimated with a GAM model:  $F_{3,254}=1.74$ ;  $P=0.16$ ). Adults tended to be slightly heavier than juveniles (adjusted to regional variation:  $+0.44\pm 0.23$ g;  $P=0.05$ ) such difference being additive over regions (age-region,  $F_{3,255}=1.39$ ,  $P=0.25$ ). Average body mass strongly varied among region ( $F_{3,258}=5.28$ ;  $P=0.001$ ; [8]). Only birds from Loire differed significantly in body mass from those from other regions being lighter. We further calculated residual variance in body mass

adjusted to age of the bird, and compared these variances among regions [8]. Birds captured in the Atlantic Coast region had higher variance in body mass than in Loire ( $F_{17,147} = 4.16$ ,  $P < 0.001$ ), Normandy ( $F_{17,37} = 2.52$ ,  $P = 0.02$ ), but not Brittany ( $F_{17,49} = 1.91$ ,  $P > 0.05$ ). The only other significant difference was found between birds captured in Brittany and Loire, with a higher variance in body mass for the former ( $F_{49,147} = 2.17$ ,  $P < 0.001$ ).

We found a significant linear trend between body mass and time elapsed between two consecutive captures of the same individuals on a site ( $F_{1,52} = 14.02$ ,  $P < 0.001$ ), but no non-linear trend beyond (GAM modelling,  $F_{3,52} = 1.97$ ,  $P = 0.13$ ). The gain in mass was 0.29 g per day, and the intercept was not significantly different from zero ( $t = -1.77$ ,  $n = 52$ ,  $P = 0.08$ ).

## Discussion

During the period 1991–2000, the breeding populations of the two most abundant Acrocephalus species (*Sedge A. schaenobænus* and *Reed A. scirpaceus* Warblers) were increasing generally across Europe (Birdlife International 2004). This might have caused a negative bias in the Acrola index over time. The fact that we failed to detect any negative annual trend in relative numbers of Aquatic Warblers migrating across Europe and France is thus reliable. Yet, numbers of breeders have been reported to have decreased over the last decade at European breeding sites, especially because of

Region (reference site)	N° days of capture	N° birds / 100m / day	Acrola index	Mean body mass (g) ± SD	N
1. North	5	0.000	0.000	-	0
2. Normandy (Genêts)	23	0.965	3.395	11.51±0.99	40
3. Brittany (Tréogat)	53	0.402	1.064	11.20±1.14	52
4. Loire (Frossay)	36	2.139	3.539	10.92±0.79	151
5. Atlantic Coast	23	0.280	0.782	11.36±1.55	20
6. South	2	0.000	0.000	-	0

**[8] Values of two indices of Aquatic Warbler relative abundance for six regions (data obtained with a standardized mist-netting methodology; 1-25 August 2002). The respective indices are: the number of Aquatic Warblers captured for 100 m of mist-net per day, and the Acrola index. The mean body mass (in grams) and the variance of body mass of all captured Aquatic Warblers are also given, with the sample size considered (N). Region localization may be found on [2].**

habitat loss (AWCT, 1999; Birdlife International, 2004). Accordingly, we found a decreasing index for Poland over the last decade (including breeders and migrants), but this does not seem to have affected numbers migrating through Western Europe. This could be corroborated by the recent re-estimation of numbers breeding in eastern European countries, which seem to be higher than previously suspected, largely over-sizing the Polish populations (e.g. Kozulin & Flade, 1999; Birdlife International, 2004). The Aquatic Warbler may be declining in its westernmost breeding grounds, but not in the east, while the eastern breeding populations are larger than the western ones. Concerning the sampling methods used to capture migrating Aquatic Warblers, tape-luring did not influence the yearly index variations in France [4]. This provides further evidence that tapeluring is highly efficient for both capturing more Aquatic Warblers and increasing the accuracy in estimating annual trends in migrant numbers. It should, however, be noted that the Acrola index could be biased in some countries, which might receive proportionately more individuals of other Acrocephalus Warbler species. Using a second index, by quantifying the sampling effort differently, as the mean number of Aquatic Warblers captured per 100m of net per day, should provide the opportunity to test this, although data on total mist-net lengths and duration of capture sessions are hardly accessible and rarely recorded by national ringing schemes.

In a European context, France appeared to receive the highest number of Aquatic Warblers during the post-nuptial migration. The fact that the Acrola index varies along the presumed Aquatic Warbler flyway (from Poland to Spain) suggests that the Aquatic Warbler does not have the same strategy as other Acrocephalus species taken together. The species seems to fly quickly to France, where it concentrates: the index in North-Western France is about four times greater than in neighbouring Belgium and the United-Kingdom [1, 5]. Because the Acrola index is lower in South-Western France and Spain, it is likely that part of the population departs directly from stopping-over sites in France to winter quarters in Africa without additional stops in Europe. In that respect, the Aquatic Warbler migration strategy appears closer to that of the Sedge Warbler rather than of the Reed Warbler. Sedge Warblers migrate earlier, and more rapidly, and most fly a long

stage to West Africa from feeding grounds in northern France or southern England. On the contrary, Reed Warblers migrate later, over a longer period and more slowly and split the journey by refueling in Spain and Portugal before the Mediterranean-Saharan crossing (Bibby & Green, 1981). This is confirmed by the rate of weight gain of migrating Aquatic Warblers, as measured in France, which is close to that reported for the Sedge Warbler by Bibby and Green (1981). Atienza *et al.* (2001) published a synthesis of migration records of Aquatic Warbler in Spain, and suggested that the species has a Mediterranean route and an Atlantic route. However, the very low value of the Acrola index based on 1993–2001 data along the Mediterranean coast in France [5] suggests that Aquatic Warblers seen in the Ebro valley and along the Spanish Mediterranean coast in Autumn come from the Atlantic French coast. What proportion of the global Aquatic Warbler population is making true stopping-over there is certainly crucial for evaluating the relative importance of Spain in the stopover system of the species.

As, therefore, France plays a very important part in the stopover sites system of the Aquatic Warbler in Europe, it should play a major role in undertaking conservation measures for this threatened species. Within France, our study revealed that three regions hold especially high relative numbers of Aquatic Warblers. As expected, coastal areas accounted for the highest indices, but, within these areas, some hierarchical importance could be achieved by comparing indices. Large estuaries in Normandy and Pays-de-la-Loire largely contributed to raise the indices of their regions, a result supported by three different analyses, based on two different indices: proportions of Aquatic Warblers captured among Acrocephalus warblers during 1993–2001 (without tape-luring), same proportions during the 2002 ringing campaign with standardized mist-netting and tape-luring, and mean numbers of Aquatic Warblers captured for 100 m of mist-net per day, during the 2002 ringing campaign. Such concordant results validate, and give confidence in, the chosen approach to estimating and comparing the importance of stopover sites for migrating Aquatic Warblers.

Postnuptial migration of Aquatic Warblers occurs during the whole summer in France, though it peaks during the third week of August, with the majority of birds



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***Audierne Bay marshes, Finistère county, are one of the major fattening places for the Aquatic Warbler in France.***

present between 1 and 25 August. To compare the relative importance of French sites surveyed in 2002 and 2003, we therefore chose to restrict the calculation of the indices to this period. Resulting indices were highly concordant for two sites monitored with the standardized method over many years and proximate sites surveyed with the same method in 2002 (Acrola index values of 0.92 for Tréogat / Baie d'Audierne during 1993-2001 and 0.97 for Brittany in 2002; 2.15 for Genêts during 1999-2001 and 2.25 for Normandy in 2002). Thus the relative importance of at least these two regions does not seem to be affected greatly by among-year variations. Results obtained in 2003 differed from this general pattern. In that year, easterly winds predominated during August, and may have pushed a larger proportion of Aquatic Warblers migrating through France to stop at Tréogat / Baie d'Audierne, while numbers stopping at Genêts were lower than usual. The same situation may also have occurred in 1995, when the Acrola index for Tréogat / Baie d'Audierne rose to 3.30, the highest value ever recorded for this site during the period considered. In 2002, some sites with high index values also showed large variances in the body mass of captured Aquatic Warblers. If such a variance can be considered to indicate variable stages in body mass gain for individual birds, we could then predict these sites to be of greater importance for migrating Aquatic Warblers to store reserves during their

migration. This is especially the case for small wetlands in Brittany and along the Atlantic Coast. The Loire estuary, covered by very large areas of reedbeds, certainly receives large numbers of migrating Aquatic Warblers, although they probably do not stay in reedbeds after their arrival, probably dispersing in grasslands, hence the large abundance indices but low mean and variance of body mass for birds captured there. By measuring the relative importance of French coastal wetlands for migrating Aquatic Warblers, we can confidently identify three main regions as important for the conservation of this species, namely Normandy, the Atlantic Coast and Brittany. According to this study, some wetland areas within these regions could be defined as priority sites: the Seine and Loire estuaries (very large wetlands), and smaller wetlands in Baie du Mont Saint-Michel (e.g. Genêts) and Brittany (e.g. Tréogat / Baie d'Audierne). The latter region further received higher relative numbers of migrating Aquatic Warblers under predominantly easterly winds during the migration peak, as happened in 1995 and 2003. Having identified important stopover sites in France, further preservation and management of wetland habitats there might be crucial for the conservation of the threatened Aquatic Warbler. More research is needed to identify precisely the ecological needs of the species on stopover sites, to enable efficient habitat management measures to be defined

and undertaken, hence a Life program running in Brittany until 2008. We are highly indebted to all ringing centres that provided access to their *Acrocephalus* ringing numbers. These are: Institut Royal de Sciences Naturelles (Bruxelles), Vogelwarte Radolfzell, Helgoland, Bird Ringing Office Zoologisk Museum (Copenhagen), ICONA (Madrid), British Trust for Ornithology (Thetford), Bird Ringing Centre Schweizerische Vogelwarte (Sempach), Istituto Nazionale per la Fauna Selvatica (Bologna), Lithuanian Bird Ringing Centre Zoological Museum (Kaunas), Vogel-trekstation (Arnhem), Institute for Ornithology Polish Academy of Sciences (Gdansk /Varsovia), Bird Ringing Centre Swedish Museum of Natural History (Stockholm), Bird Ringing Centre Matsal Nature Reserve (Estonia), and CEMO (Hamid Rguibi Idrissi, University El Jadida, Morocco). We are also indebted to all ringers that conducted capture and ringing of reedbed warblers and especially Aquatic Warblers in 2002 and 2003 by adopting the standardized

methodology within the so-called 'Acrola' project. The manuscript much benefit from thorough revision by Will Peach, James Reynolds and a third anonymous referee: many thanks for their work. This study received the financial support of the French Ministry in charge of the Ecology and the Centre National de la Recherche Scientifique, and is part of the life project «Conservation du phragmite aquatique en Bretagne», n°LIFE04NAT /FR/000086RE.■

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# The importance of Brittany in the Aquatic Warbler's migration as brought to light by the Bay of Audierne ringing station

Bruno BARGAIN



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The Aquatic Warbler breeds in Central Europe and winters in West Africa. To reach the Sahara regions, these birds have to make some stopovers in areas rich in food supply where they will be able to accumulate energetic reserves in order to resume their journey (de By, 1990). The information that has been gathered for twenty-five years by the ringing stations show that the main migratory staging and fattening areas during their post-nuptial migration is located in the Northwest of France (Juillard *et al.*, 2006). To return to its breeding quarters in the spring, the species follows a more eastern and more direct migration route. Observations and captures are then performed in March and April along the coasts of North Africa and in Italy (Schäffer *et al.*, 2006).

The information obtained through the ringing operations in the bay of Audierne shows that for its migratory stop-overs localised in the coastal marshes, the species uses almost exclusively a very narrow strip of land along the coast. The captures and observations are made in flooded and dry reed beds, rush beds and sedge beds and halophytic grasslands (Bargain, 1999).

**T**he ringing station of the Bay of Audierne is located next to the Trunvel pond in Tréogat (Finistère). The whole Trunvel site is characterised by an open landscape with low herbaceous vegetation. The studied zone covers an area of about 20 ha.

Since 1990, a standardised monitoring of post-nuptial migration which runs from the 1<sup>st</sup> of July until the 31<sup>st</sup> of October has been implemented at the ringing station.

With close to 90,000 sedge warblers, 45,000 reed warblers and close to 2,000 aquatic warblers captured, it is one of the most important ringing stations dealing with palustrine passerines. The daily work carried out from dawn to noon involves a team of salaried professionals and volunteers. The number of nets, which are about 200-meter long, and their location differs very little from one year to the other (Bargain et Henry, 2005).



**Foreground, Aquatic Warbler habitats in Audierne Bay.**

## Analysis of the captures

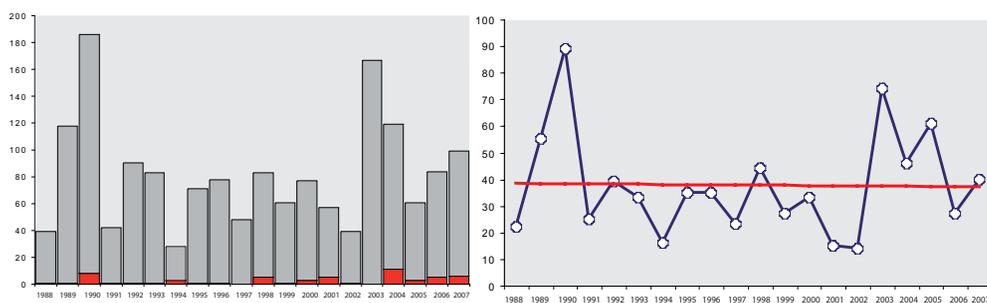
The captures that have been performed for 20 years at the Bay of Audierne ringing station show that there are strong year-to-year variations in the number of birds stopping over on this site. The yearly average is of 89 captures (extremes being 28-186 captures) [1]. To cancel out the year-to-year variations from the calculation of the average daily capture, we calculated the number of birds captured each year for 100 meters of nets [2]. The resulting histogram shows that the trend has been stable over the studied period. The number of adults is very low, with an average of 3 individuals a year. Depending on the years, the part of adults varies from 0 to 14 %, with an average of 4 % [1]. This suggests that adults and juveniles have different migration strategies.

## Analysis of the controls

Four hatchlings ringed in the Biebrza Marshes in Poland and one juvenile ringed in Trunvel in 2003 and controlled in 2004 in the Zvanets Marshes in Belarus show the origin of at least part of the birds which stop over in the Bay of Audierne.

A bird ringed in Friesland in the Netherlands, another one ringed in Oorderen near Antwerp in Belgium and lastly a juvenile ringed in the Bay of Seine tell us that at least part of the birds stop over between the nesting areas and the Bay of Audierne.

Two juveniles ringed in Trunvel have been found in Massereau in the Loire estuary near Nantes. A juvenile ringed in Trunvel has been controlled 11 days later in Alava,



**[1] Aquatic Warbler captures' number evolution in Audierne Bay ringing station from 1988 to 2007 (grey for juveniles and red for adults).**

**[2] Captures' number evolution by 100 m of mistnets between 1988 and 2007.**

near Vitoria, in Spain. Another juvenile ringed in Trunvel has been controlled 6 days later in Fuentes de Nava, near Palencia, in Spain.

The ring of a juvenile ringed on the 24<sup>th</sup> of August 1990 in Trunvel has been found on the 15<sup>th</sup> of September of the same year in the aerie of an Eleonora's falcon (*Falco eleonora*) on Lanzarote Island in the Canary Islands. These pieces of information tell us that when they leave the Bay of Audierne, some birds may stop over around the Loire estuary. Some then follow a route that crosses the Iberian peninsula in a beeline to get to Africa.

Lastly, a juvenile ringed in Trunvel has been controlled on the 17<sup>th</sup> of April 1996 on Capraia Island, located between Corsica and the Livorno Province in Italy. This data is the first proof that the species follows a loop migration route. [3].



[3] **Origine and destination of caught birds in Audierne Bay**

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## Local controls

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A juvenile ringed in Trunvel on the 17<sup>th</sup> of August 1989 has been controlled at the same place on the 31<sup>st</sup> of July 1990. Another one marked on the 18<sup>th</sup> August 1992 has been seen on the premises on the 7<sup>th</sup> of August 1993. These data prove that some birds stop over exactly in the same marshes from one year to the other and show that there is a certain fidelity to the migratory staging areas. In both of these cases, the date of control occurs earlier in the year than that of the ringing.

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## Sequence of the migratory passage

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### Adults

The passage of the adults is spread out from the 25<sup>th</sup> of July to the 24<sup>th</sup> of September. The July captures remain rare, but the passage peak occurs as early as the first days of August and the captures are then numerous until the 20<sup>th</sup> of August. The number of captures then drops drastically and, in September, they are episodic. These late captures concern most probably birds which have had a second brood or a replacement clutch. The median date of the captures is the 11<sup>th</sup> of August and the average date of capture is the 16<sup>th</sup> of August.

Twenty-six adults could be sexed thanks to reliable criteria like the brood patch or the cloacal protuberance. The average date of capture for 14 males is the 11<sup>th</sup> of August, whereas the equivalent date for 12 females is the 19<sup>th</sup> of August. The females' capture period is more spread out in time than that of the adult males, but there is no significant difference regarding the median date of passage ( $W = 114.0$   $p\_vale = 0.127482$ ). The fact that the females' passage is more widespread is not surprising since, in this species, males do not play any role in the breeding of the hatchlings, which allows them to leave the nesting areas on average earlier than their partner [4], [5].

### Juveniles

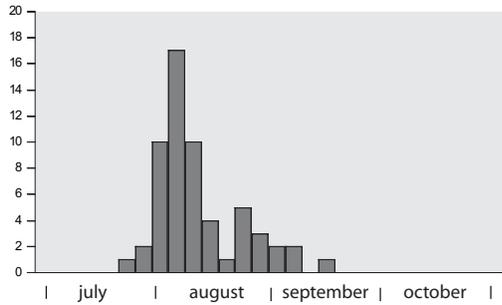
The passage of the juveniles occurs between the 1<sup>st</sup> of August and the 16<sup>th</sup> of October. If captures are rare before the 3<sup>rd</sup> of August, they quickly become numerous and regular, with a peak in captures around the 15<sup>th</sup> of August. After a noticeable decrease at the end of August, the

passage is of the same intensity until mid-September. Captures become irregular at the end of September and at the beginning of October. The median date of captures for juveniles is the 18<sup>th</sup> of August and the average date the 21<sup>st</sup> of August [6].

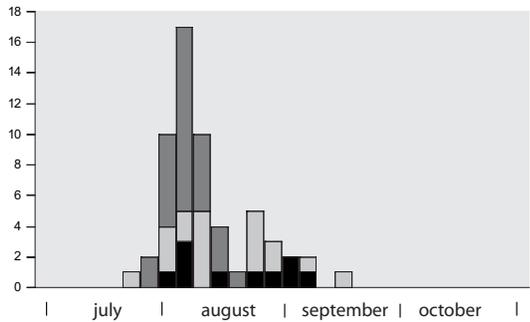
The dates of the beginning of the migration remain comparable from year to year, since the first captures are always recorded between the 1<sup>st</sup> and the 8<sup>th</sup> of August, and generally around the 3<sup>rd</sup>-4<sup>th</sup> of August. On the other hand, the passage peak can occur at a different time and the date of the last capture strongly differs. Indeed, the passage finished twice in the early days of September, whereas in two other seasons, the last captures occurred only in October. However, the passage generally ends during the second half of September. Over 20 years, the average duration of the species passage is 53 days. There are visibly some years with two passage peaks, the highest around mid-August and the second one in mid-September. According to Warwzyniak and Sohns (fide de By, 1990), the bimodal distribution of captures could be explained by the passage, in August, of the adult males and of part of the breeding females, as well as of the juveniles born in the first broods. The September passage would then mainly concern females which have had a second clutch and the juveniles born in them. The strong year-to-year difference in the proportion of second clutches would explain the absence of a second peak some years [7].

### Period of stay

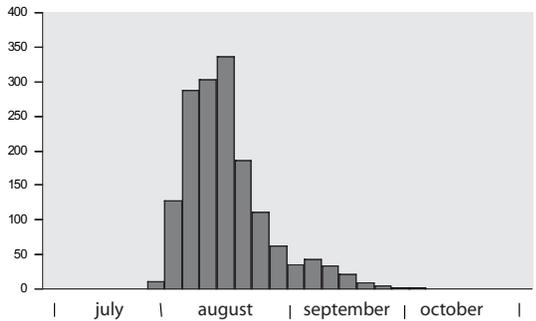
The local controls rate within one year is of 6 %, which suggests that the stop-over in the Bay of Audierne is very short. More than 95 % of the captured birds are not recaptured. Among those which are seen again, the great majority are seen again within the 5 days following the ringing and



[4] **Adults' captures calendar from 1988 to 2007.**



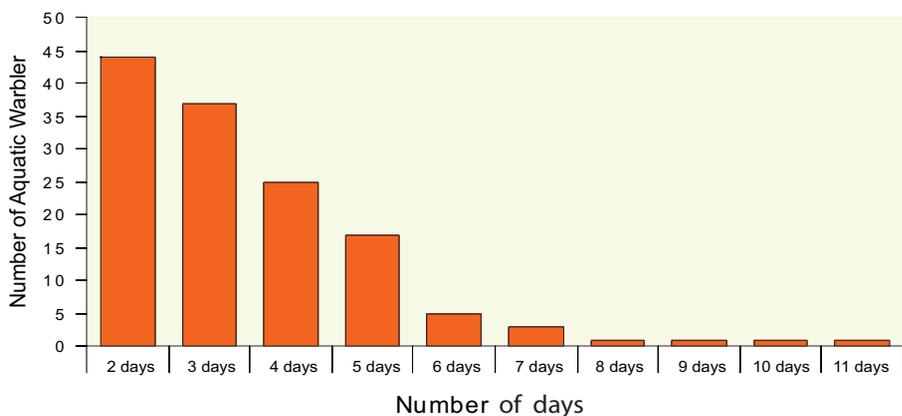
[5] **Adults' migration analysis by sex.**



[6] **Juveniles' captures calendar from 1988 to 2007.**

	Annual numbers	Stop over time		Stop over median		Stop over average		Extreme dates
		average	extreme	average	extreme	average	extreme	
Adults	3	31	7-44	11 Aug.	2-22 Aug.	16 Aug	10-26 Aug	24 July- 23 September
Juveniles	79	53	29-72	18 Aug.	14-27 Aug	21 Aug	16-27 Aug	1 <sup>er</sup> August 16 October

[7] **Characteristic of the Aquatic Warbler migration in Audierne Bay.**



**[8] Period of stay at Trunvel.**

the longest stay registered on the site is of 11 days. Many birds arrive at dawn and leave on the very same day at the beginning of the night. The average period of stay of aquatic warblers in the Bay of Audierne is comprised between 2 and 3 days [8].

from 280 to 4,000 individuals could stop over on the site depending on the years

**Population estimation**

The number of captured aquatic warblers and especially of controls per session of captures is too low to allow for the use of population estimation softwares like POPAN 5. This type of analyses has been carried out for the Sedge Warbler in the Bay of Audierne (Bargain *et al.* 2002). The number of birds of this species which pass through the site every year is 10 to 20 times higher than the number of captures. We then think that the annual numbers of Aquatic Warblers stopping over in the Bay of Audierne are also at least 10 to 20 times more than the number of captures. Thus,

**Discussion**

The Bay of Audierne is only concerned with the post-nuptial passage of the Aquatic Warbler. The capture sessions organised in the spring did not lead to the capture of any individual.

The rare controls performed on the Aquatic Warblers captured in the Bay of Audierne inform us on the origin of these birds: they come from the Biebrza Marshes in Poland and the Zvanets Marshes in Belarus. Three controls tell us that certain individuals stop over at least once between the breeding quarters and the Bay of Audierne. These stopover areas are located in the Netherlands, in Belgium and in the Bay of Seine, and are always near the coast. The information gathered south of the Bay of Audierne shows that some birds can stop



over in the Loire estuary and then follow the Atlantic coast. The controls made in Central-Northern Spain lead us to believe that the majority of migratory birds cross the Iberian peninsula in a beeline to then follow the coasts of Morocco and Mauritania. This route is the shortest way for them to get to Senegal.

The trend of captures for 100 meters of nets shows that there has been a stability in the number of birds stopping over in the Bay of Audierne these last two decades. However, there are year-to-year differences in the number of captures which could be explained by variations in the breeding quality, but also in the way the migration goes depending on the weather conditions in Western Europe during their post-nuptial passage.

The passage of the adults occurs, on average, earlier than that of the juveniles. The adult males pass, on average, earlier than the adult females. The percentage of adults in the Bay of Audierne is much smaller than that of adults in nature. This unbalance in favour of juveniles is probably due to a difference in the migration strategy depending on age. Part of the adults may be able to fly longer distances than the juveniles and would then be able to fly over the North of France without stopping over or, some might stop over but without eating, which makes them hard to capture. The passage phenology strongly differs depending on the years. This phenomenon could be related to the way the breeding went, especially with the numbers of second clutches and replacement clutches.

The average period of stay in the Bay of Audierne is very short. Most of the birds leave the night following their arrival. These individuals probably have a migration strategy made of small leaps, characterised

by brief stop-overs during which they only make a minimum of fat reserves. However, this is enough for them to get to the various coastal wetlands, from the North Sea to the Southwest of France. Other individuals stay longer in the Bay of Audierne and then accumulate several grams of fat, which allows them to fly over a long distance without having to find food supplies.

Considering the fact that the average production per breeding female is of about 4 juveniles a year (Warwzynieak et Sohns, 1977) and that 1 death occurs at the time of emancipation, we can estimate that probably around 30,000 juveniles migrate to the wintering quarters every year. It is rather difficult to estimate with accuracy the proportion of the Aquatic Warblers' population which stops over in the Bay of Audierne, but a number comprised between 1 and 10 % depending on the years is probably close to the accurate number.

The standardised ringing which has been done in 2002 in 19 marshes in Brittany lead to the capture of 18 Aquatic Warblers (Bargain, 2003) in six different sites. Each of these sites have been sampled for only 3 or 4 days. The birds passing through those sites during the whole post-nuptial passage are probably far more numerous and represent a great proportion of the world population. This network of wetlands in Brittany obviously plays an important role in the migration of the species and in its long-term conservation. ■

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# Research on Aquatic Warbler at Biebrza Valley

Piotr MARCZAKIEWICZ  
& Grzegorz GRZYWACZEWSKI



**The Biebrza wetlands are the largest natural and semi-natural wetlands in European Union. They cover about 100,000 ha of almost intact valley peatlands. The Biebrza National Park, created in 1993, covers 59,223 ha and is the largest national park in Poland. Due to the natural character of the valley, its extent, abundance of water, diversity of habitats and limited human activity, the bird life is very rich there.**

**Almost 280 bird species were observed here, 180 of them breeding. The Biebrza valley is the biggest breeding site of Aquatic Warbler in the European Union and the second biggest in the world. Local population of this species constitutes 90% of the Polish, 70% of the European Union, and 16% of the global population.**

**O**ne of the best Aquatic Warbler habitats are fen mires and moss bogs at the Bagno Lawki (Lawki Marsh) area which host about 60% of Biebrza's population.

The Biebrza valley is the place where pioneer studies on Aquatic Warbler biology were carried out for 15 years, beginning in mid-1980's, by a Polish-German working group with principal share of the field work done by Andrzej Dyrzc and his co-worker Wanda Zdunek. Its results were reviewed in several papers, e.g. by Dyrzc (1993) and by Schulze-Hagen *et al.* (1999). However, this was the only assessment of the number of breeding Aquatic Warbler in the whole valley until the two-years of survey in 1995 and 1997.

Aquatic Warblers were censused thrice (1995 and 1997, 2003, 2007) in the whole Biebrza Valley and twice (2005, 2008) at Bagno Lawki only (Krogulec, Kloskowski 1997; Maniakowski 2003; Grzywaczewski, Marczakiewicz 2005, 2007). There were,

accordingly, ca 2,062, 2,710 and 2,136 singing males in the whole valley as well as 2017 and 1642 on Bagno Lawki [1]. Those results shows that the Biebrza's Aquatic Warbler population, although fluctuating, was generally stable during last thirteen years. Two initial surveys were organized by Polish Society for the Protection of Birds (OTOP) in cooperation with Biebrza National Park (BPN), all remaining censuses were organized in the framework of Life project by BPN and OTOP.

Every census was carried out with use of a similar method. All probable breeding areas were divided up into smaller parts that could be counted by one team (usually about 5 people) within 2 hours around sunset, while AW males are most active. Members of each team formed a line with an interval of about 70 m to each other. Each team member counted singing males on the strip between himself and one of his neighbours. All those records were summed up, and from 2003 also marked

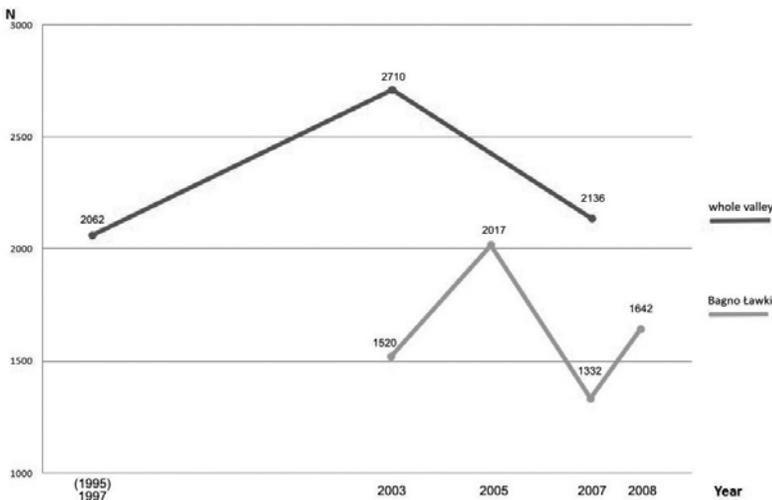
on a map. GPS and GIS were increasing used throughout the time that censuses were carried out. There are digital maps of singing males distribution in the results of those counts from 2005. Each male is represented by a point of known geographical position. Those maps are invaluable tools for research and nature protection.

We are not really able to improve Aquatic Warbler's best habitats, we are more liable to worsen it by our actions. That's why, while planning habitat management measures, it is better to focus on areas with lower densities (suboptimal habitats) or even without Aquatic Warbler (potential habitats) and avoid areas with highest densities. It is relatively easy with a map of singing males distribution [2].

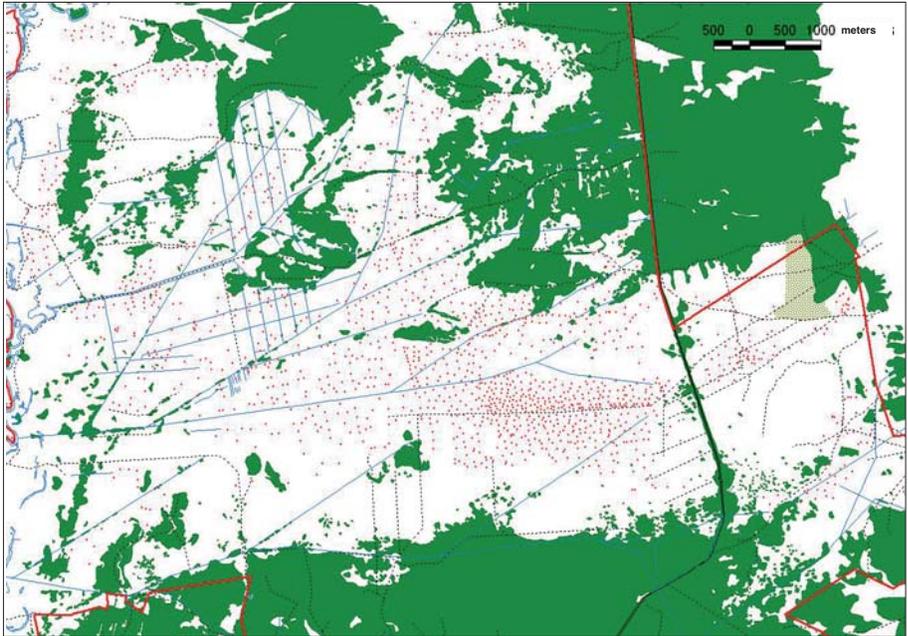
Such maps could also be used to assess an impact of protection activities on Aquatic Warbler (especially new habitats creating should be visible). For example, an estimation of the first-year effect of protection measures, like bush removing and mowing, which were carried out at Bagno Lawki in autumn 2007 and winter 2007/8, was performed. An overlay analyses on three GIS layers was used: AW singing males distribution in 2007 map (before activities), the same for 2008 and protection activities in 2007/8 map. There were two types of vehicle used for those protection works – a harvester based on an old snow grooming machine – and tractors with double wheels. A difference between areas mowed by those two types of machines was quite visible next spring. Tractors left deeper

tracks and evidently damaged the vegetation more than the harvester. This happened even despite the fact that tractors were working in more favorable (drier) conditions than the harvester. To measure the consequences of protection activities for AW habitat quality (indicated by singing males density), 175 squares (200m x 200m) at Bagno Lawki were chosen by regular sampling. Each of those plots was assigned to one of three groups: «no activity» (n=125), «tractors mowing» (n=23) and «harvester mowing» (n=27). A difference between number of singing males on each plot in 2007 and 2008 was calculated. Mean values of those differences were calculated for every group («no activity»  $\bar{x}=0.46$ ; «tractors mowing»  $\bar{x}=-0.26$ ; «harvester mowing»  $\bar{x}=0.81$ ) and compared [3]. T-test for independent samples was used to evaluate the differences in means between those groups. The statistical significance is as follows:  
 «no activity»- «tractors mowing»:  $p=0.13$   
 «no activity» - «harvester mowing»:  $p=0.42$   
 «tractors mowing» - «harvester mowing»:  $p=0.06$ .

There were more singing Aquatic Warblers in 2008 on Bagno Lawki than in 2007. This is reflected by the mean for a non mowed area, which is higher than 0. The mean for an area mowed by the harvester is even higher, while the one for the area mowed by tractors is less than 0. However the statistical difference between mowed and non mowed areas is not very significant, so one can say that a first-year effect of protection activities was not important for Aquatic Warblers.



[1] Aquatic Warbler population of the Biebrza Valley.



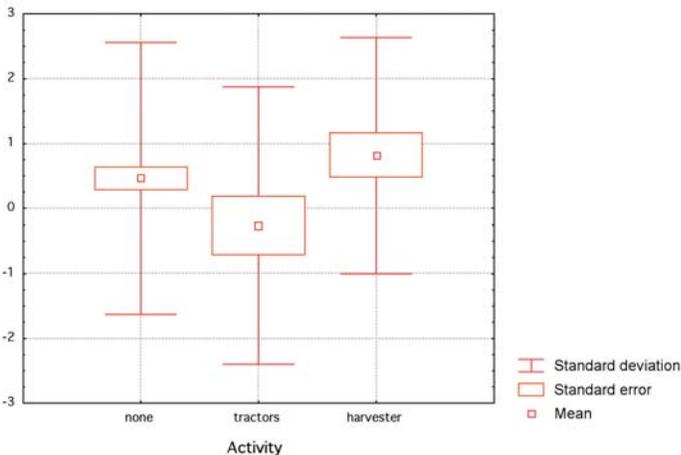
**[2] Location of Aquatic Warbler singing males at Bagno Lawki in 2007.**

However, the statistical difference between areas mowed by two types of machines is much more significant, so another conclusion is that mowing by the harvester is more favorable for Aquatic Warblers than mowing by tractors, even equipped with double wheels.

Actually, the fact that there was no real differences between densities of Aquatic Warbler singing males on areas with and without protection activity is a positive effect of those measures. One should remember that those activities were

executed mostly on areas threatened by bush, trees and reed succession, so density of Aquatic Warblers is more likely to decrease there. Although it is preferable that this density should increase after our actions thanks to habitat improving, one should not expect that it to happen during the first year of active protection.

It is also possible to research Aquatic Warbler habitat selection if we have maps with habitat feature. For example, an overlay analysis of two GIS layers - Aquatic Warbler singing males



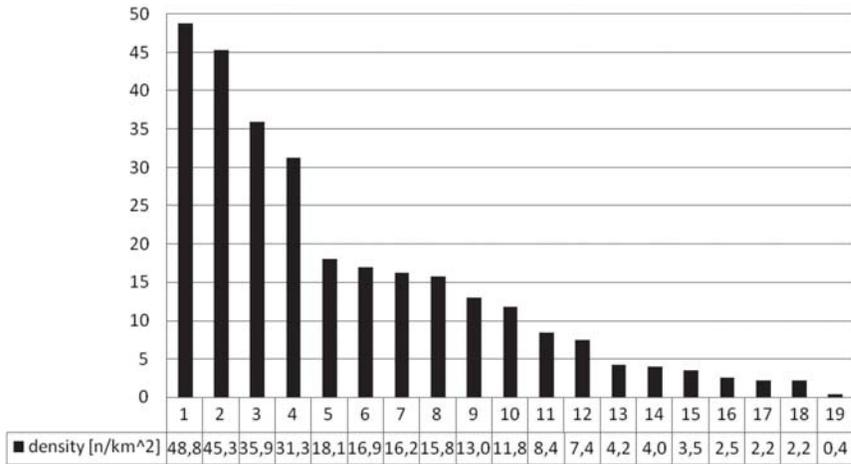
**[3] Change of singing Aquatic Warbler numbers with different machines.**



**Above, land managed with a harvester; below, land managed with a tractor.**

distribution in 2007 and map of vegetation (Matuszkiewicz, 2000) allows to assess which plant communities are preferred by Aquatic Warblers in lower basin of Biebrza valley. Results are presented as a bar charts. Plant communities are

numbered as follows:  
 1 - *Caricetum diandrae* var. with *Carex appropinquata*  
 2 - Mosaic of moss-sedge communities and meadows  
 3 - *Carex diandrae*

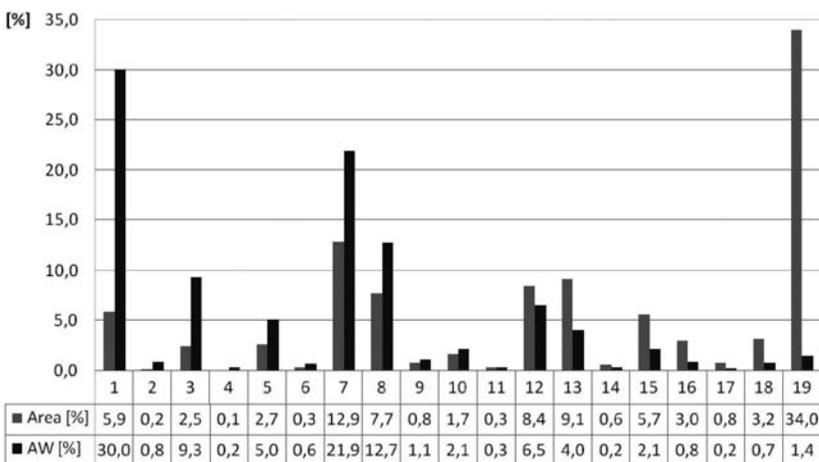


**[4] Density of Aquatic Warbler singing males in non-forest plant communities in lower basin of Biebrza valley in 2007.**

- 4 - Mosaic of moss-sedge communities and sedge communities
- 5 - *Carici-Agrostietum caninae* var. with *Carex diandra*
- 6 - *Caricetum rostratae*
- 7 - *Caricetum appropinquatae*
- 8 - *Carici-Agrostietum caninae* variation with *Carex appropinquata*
- 9 - Mosaic of wet meadows and pastures
- 10 - *Caricetum lasiocarpae*
- 11 - *Agropyro-Rumicion crispi x Sparganio-Glycerion x Magnocarici*
- 12 - *Caricetum elatae*
- 13 - *Caricetum gracilis*
- 14 - Tall herbs of Filipendulion

- 15 - *Carici-Agrostietum caninae*
- 16 - *Phragmitetum communis*
- 17 - Litter meadows of Molinion
- 18 - Tall sedges of Magnocaricion
- 19 - Others

The first bar chart [4] shows density of Aquatic Warbler singing males in non-forest plant communities in lower basin of Biebrza valley in 2007. The second one [5] compares plant communities availability and their selection by Aquatic Warbler. The red bar («Area») represents plant communities availability – it is the percentage of any given plant community



**[5] Comparison between non-forest plant communities valability and their selection by Aquatic Warbler.**



***Biebrza river and adjacent peaty and wet meadows.***

area of the whole area of non-forest plant communities in the lower basin. The blue bar (Aquatic Warbler) shows the percentage of singing males of Aquatic Warbler observed in that plant community of all observed singing males in the lower basin in 2007. If Aquatic Warblers were dispersed evenly, those two bars should be equal for every plant community. The difference between those two bars shows the habitat selection of Aquatic Warbler.

Another scientific research is developing a model of Aquatic Warbler optimal habitat, which is carried out in the framework of Life project since 2007. It is intended to describe optimal breeding conditions for Aquatic Warbler and developing a model which could be used

for habitat management measures planning and monitoring. It consist in sampling data on transects to gather information of vegetation structure and plant species composition, water level, abundance of arthropods of main potential prey groups and Aquatic Warbler singing males density. As those studies began recently, there are no results yet. ■

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# Habitat analysis of Aquatic Warbler wintering grounds: first field period 2008

Cosima TEGETMEYER



**A detailed habitat analysis is realized in the first confirmed wintering ground of the Aquatic Warbler in the Djoudj National Park in Senegal, with the aim to identify the basic landscape-ecological prerequisites of the species. These informations will provide the scientific basis for the long-term conservation of Aquatic Warbler wintering grounds.**

**S**ince January 2008 a detailed habitat analysis is realized in the first confirmed wintering ground of the Aquatic Warbler in the Djoudj National Park in Senegal [1] (Flade, 2007; Bargain and Guyot, 2007) within a PhD study. The PhD study aims at identifying the basic landscape-ecological prerequisites, providing the scientific basis for the long-term conservation of Aquatic Warbler wintering grounds. The major components of the PhD study are 1. the assessment of the spatial and temporal

wintering habitat use of the Aquatic Warbler, 2. the identification of the relevant biotic and abiotic site conditions, and 3. the investigation of threats to current wintering sites and their ongoing modifications. Below results of the first field period from January till March 2008 and planned activities for the next field period in winter 2008/2009 are presented.

The first field work period January-March 2008 concentrated on the first and the second component. As the National Park ran some construction works at the pelican colony and thus caused very low water levels in January-March 2008, it was very difficult to capture Aquatic Warblers.

However, all planned methods were tested and appeared feasible. In total, eight Aquatic Warblers were caught at the north border of Grand Lac [2] by means of 100 m of mist nets using the « rope-method », pushing the birds into the mist nets by pulling a rope over the grassy vegetation.

Four emitters were fixed on the birds. One of the tagged birds could be observed over four days in the near neighbourhood of the mist net where it was caught.

Probably suitable Aquatic Warbler habitats could be distinguished into four



**[1] Location of the study site the Djoudj National Park in Senegal (International Travel Maps – Sénégal – itmb publishing ltd)**



[2] Installation of the 100 m mist nets at the north border of Grand Lac in the Djoudj National Park (February 2008).

vegetation types which are dominated by different plant species: 1. *Scirpus littoralis*, 2. *Oryza barthii*, 3. *Eleocharis mutata* and 4. *Sporobolus robustus*.

The results of the vegetation investigations built the basis for further studies. In the next field period the four vegetation types will be compared systematically by means of a 900 m x 900 m plot raster and a fixed mist net position. Over a 3 months period of bird capture, telemetry studies and the survey of biotic and abiotic conditions will be conducted in constant time intervals (two week schedule). Probably, the raster will be extended to cover also areas burnt in June 2008 by PNOD (c. 4000 ha) in order to compare the conditions in burnt and

unburnt sections. In addition, the food supply and moult will be investigated.

The construction works at the pelican colony are now completed and additionally the Sahel has run through a good rain season. It is assumed that the water conditions in the Djoudj National Park will be favourable this winter to accomplish a successful field season from November 2008 until February 2009. ■

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# Specificity of the Aquatic Warbler's diet during its migratory stop-overs

Christian KERBIRIOU & Bruno BARGAIN



**On stop over areas, birds have to find suitable and abundant food to accumulate the necessary migration fat reserves. The knowledge of the Aquatic Warbler diet is a requisite before the management of the habitats of those stop over sites.**

**T**he causes of the decline of many long distance migratory birds are varied, due to the complexity of their annual cycle. Thus, these species which nest in Europe and spend the winter in subsaharian Africa can be endangered by the degradation or the disappearance of their breeding or wintering sites (Robbins *et al.*, 1989). In addition, the current climate change context also poses a threat, indeed, it may cause some discrepancies between the cycle of their preys and their own breeding cycle (Both *et al.*, 2006). Lastly, some studies recently put the emphasis on the importance of the conservation status of the staging areas for these migratory species (Russell *et al.*, 1994; Moore *et al.*, 1995; Ktitorov *et al.*, 2008). In order to propose adapted conservation strategies for the staging areas, having a good knowledge of the ecology of the concerned migratory species is crucial. However, regarding rare, cryptic and endangered species, we very often have very few elements at hand, be it on their ecology in staging areas (preys and habitat selection, etc.) or on their migration strategy. Because of the urgency to act, the implemented conservatory measures are quite often inspired from those already developed for twin species, which are more common and better known. This emergency strategy may turn out to be relatively ineffective if the ecological differences between the target (rare or cryptic) species

and the twin (common) species are too important. As a result, the comparison of the ecological requirements of endangered species and twin species, which are more common, can give us interesting information regarding conservatory management.

The Aquatic Warbler is currently one of the most endangered bird species in Europe (Collar *et al.*, 1994). This palustrine warbler underwent a strong decline during the last decades (Kozulin *et al.*, 2004). If the urgency to implement conservation projects for this species is accepted both at European (Life project) and national level (in France, a national restoration plan has been launched), the available data concerning its ecology on its staging areas were relatively limited. The importance, at European level, of the coastal areas of the Channel-Atlantic sector for the bird's stop-overs has been highlighted very recently (Julliard *et al.*, 2006). Considering the responsibility of Brittany and of sites like the Bay of Audierne for its migration, Bretagne Vivante undertook a vast study programme on the Aquatic Warbler, the goal being to propose an efficient conservation management. Part of it has been devoted to the study of its diet: what are the Aquatic Warbler's preys? What link is there between preys and habitat? What is the fattening strategy on the staging areas?

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## The Preys of the Aquatic Warbler

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In order to establish the diet of the Aquatic Warbler, we analysed 128 droppings of the species, which were collected during the ringing operations carried out at the Trunvel/Bay of Audierne station between 2001 and 2004. The description of its diet based on the remains of identifiable preys in its droppings comes up against the fact that the preys are not all digested in the same way. Thus, certain large preys with chitinous carapace like beetles are more likely to be found than small preys with a « soft » body like aphids, for instance. We then decided to analyse simultaneously the droppings of other palustrine warblers which are very close to the Aquatic Warbler: the Reed Warbler (*Acrocephalus scirpaceus*) and the Sedge Warbler (*Acrocephalus schoenobaenus*), with respectively 28 and 78 droppings. The hypothesis was then that the detectability of the preys in the droppings must be very similar for those three warbler species. The comparative study of the droppings tells us about the specificity of the Aquatic Warbler's diet in comparison to the two other species.

The analysis of the Aquatic Warbler's droppings made it possible to identify 571 preys but, in the end, very few could be determined at species level. In terms of abundance, the diet of the Aquatic Warbler appears to be dominated by diptera (38%), then secondarily by *Hyalopterus pruni* (19%). It is also the case for the Reed Warbler (respectively 54% and 22%), whereas the diet of the Sedge Warbler is first dominated by *Hyalopterus pruni* (67%) and then by diptera (17%) [1]. It is, however, the Aquatic Warbler which has the most large size preys: blue-tailed damselflies (*Ischnura elegans*), long-winged coneheads (*Conocephalus discolor*), spiders (*Clubiona phragmitis*, *Tetragnatha extensa*, *Larinoidea cornutus*) and lepidoptera.

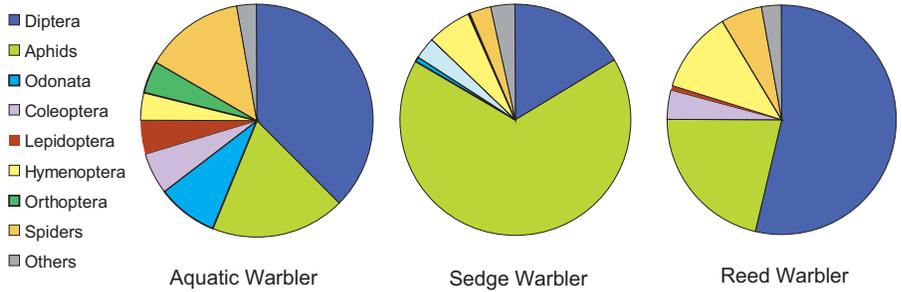
In addition to their global abundance, we explored the frequency of the preys in the droppings during the post-nuptial migration period [2]. No matter which time of the season the Aquatic Warblers are captured, their droppings have almost always diptera in them (in 96% of the cases, on average). Besides, some preys which are recorded as being quite a minority in terms of abundance, are quite regularly identified: thus, the blue-tailed damselflies are seen in 38% of the droppings, spiders in 28%,

long-winged coneheads in 21%. On the other hand, the *Hyalopterus pruni*, which come second in terms of abundance are observed in a quarter of the droppings only. Moreover, the *Hyalopterus pruni* seem to be seen less often during the peak of the Aquatic Warbler's passage, from the 10<sup>th</sup> to the 25<sup>th</sup> of August (Bargain & Henry, 2005). During this key period, the blue-tailed damselflies, spiders and long-winged coneheads are observed in more than 50 % of the droppings [2].

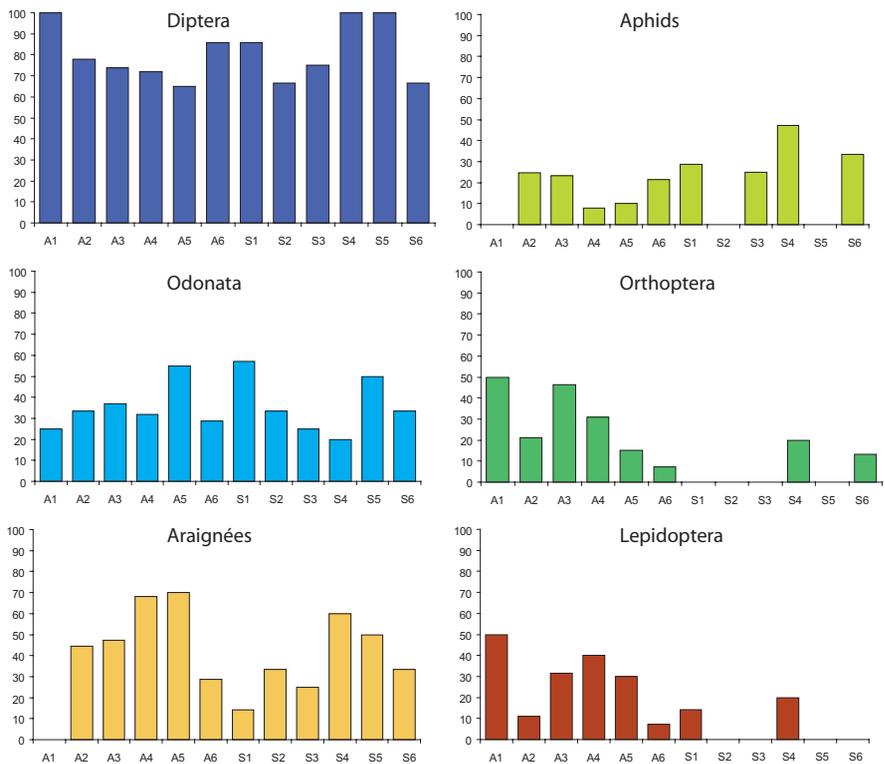
A multivariate statistical analysis integrating abundance and frequency (Kerbiou *et al.*, *in prep.*), made it possible to observe that the blue-tailed damselflies, long-winged coneheads, lepidoptera and leafhoppers were more specifically linked to the Aquatic Warbler, whereas the *Hyalopterus pruni* are linked to the Sedge Warbler, and the diptera and hymenoptera to the Reed Warbler.

Considering, this time, the weight of the preys, we realised that preys which are secondary in terms of abundance for the Aquatic Warbler appear to be particularly important in terms of biomass: thus, the blue-tailed damselflies represent 43% of the preys' biomass, the spiders 13%, the long-winged coneheads 12% and the lepidoptera 8%, the part of the *Hyalopterus pruni* then appears to be quite marginal (about 1%). These estimations are to be considered with caution since the large preys may be over-represented because of their lesser digestibility. However, let us note that the most important preys in terms of biomass are also those which appear to be specific to the Aquatic Warbler.

These first results confirm the diet studies already published on these three palustrine warblers: thus, the dominance of the *Hyalopterus pruni* in the Sedge Warbler's diet in Trunvel had already been observed on breeding sites (Koskimies & Saurola, 1985; Chernetsov & Manukyan, 2000; Leivits & Vilbaste, 1990) as well as on staging areas (Bibby & Green, 1981). Similarly, the diet of the Reed Warbler based on diptera has also been observed by Bibby & Green (1981), Evans (1989) and Grim & Honza (1996). If the Aquatic Warbler's diet during its stop-overs had never been studied up to now, these first results have strong convergences with those obtained on the breeding sites where the species also seems to select large preys: spiders, diptera, coleoptera, long-winged coneheads and lepidoptera (Shulze-Hagen, 1989). This diet based on large



[1] Diet of the Aquatic Warbler, Sedge Warbler and Reed Warbler.



[2] Evolution of the frequency of the preys in the Aquatic Warbler droppings from beginning of August to end of September. Each month is cut by 5 days period (August A1 to A6 ; September S1 to S6).

preys, some of which are predators like the spiders or the blue-tailed damselflies, places the Aquatic Warbler on top of a complex trophic network and makes it a good indicator of the environments' quality.

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## The Habitats of the Aquatic Warbler's preys

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In order to elaborate management propositions adapted to the migrating Aquatic Warbler, it is crucial to assess the importance of the habitats favourable to its preys. During the creation of the reference collection, three environments have been sampled at the Trunvel pond, near the ringing station:

- the reed bed with *Phragmites australis*, where the migratory birds' capture nets are placed and where no management is practised;
- the subhalophilous meadow dominated by *Juncus maritimus* and *gerardii*, *Eleocharis palustris*, *Iris pseudacorus*, *Cenante lachenalii* and *Orchis palustris*. This formation is located at the periphery of the reed bed and is mowed in the summer according to a 3 to 5-year rotation;
- the meso-hygrophilous meadow grazed extensively by ovines, dominated by *Agrostis stolonifera*, *Dactylis glomerata*, *Hydrocotyle vulgaris*.

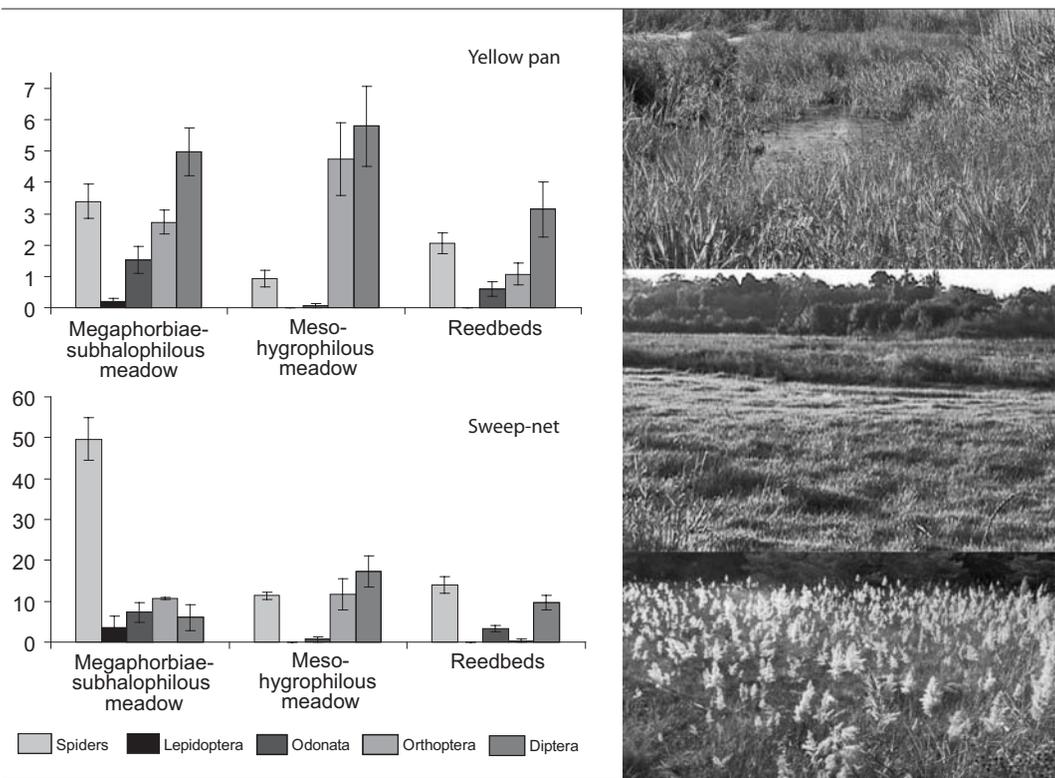
Three sampling techniques have been developed simultaneously in each of these environments: the sweep-net, the yellow pan and the Barber trap. The sweep-net is adapted to the capture of species living in the high stratum of the vegetation like, for instance, the spiders spinning a geometrical web or flying insects. The yellow pan is placed on the vegetation, it is an attracting trap designed for floricolous species (diptera, hymenoptera), but it also collects many other species which fall in it while moving about (long-winged coneheads, roaming spiders). Lastly, the Barber trap is an interception trap which captures mainly insects moving at ground level (ants, roaming spiders, carabidae coleopteras, etc.). For technical reasons, the latter traps could not be placed in reed beds.

The main preys of the Aquatic Warbler seem to be globally more abundant in the subhalophilous meadow, and secondarily in the mesohygrophilous meadow, than in the reed bed [3]. When focusing on a group sensitive to the vegetation structure

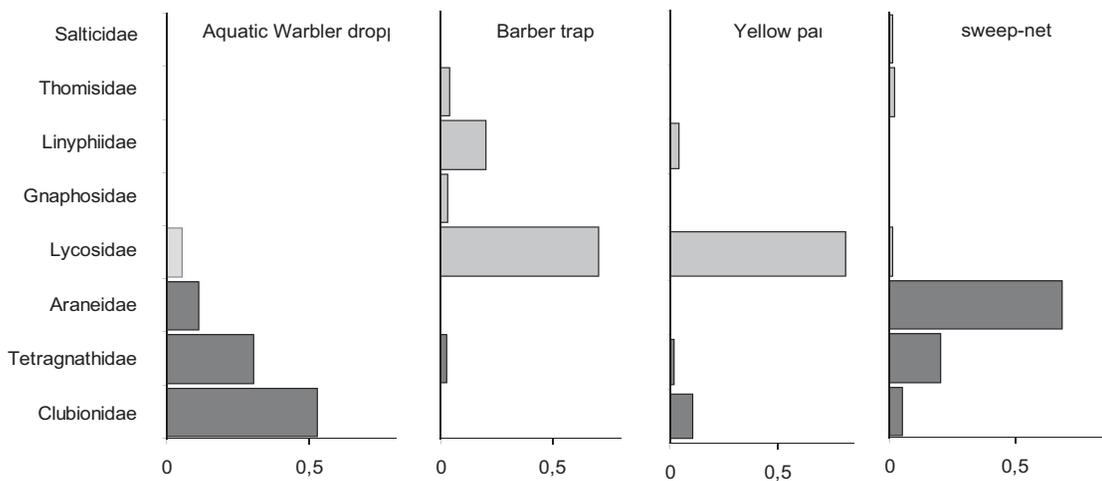
like spiders, and when comparing the results of the droppings' analyses and of the various sampling techniques, it is also possible to understand the stratum in which the Aquatic Warbler forages [4]. Thus, the three main families of spiders identified in the Aquatic Warbler's droppings are the Clubionidae, Tetragnathidae and Araneidae. These last two are mostly sampled by the sweep-net, since they are species spinning geometrical webs and looking for the higher strata. The Clubionidae represented here by the *Clubiona phragmitis* and *C. stagnatilis* species are roaming species which also generally forage high in the vegetation. On the other hand, the families which are mainly more active at ground level like the Lycosidae or Gnaphosidae are logically sampled by the Barber traps and are very poorly represented in the diet of the Aquatic Warbler.

Thus, these first analyses seem to suggest that the Aquatic Warbler eats mainly in the high strata of the vegetation and that its preys have a maximum abundance in the subhalophilous meadows. If, at dawn, the Aquatic Warblers are captured in reed beds, probably since they spend the night there, protected against predators, the majority of the captures are then made in the subhalophilous meadows, be they colonised or not by low reeds. The location of the captures during the foraging periods thus corresponds to the habitat of the species' preys.

Everything seems to suggest that the Aquatic Warbler is a specialised species regarding habitat selection, since there is a strong similitude between its breeding sites, the habitats it frequents in Senegal during the winter (Bargain *et al.*, 2008) and the habitats potentially used during its stop-overs: medium height herbaceous vegetation within natural meadows. Thus, a management of the wetlands in favour of the Aquatic Warbler could consist in maintaining expanses of wet meadows near the reed beds, which implies, in certain areas, fighting the extension of reed beds or willows on this periphery via a summer mowing. Lastly, numerous preys of the Aquatic Warbler carry out part of their cycle in an aquatic environment: blue-tailed damselflies, hydrometra (*Hydrometra stagnatorum*), and *Dolichopodidae diptera*. Assuring the maintenance of good quality water is a priority, and maintaining or creating pools in these areas is to be considered.



**[3] Abundances of the main groups of Aquatic Warbler preys in mowed subhalophilous meadow, grazed meso-hygrophile meadow and reed bed. In the lower figure, the sampling carried out with sweep-nets and in the higher one, the sampling carried out with yellow pans.**



**[4] Distribution of the families of spiders according to the sampling techniques. In yellow, the families of spiders often found in the Aquatic Warbler's diet, in green the families which are rare or absent.**

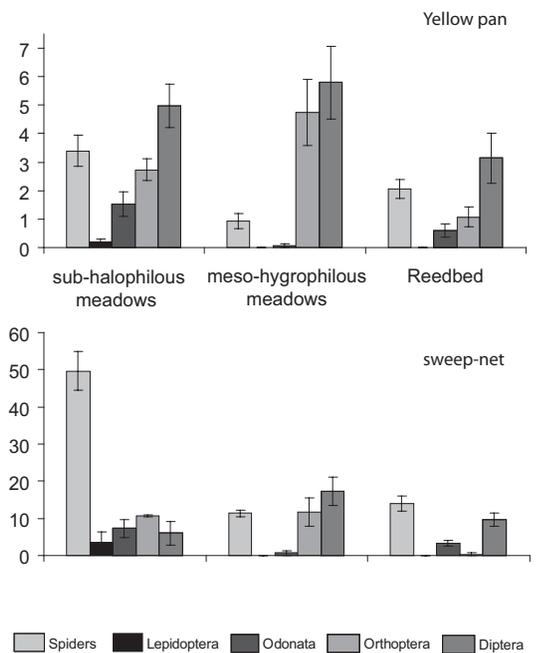
## What is the fattening strategy on the migratory stopovers?

To protect a migratory species, it is also important to assess its migration strategy: is it a migration made up of small leaps between a multitude of sites or rather long trips with a few major stop-overs? In this last case, the migratory stop-overs are not numerous, but each site then takes on a great importance, since the birds stop there and accumulate the necessary reserves to travel to the next staging area. The study of the migratory routes and the description of the migratory strategies is traditionally carried out by analysing the data related to the recapture of ringed birds: which distance has been covered? In how much time? This is how we were able to determine that a majority of the Sedge Warblers stopping over in Trunvel were most probably coming from the British Isles (Bargain *et al.*, 2002). At European level, it has been shown that the Reed Warbler rather tends to migrate in small leaps of about one hundred kilometres between each site. The Sedge Warbler starts to migrate earlier, the British individuals gathering on a couple of vast areas on the Channel-Atlantic coast, where they fatten before flying long distances and, from there, some even manage to get directly to Africa (Bibby & Green, 1981). There are still too little control data relative to Aquatic Warblers between two sites in the ringing base of the CRBPO-MNHN to study its migration strategy that way. We then chose to carry out a comparative analysis between the three palustrine warblers by focusing on the evolution of their weight during a same stop-over. Do the birds which stay on a site fatten?

We have used the data from the Trunvel station (1988-2005 period) in which there were weight measurements for the capture-recapture data. The whole data collection includes 3,517 data for the Sedge Warbler, 2,727 for the Reed Warbler and 50 for the Aquatic Warbler. For the latter, we added 31 data issued from other French sites. As there are intra-individual variations (in other words, among birds there are also some which are small and big, others which are tall and thin), it is better to study the evolution of the weight in terms of relative mass gain. This is calculated in the following manner, Mr being the mass at the time of control and Mc, the mass at the first capture.

The analysis of the weight variations reveals that, on average, the Reed Warblers do not accumulate fat reserves according to the duration of their presence on the site. There are fat and thin individuals, some gaining weight, others losing weight (negative relative mass gain), but the individual evolution of their fat reserves is not related to the duration of their stay on the site [5]. Given the fact that, in Trunvel, a sizeable part of the Reed Warblers might be local individuals which did not start their migration yet, we have carried out this analysis once more with only foreign birds (identified by the ringing centre) and we found the same pattern: namely, that, on average, there is an absence of a fattening trend for this species. On the contrary, the weight gain is positively correlated to the duration of the stay for the Sedge Warbler and for the Aquatic Warbler [5]. On average, a Sedge Warbler accumulates 0.22 g a day and the Aquatic Warbler 0.34 g a day.

This similarity relative to the fattening process between Sedge Warbler and the Aquatic Warbler seems to suggest that the latter has a migration strategy which is closer to that of the Sedge Warbler, namely, an important fattening on a site



[5] Temporal variation of the relative mass gains for the Reed Warbler, the Sedge Warbler and the Aquatic Warbler.

before a quite long trip to get to the next site. This strategy then underlines the importance of the sites identified on the Channel-Atlantic coast, including the Bay of Audierne, for the conservation of this species.

The first elements of this study then suggest that the Aquatic Warbler has diet requirements – large preys – which are clearly different from those of the other palustrine warblers, a probably strong habitat selection (natural meadow) and a migration strategy based on a few key sites to make the necessary reserves to fly the long distances of the migration. The good conservation status of the coastal wetlands in the Channel-Atlantic sector, maintained by adequate management, thus seems to be a crucial parameter for the survival of the species. ■

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## Notes

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1 C.R.B.P.O : Centre de recherche par le baguage des populations  
2 M.N.H.N. : Muséum national d'histoire naturelle

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# Workshop **B**

## Habitat management: which methods and which economical and social development?

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Oskars KEISS



# Habitat preferences and management recommendations for the Pomeranian population

Franziska TANNEBERGER, Jochen BELLEBAUM & Martin FLADE



**The Pomeranian population is the last remnant of a former large Western/Central European population. Its conservation has high priority, but was hampered by insufficient knowledge on habitat requirements. Whatever, some management recommendations can be provided.**

**T**his presentation refers to the currently westernmost breeding sites of the Aquatic Warbler, which are located in East Germany and Northwest Poland. It presents the current state of knowledge on habitat preferences of the Pomeranian population and gives management recommendations, how to protect it. This work is largely based on the results of a PhD study 2004-2008 (Tanneberger, 2008).

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## Characteristics of the Pomeranian population

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The Aquatic Warbler was once widespread and numerous throughout Europe (Schulze-Hagen, 1991; Cramp, 1992). For the federal state of Brandenburg in Germany, Hesse (1910) described its occurrence as follows: « What in particular characterises the Aquatic Warbler is its commonness... it occurs all over the vast fen mires...and here, we have at times particularly large aggregations... » (translation: F. Tanneberger). For the region south of Szczecin (Northeast Poland), Hübner (1908) describes the species as 'exceptionally numerous.

Today, the Aquatic Warbler population in Pomerania is the smallest in Europe.

However, it has a key function for the conservation of the species: It is genetically distinct from all other Aquatic Warbler populations (Giessing, 2002; *and unpublished data*), and isotope analyses of feathers revealed that the Pomeranian Aquatic Warblers probably have a more northerly wintering area than the Central European core population in West Africa (Pain *et al.*, 2004). These findings and the historical records suggest that the remaining birds in Pomerania are the last survivors of a distinct, large Western population (AWCT, 1999). The conservation of the Pomeranian Aquatic Warbler population has high priority, but was hampered until recently by insufficient knowledge on habitat requirements.

Aquatic Warbler censuses in Pomerania before 2004 cover only three years (1993, 1997 and 2003) and are less reliable because of long counting periods and lack of sufficient data. As observations of colour-ringed Aquatic Warblers show that males move between breeding sites between the first and the second brood (e.g. between Karsiborska Kepa and Rozwarowo Marshes in 2006; G. Kiljan, *pers. comm.*), synchronous counts are indispensable for reliable estimates of the population size. Such counts have only started in 2004. However, judged from the existing data, a population



**The National Park Lower Oder Valley, last breeding site for the Aquatic Warbler in Germany.**

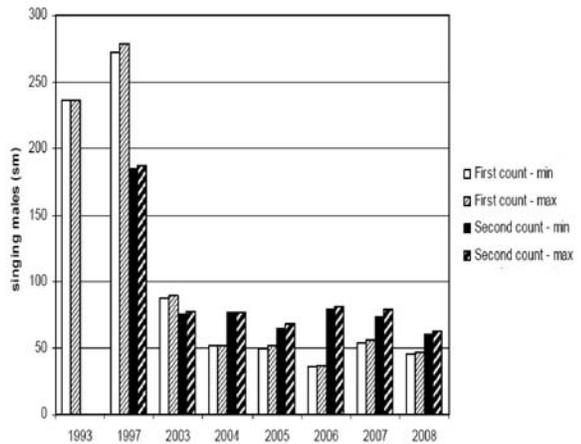
decline from about 250-300 singing males in the 1990s (Czeraszewicz, 1993, 1997) to about 60-80 in recent years [1] is obvious.

According to historical records, Aquatic Warblers have bred also along the German Baltic Sea coast: E.g. on Schadefähre island in the Peene river valley until 1975, on the Karrendorfer Wiesen near Greifswald until 1989, and on the Freesendorfer Wiesen / Struck peninsula near Greifswald from 1973–1997 (Sellin, 1990; Helmecke *et al.*, 2003). Today, the last German breeding site is the National Park Lower Oder Valley. The Polish part of the Pomeranian population includes another eight breeding sites [2].

**Site conditions and plant communities**

The Pomeranian Aquatic Warbler breeding sites can be subdivided into sites near the coast and in small river valleys (sites in river Swina delta, Rozwarowo Marshes) and sites in the lower Oder valley with strong influence of nutrient-rich inundation water (Lower Odra Landscape Park, National Park Lower Oder, Warta Mouth National Park). The sites near the coast and in small river valleys are characterised by sparse and low *Phragmites australis* stands with a well-developed lower sedge and herb layer. They are generally less nutrient-rich

[3]. The sites in the lower Oder valley are more nutrient-rich and dominated by *Carex acuta*, *Phalaris arundinacea*, and other meadow grasses. Whereas reed cutting is the prevailing land use form in the coastal sites, the Oder valley sites are mostly mown or grazed. All current breeding sites are currently management-dependant [3].



**[1] Number of singing males in Pomerania 1993-2008.**



[2] Current breeding sites of the Pomeranian population.

### Vegetation structure and influence of land use

Sites with recent Aquatic Warbler records showed shorter and sparser vegetation, a thinner litter layer, and a higher total plant species richness and cover of small and least competitive (CSR) species than abandoned or unoccupied sites. This could be shown both for the coastal sites (Tanneberger *et al.*, *in press*) and for the Lower Oder valley sites (Tanneberger *et al.*, 2008) separately as well as in an overall habitat model.

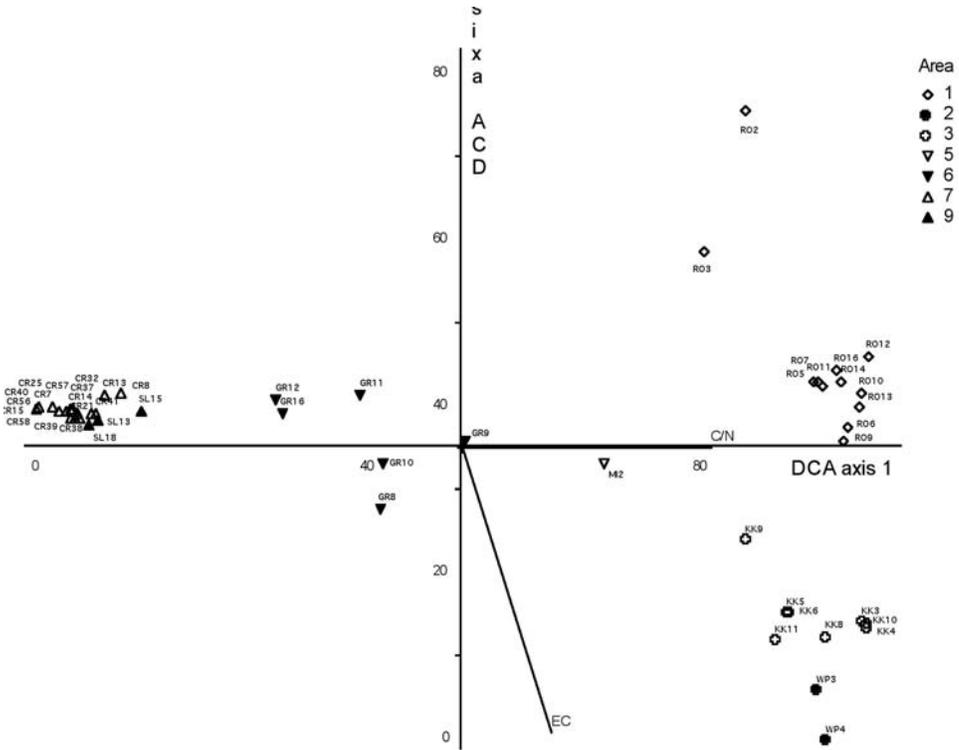
Similar to the core population sites (Dyrzc & Zdunek, 1993; Kozulin & Flade, 1999), optimal conditions during late May/early June include a rather sparse vegetation with a height of less than 70 cm, a cover of the lower herb layer of approx. 20% and a cover of the upper herb layer of less than 60%. These requirements relate to the morphological adaptations of Aquatic Warblers that allow climbing and foraging in this type of vegetation (Leisler,

1981; Leisler *et al.*, 1989). In contrast to the core population sites, where the water height is up to 20 cm and a thick litter layer is needed for building nests above the water surface (Dyrzc & Zdunek, 1993; Vergeichik & Kozulin, 2006), in Pomerania the water height is only 0-1 cm and the thickness of the litter layer should not exceed 10 cm. In the relatively dry Pomeranian sites, a thicker litter layer probably has negative effects on prey supply. Again in contrast to the core population sites, habitat heterogeneity is high.

In the coastal site Rozwarowo Marshes, it could be shown that winter reed cutting currently meets the habitat requirements of Aquatic Warblers (Tanneberger *et al.*, *in press*). On a long-term study plot in Lower Oder valley National Park (Tanneberger *et al.*, 2008), during a period of late mowing and subsequent cessation of land use, vegetation height increased, the cover of CSR species decreased, and the site became abandoned by Aquatic Warbler. It could be shown that in such eutrophic sites, early summer land use is needed to maintain Aquatic Warbler habitat suitability (Tanneberger *et al.*, 2008).

### Food supply

Female Aquatic Warblers in Pomerania appear to select sites which are «used» sites (= i.e. early summer mown or grazed or winter cut) for nesting, to prefer ditches and edges within «used» areas for foraging, and fly longer distances for provisioning their nestlings than in the core population (60 m and 25 m, respectively). Fledglings were observed at seven out of nine studied nests. There is no difference between prey mass and delivery rate of Sedge Warbler in Pomerania and in Belarus. In «used» areas, the total invertebrate biomass is larger than in «not used» (= i.e. not or late summer mown or grazed) areas during the first brood in late May and early June. We conclude that in current Aquatic Warbler breeding sites, the distance between foraging habitats with sufficient food supply and nesting sites might cause unfavourably long foraging flights, but still allows successful breeding. Depending on the site conditions, early summer or winter land use is beneficial for providing Aquatic Warbler nesting and foraging sites. Also «not used» patches in a fine scale mosaic are needed for safeguarding broods, for providing nest-building material, and for facilitating the overwintering of mowing-sensitive invertebrates.



[3] Ordination diagram of all Pomeranian Aquatic Warbler sites (48 plots). The ordination (DCA) is based on plant species cover values and is presented as a joint plot with site condition values (C/N ratio and EC [ $\mu\text{S}/\text{cm}$ ];  $r^2 > 0.285$ ). Total number of plant species: 77. The numbers in the legend refer to [2]. From Tanneberger (2008).

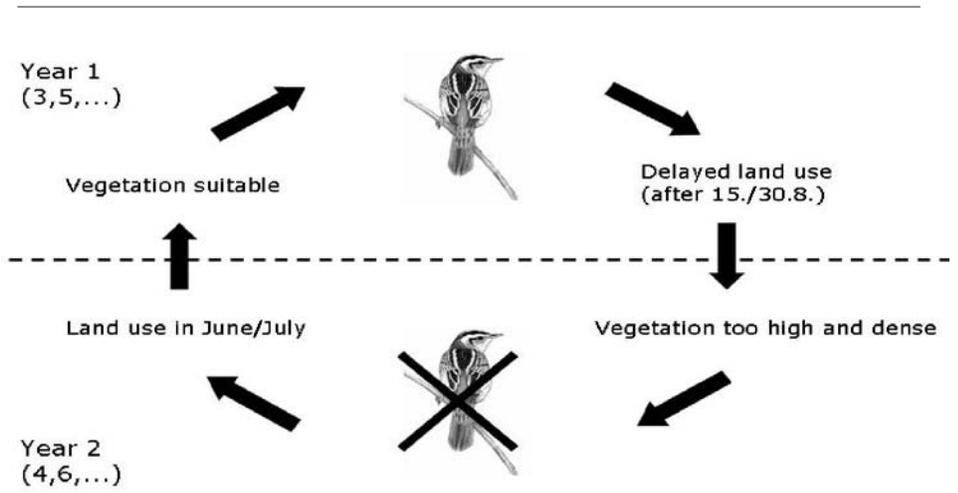
### Management recommendations

To improve Aquatic Warbler habitat in Pomerania, we give the following recommendations for the short-term:

- With respect to less eutrophic breeding sites: Reduce further eutrophication from the inundation with nutrient-rich water. In Rozwarowo Marshes, reduce the nutrient load on the peatland by reducing the volume of irrigation water or by improving the water quality of the Wolczenica river. Continue winter mowing in sites with good habitat quality (e.g. Rozwarowo Marshes) and improve the habitat quality in those with reduced habitat quality (e.g. islands in the Swina delta) by temporary summer mowing or grazing. Leave stripes uncut to provide nest-building material and increase food supply.
- With respect to more eutrophic breeding sites: implement and maintain alternating land use [4] in the Lower Oder Valley National Park on the basis

of continuous monitoring of Aquatic Warblers and habitat conditions. Help farmers to avoid nest protection zones by providing GPS-based acoustic guidance. Continue mowing after the breeding season in the Warta Mouth National Park and near Gryfino and monitor the effects in order to quickly detect habitat deterioration (cf. Tanneberger *et al.*, 2008). Create a mosaic of early, late, and not used areas to increase heterogeneity in vegetation height and plant composition (if possible, using natural relief differences) and thus the availability of foraging habitat preferred by Aquatic Warbler females provisioning their nestlings.

- With respect to potential breeding sites (e.g. Peene valley, Lower Odra Valley Landscape Park): Implement early summer mowing to reduce high and dense vegetation. Check thoroughly for the occurrence of Aquatic Warblers and



[4] *Alternating land use on eutrophic Aquatic Warbler breeding sites. From Tanneberger (2008).*



*Rozwarowo marshes*

other threatened species before mowing when habitat conditions have improved.

- With respect to all sites that are summer mown or winter cut: Remove the biomass to avoid the accumulation of a high litter layer with adverse effects on habitat quality.

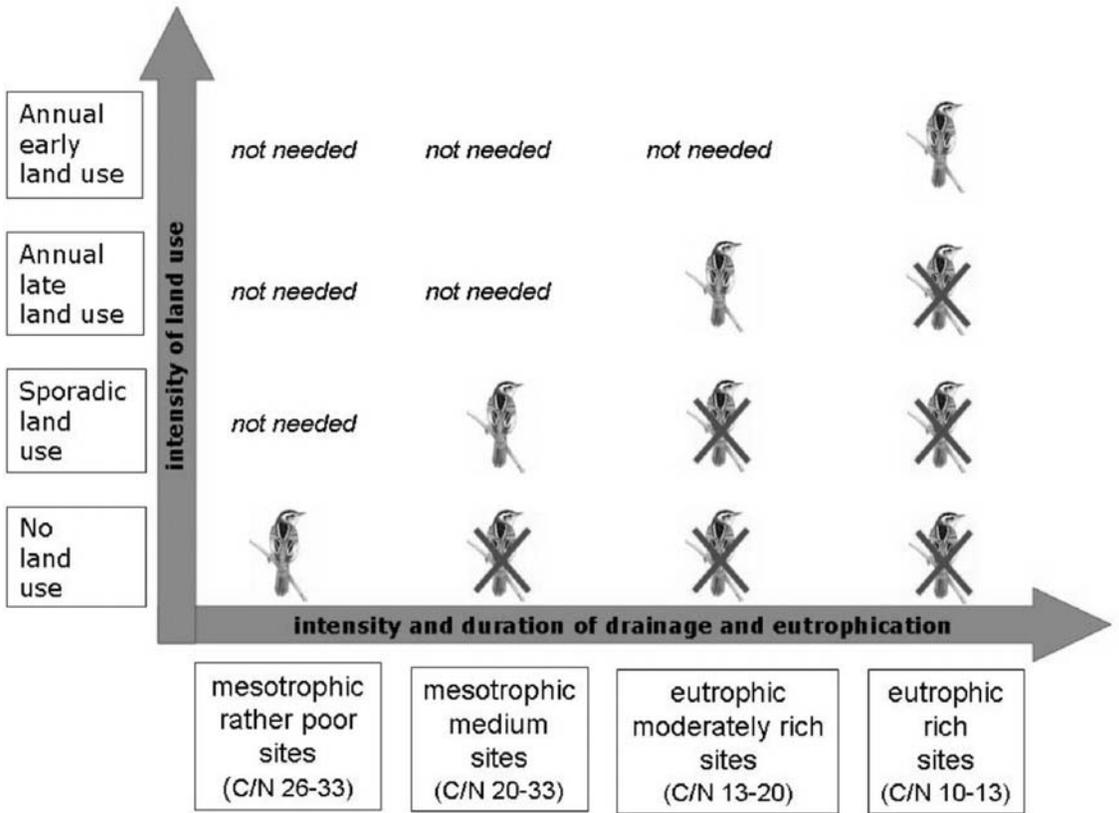
With regard to the long-term perspective, it is recommended to

- Identify long-term funding perspectives with particular attention to so-called paludicultures, which offer benefits in terms of climate (avoidance of greenhouse gas emissions), biodiversity (improved conditions for threatened habitats and species), and local economies (new sources of income).
- Identify areas for habitat restoration in Northwest Poland and Northeast Germany, develop regional management plans, and start restoration activities.
- Assess the probability of re-colonisation of restored sites.

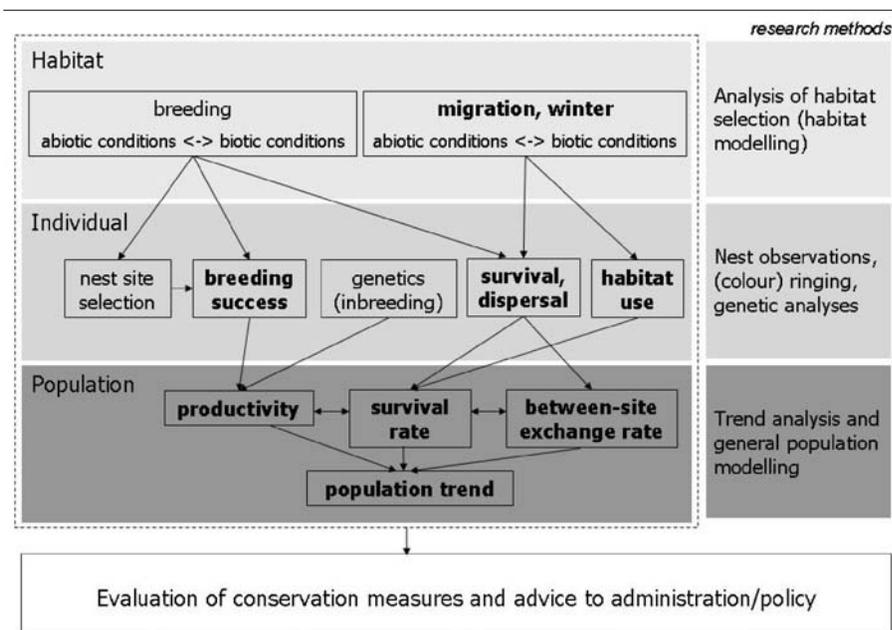
The proposed management for more eutrophic sites is expected to become with increasing drainage and/or eutrophication more important also in other breeding areas further East [5]. In the eutrophic Nemunas delta in Lithuania, alternating land use is already needed, as Aquatic Warblers occur mostly on areas with early summer mowing [5].

**Suggestions for further research**

In general, there is now extensive knowledge at the habitat level [6]; except for the wintering sites – the sites in Senegal delta are currently studied by C. Tegetmeyer – and good knowledge at the individual level (Giessing, 2002; Pain *et al.*, 2004; this study - to be improved with regard to nest site selection) for the Pomeranian population. However, the understanding of population processes is still weak. Successful conservation of small remnant populations has to take key population processes such as



[5] Model of the occurrence of Aquatic Warblers under natural conditions and at three stages of increasingly intensive and long drainage and eutrophication in relation to the intensity of land use (mire typology according to Succow & Joosten 2001). From Tanneberger (2008).



**[6] Information needs for habitat and population management of the Pomeranian population. Bold printing indicates a high priority. From Tanneberger (2008).**

productivity, survival and between-site movements into account. These processes are essential for understanding the (meta)-population dynamics of local breeding populations, and properly assessing a population's survival perspectives.

The restoration of former and the creation of new breeding sites cannot be successful if these processes are neglected. In order to move from the individual to the population level we should take advantage of the large amount of existing data to perform comprehensive analyses and modelling. Therefore, additional recommendations are:

- to monitor the breeding success of Pomeranian Aquatic Warblers in order to evaluate the conservation activities;
- to close gaps in the database of Aquatic Warbler records from Pomerania by intensive search for historical data;
- to subsequently analyse the development of the population with respect to factors potentially influencing the population;

- to investigate survival and exchange between breeding sites by observing colour-ringed Aquatic Warblers (started within EU Life project in 2008). ■

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# Management of Aquatic Warbler breeding habitats in Belarus – experiences and conclusions

Vladimir MALASHEVICH, Alexander KOZULIN & Viktor FENCHUK



**Since 1995, some detailed researches have been applied on three key breeding sites for the Aquatic Warbler to optimise the management of those sites and improve the conservation of the species.**

**M**anagement of Aquatic Warbler breeding habitats in Belarus is based on thorough research implemented since 1995. The research was carried out in the following areas:

- Complex study of mire ecosystems (water, soil, vegetation, insects, birds).
- Monitoring of Aquatic Warbler density and main habitat parameters, 6 key monitoring plots were established since 1996.
- Monitoring of breeding success and causes of nest mortality, destiny of 164 nests followed (Vergeichik & Kozulin, 2006b).
- Study of feeding and nutritive base evaluation, 1,300 ligature samples.
- Study of migrations, 450 birds were ringed, 5 returns were registered.

Currently the research(es) and conservation activities are focused on 3 key Aquatic Warbler breeding sites: Zvaniec, Sporava and Dzikaje that hold 95% of Belarusian and 46% of the global Aquatic Warbler population.

The main threats Aquatic Warbler deal with in Belarus are: unstable water regime of fen mires results in floods, lack of water, uncontrolled fires; and natural

succession results in overgrowing with reeds and bushes. Summer floods cause destruction of nests and lack of water leads to reduced breeding success and population decline in addition the low water level could be the reason of uncontrolled fires (Kozulin & Flade, 1999). According to the correlation between water level and density of singing males, in average the optimal water level lies in the range from 12 cm above the soil to 5 cm below it (Kozulin *et al.*, 2004).

During the process of evolution Aquatic Warbler adapted to unfavorable factors such as fires, floods, droughts. The ability to move to more favorable mire plots (up to 20 km) even during breeding season could be considered as an example of such adaptation (Kozulin *et al.*, 2004). The next adaptation is variable breeding terms. Under unfavorable conditions most females can breed not in May, but in July, which is confirmed by increasing male density in July compared with May. Besides, Aquatic Warblers are able to construct nests in not typical places: in rectangles of old vegetation over the water – when the water level is high; without the



**Lock built on Paviedskyt canal.**

cover of old vegetation (in tussocks, among green sedge leaves) after spring fires (Vergeichik & Kozulin, 2006a).

In spite of such flexibility the number of Aquatic Warblers is continuously declining and urgent conservation measures are required. As the first step, management plans for the key territories Zvaniec, Sporava and Dzikaje were developed. The management plans identified main threats and specified and prioritized actions that need to be implemented. For all three sites, water management was deemed as priority action and several conservation projects targeted restoration of hydrological regime of these sites.

The restoration of the water regime was targeted in the framework of the project: Implementing urgent conservation actions in mesotrophic fen mires in Belarus. The main aims of the project were the following: optimisation of hydrological regime of fen mires (Zvaniec, Dzikaje and Sporava); development of hydrological and species monitoring system to evaluate the effectiveness of taken measures; the establishment of management units for reserves.

Zvaniec mire is characterised by an unstable water regime of the mire which is caused by two large artificial canals

connecting Dnipro-Buh Channel with the Prypiac (Kozulin & Flade, 1999). Water regulating facilities of different types were constructed: sand & gravel blocks, regulated and unregulated dams.

Dzikaje mire contains the springs of Jaselda and Narau rivers, but no rivers flow into it. The mire is exclusively fed by ground water and precipitation. This guarantees a relatively stable water level. Nevertheless the eastern part of the mire suffer from five canals which were dug as part of drainage work (Kozulin & Flade, 1999). The main targets of the project at Dzikaje mire were to stop losses of water through draining canals and to develop operation regulations of drainage system adjacent to the mire. As a result a number of dams were constructed in the mire and special water operation regulations were developed for the drainage system adjacent to Dzikaje mire.

Sporava mire is situated in the Jaselda river floodplain and around the Sporauskaje Lake. The artificial hydrological regime of the area is explained by Sialec fish farm situated upstream the river (Kozulin & Flade, 1999). The analysis of the water level dynamics at the river Jaselda floodplain since 1981 till 2002 showed that only 11 years favoured the success of the first clutch (47,8% of

analyzed period) and during only 4 years the conditions were suitable for the second clutch – 17,3% (Kozulin *et al.*, 2004). To get closer to optimal water regime of the Jaselda river floodplain the water table should be 5-10 cm above the ground level during May and on the ground level in July. Floodings higher than 15-30 cm as well as decreasing of water level lower than 10 cm below the ground are considered to be unacceptable. To organize management of hydrological conditions in Sporauski reserve water operation regulations of Sialec fish farm were developed; the riverbed of the Jaselda river was cleaned of floating bogs; besides these measures the sewage treatment should be secured.

All together during the project 13 sluices and dams were constructed: 6 at Dzikaje, 6 at Zvaniec, 1 at Sporava. Hydrological management helped stabilize water level and prevent further rapid habitats' degradation.

The next important threat is overgrowing, that leads to the decrease of the area of open fen mires and to fragmentation of suitable habitats. Cessation of mowing and absence of floods result in accumulation of a thick litter layer, which has a negative impact on breeding success and density (Kozulin & Flade, 1999).

The problem of overgrowing is more relevant for Sporava, because the area of open fen mires decreased by more



**Dams built on the canal near Viunauka (above) and on the Narau river (below).**

than 20% during the period between 1955 and 2006. Consequently the first vegetation management project was pioneered namely in Sporava reserve. The whole Sporava mire was mown



**Hand-mowing championship helps to attract public's attention to the problem of open fen mires overgrowing.**

Mowing for hay	Speed Productivity Cost	13 ha/day 3-4 tons of wet biomass/ha 35 €/ha
Mowing for silage	Productivity Cost	1,3 tons of silage/ha 71 €/ha or 60 €/1 ton of silage

**[1] Some economical details of the mowing and bush removing.**

regularly 20-30 years ago but today this practice as well as grazing has nearly stopped and a quick succession took place. The following factors favor fast natural succession: artificial water regime (the absence of floods) of the Jaselda river and the lake Sporauskaje caused by fish ponds situated upstream the river; the lack of water caused by melioration of adjacent lands (Kozulin & Flade, 1999).

Currently the high density of aquatic warbler near the lake Sporauskaje (close to Kakoryca village) is registered ONLY in places that are mown or were mown during the last 5-7 years. If mowing is ceased the following consequences are expected: rapid decline (within the next 5-7 years) of the core population of aquatic warbler near the village Kakoryca and further 50-70% aquatic warbler population decline within the next 10 years in the whole reserve.

Public awareness rising campaigns like a hand-mowing championship help to attract public attention to the problem of open fen mires overgrowing. The first hand-mowing championship in Sporauski reserve took place in 2007.

Effective mowing can be achieved only with the use of machinery. Altogether 367 hectares of Sporava mire were mown and 30 hectares cleared from bushes between 2006 and 2008. Monitoring

works implemented showed positive effect of habitat management, leading to up to 3 times increase in the density of vocalizing males of the Aquatic Warbler. The next conclusions could be made: mowing is extremely needed to stop succession, mowing is technically possible, mowing can be economically justifiable. Here are some economical details of the mowing and bush removing according to owner data [1].

Area suitable for mowing in Sporauski is up to 500 ha/year.

In December of 2007 the first controlled burning was piloted at Zvaniec. The whole mire was covered with frozen water and adjacent areas were covered with snow. Such weather conditions favored safe burning. As a result only high old vegetation was burned and turf layer was not damaged. ■

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# Hydraulic management of Aquatic Warbler habitats in the upper Pripyat river region (Ukraine)

Anatoly POLUDA



There are two populations of Aquatic Warbler in Ukraine: the Pripyat' group (nearly 85%) and the Desna-Dnipro group (Poluda *et al.*, 2001). The numbers of the Ukrainian population are estimated at 3,500 to 4,000 males depending on the years. The highest numbers were registered in 2005 (3,700-4,200 males) and in 2008 (3,800-4,365 males). It is true that during the last breeding season two new territories were discovered in the valley of Stokhid river (170-180 males). The last 5 years, the numbers of the Pripyat' group changed from 2,600 to 3,700 males and the Desna-Dnipro group – from 470 to 665 males.

**M**ore than 60% of the Ukrainian Aquatic Warbler breed in the Pripyat river floodplain between the village of Richytsya and the lake Lyubyaz [1] (Aquatic Warbler Conservation Team, 1999). In this area, we find more than 3,600 ha of habitats suitable to the Aquatic Warbler. The greatest breeding site of the Ukrainian population is located on the territory between the villages of Vetly - Girky - Lubotin - Tsy - Birky. There are almost 2,500 ha of suitable biotopes there and nearly 2,000 males breed there some years.

The formations of the hydrological conditions in the breeding sites of the two populations differ very strongly. The water regime of all the breeding habitats of the Desna-Dnipro Aquatic Warbler population is stable. This is due to the influence of various artificial hydrotechnical constructions and landscape features. For example, the water level of the habitats in the valley of the Uday river is always suitable to Aquatic Warbler, even in the driest years. The water regime of the Pripyat' breeding

sites strongly depends on the river. It concerns habitats which are located in the valleys of the Pripyat, Stokhid and Stir rivers. The numbers of the Pripyat' population decreased in the « dry years » (for example, in 2003: 1,610-2,070 males) and in the years with « very high water » (in 1999: 880-1,230 males).

All biotopes of the Desna-Dnipro Aquatic Warbler population group are stable. Succession processes are practically absent. A lot of breeding sites of the Pripyat' population are heavily impacted by vegetation succession (overgrowing with willow bushes, reeds etc.) which is due to alterations in the water regime and to the cessation of traditional land-use practices (hand scything, low-intensity grazing). The stable sites are stable because of their isolation from sources of pollution (river included) and where hay-making still takes place (mires « Zalissyia » and « Vizhery », the Pripyat valley near Grechishcha, area north of Lyubyaz lake, Stokhid valley near Sudche and Berezna Volya). Unfortunately, local people ceased to mow the

Site and location	2004	2005	2006	2007	2008
Pripyat valley between Komarove and Richytsya	? (25)	? (25)	0	0	0
Pripyat valley between Richytsya and Pidgiriya (Schedrogir) (350 ha)	300 - 350	150 - 170	240 - 270	120 - 150	80-100
Pripyat valley between Pidgiriya and Turiya mouth (~175 ha)	120 - 150	10 - 20	40 - 60	30 - 40	15-20
Eastern part of Turya mouth (30-40 ha)	(30)	?(30)	(30)	(30)	(30)
Area near canal Wizhewskiy – Pripyat (~350 ha)	(105 - 160)	? (105 - 160)	(105 - 160)	(105 - 160)	(105 - 160)
Pripyat valley to the south of Nevir (including mire "Zalissya") (more 500 ha)	200 - 250	200 - 250	300 - 350	(200 - 250)	300 - 350
Area between Vetly, Birky and Tsyra (~1900 ha)	800 - 900	1400 - 1600	900 - 1100	800 - 900	1,100 - 1,200
Pripyat valley (left bank) between Vetly – Lubotin (>500 ha)	?	~ 250 - 300	400 - 500	(400 - 500)	(400 - 500)
Pripyat valley (left bank) to south-western of Grechishcha and hay-mowing to south (200 ha)	(20 - 50)	10 - 30	80 - 100	(80 - 100)	100 - 120
Area to north of Lyubyaz lake (90-100 ha)	(80 - 100)	80 - 100	80 - 100	110 - 120	110 - 120
Area to north of lake Rogozne (30-40 ha)	(40)	(40)	(40)	(40)	(40)
Southern and eastern banks of Wolyanske lake and canal "Khabarishe" (~100 ha)	20 - 50	70 - 90	(70 - 90)	(70 - 90)	(70 - 90)
Turya valley (mire "Vizheri") (275 ha)	270 - 290	310 - 330	320 - 340	330 - 350	210 - 230
Stokhid valley (St.Chervishche) (20 ha)	(~50)	0	0	0	0
Stokhid valley near Sudche (150 ha)					150
Stokhid valley near Berezna Volya (~150)					20 - 30
Stir valley between Navoz – Godomitchy (180 ha)	120 - 130	70 - 80	70 - 80	70 - 80	130 - 150
Area between lakes White and Pischne (310 ha)	> 150	120 - 150	(120 - 150)	(120 - 150)	(120 - 150)
Chornoguzka valley (430 ha)	> 100	150 - 200	120 - 150	(120 - 150)	(120 - 150)
Total number of the colonies	2,390 - 2,785	2,980 - 3,545	2,915 - 3,520	2,625 - 3,110	3,100 - 3,590
Total number of Pripyat's population (Ukrainian part), including Shatsk NP (25), Rivne reg. (60)	2,620 - 3,015	3,105 - 3,670	3,000 - 3,605	2,700 - 3,200	3,200 - 3,700

**[1] Number of Pripyat's population group (Ukrainian part) of Aquatic Warbler.**

grass in the mires – in the last years they received plots located outside the floodplain.

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### **Management relative to the Aquatic Warbler in the floodplain of the Pripjat river**

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It is obvious that, for the Pripjat' population, water management is very important. The influence of the water regime on the numbers of Aquatic Warbler on one plot of the area between the villages of Vetyly and Birky has been investigated since 2002. There is a drainage canal on this territory. It was dug through the central part of the area. In usual and dry years, the canal strongly influences the hydrological regime of biotopes. All these biotopes of Aquatic Warbler are used for haymaking and the crop of grass is very low in « dry » years. It is possible to assert that this canal has a negative influence on a minimum of 120 -150 ha of biotopes of Aquatic Warbler. In this drainage canal there are no adjusting sluices. Their presence could make it possible, in low-water years, to maintain an optimum level of water for the nesting of Aquatic Warbler in localities and to enable birds to successfully finish a 2<sup>nd</sup> cycle of nesting. By the way, in the second half of June - first half of July 2003 and 2004, the numbers of birds were very low – 2 and 5 males on 100 ha. In October 2005, three wooden dams with sluices were built on the canal and in 2006 – 2008 the optimum water mode was created in this territory. As a result, the numbers of Aquatic Warbler during this period (end of June - beginning of July) increased a lot – in 2006: 48 males on 100 ha; in 2007: 62; in 2008: 58.

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### **The effects of the river channel deepening on the AW population**

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Now, the real threat for the breeding sites in the valley of the Pripjat river comes from the programme « Ecology-2010 ». This programme was prepared by the Volyn State Department for Water Resources Management. It includes a « concealed » draining of the Pripjat floodplain – for example, the Activity 2.1.1 of the Programme - « Restoring water regimen of Pripjat from Vyzhivsk water diverting structure to lake Lyubyaz, river

bed regulation » and the Activity 2.1.2 « Restoring water regimen of Pripjat from Richytsya to Vyzhivsk water diverting structure, river bed regulation ». According to the Programme, between 2005-2010, it is planned to deepen the river bed within the framework of Activity 2.1.1 on a length of 50.8 km, which constitutes 71% of the river's total length (71.3 km) in this area. As to the Activity 2.1.2, it implies a deepening on a length of 15.3 km (70%), the total length of the river in this area being of 21.9 km.

This area of the Prypyat is crucial to the protection of water resources and of biodiversity in Ukraine, as it is part of one of the European ecological corridors. With accounting for the importance of the area at regional, national and European level, a lot was done in the Volyn region and in the country to protect this part of the floodplain. There are 10 hydrological zakaznyks (reserves) and the National Nature Park « Prypyat-Stohid » was established in 2007; the whole area is designated as a wetland of international importance and is a Ramsar site.

One of the key arguments of the water management authorities to justify the necessity to deepen the river bed is that, during the last decades, the river has been deteriorating from the village of Richytsya to the Rivne region. This includes a decrease in the river's carrying capacity, which lead to the extension of the period of flood-water stay. The experts' justifications of the river « restoration » have being prepared by the Research Institute of Water Resources Engineering and Melioration (they are subordinated to the Volyn State Department for Water Resources Management). The experts of the Institute deemed the melioration channels in better condition than other natural parts of the river.

How do the experts in water management see the reasons of the river's deterioration? In their report on the scientific justification of the river bed deepening projects in the upper Prypyat of the Volyn region (2003), they wrote that the main reasons for the prolonged flooding of large areas, which causes economic losses for agriculture, a decrease in grass diversity and a worsening of the habitat conditions for animals, include:

- the building of fishing dams by local people;
- the lack of shrubs' removal and grass mowing by local people;
- the water intake to Belarus via the Dnipro-Buzskiy Channel.



**[2] Prypyat river-bed deepening in 2005-2007. The red line represents the section of the river where these works were carried out. The green areas - Aquatic Warbler habitats. The blue circle - monitoring water post.**

Unfortunately, the conclusion reached in the report is that the river-bed deepening is the only answer to those problems.

If the above-mentioned factors are the main ones, then it would be logical to reduce their influence – de-mount fishing dams, promote mowing and bush removal, reconsider the water supply regimen to Belarus, build new road-dams across the floodplain to promote extra water-flow passage etc. This would be the most cost effective way to increase the river's carrying capacity.

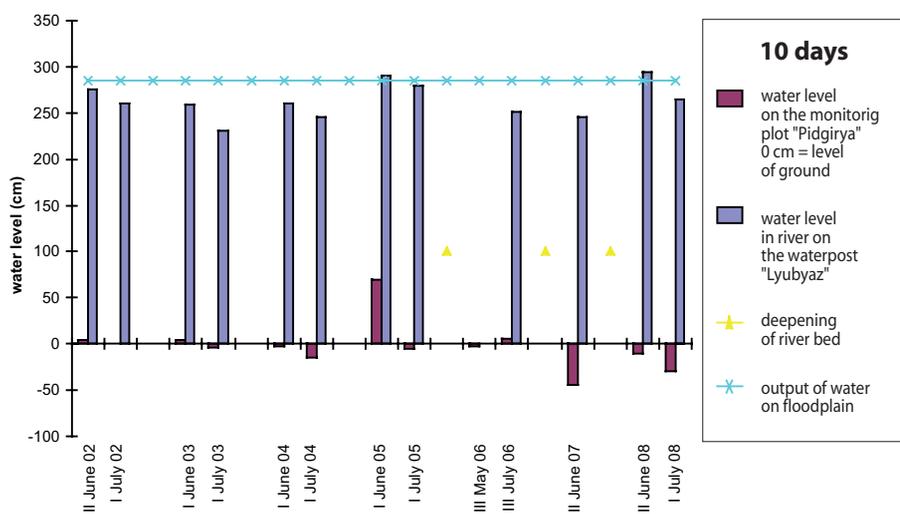
For some projects, water management experts justify the need for the « river bed restoration » by the need to protect local populations from floods. At the same time, our data and water monitoring results show that the flood threat in the area is over-estimated and that, in any case, dredging is not the most effective solution.

The scientific data used to justify the need for the river-bed deepening mainly include dynamics of the average over-year duration of water stay in the floodplain. The water management experts show there was an increase of this parameter at the end of XX<sup>th</sup> century. Is their conclusion concerning a constant and drastic increase of the water stay duration (up to 165 days in 1988-1997 at the Lyubyaz water control point) actually true?

The figure of 165 days was typical for 1970-90s. However, when one takes into account the landscape of the valley, floods are a natural phenomenon there. For

example, there were times in the first half of the XX<sup>th</sup> century when water covered the floodplain for almost a whole year (333 days in 1926). The serious increase in the water stay period was caused by the large-scale melioration of the upper Prypyat and of its in-fluxes in the part of the river where the melioration started. According to Volynvodproekt, the average over-year water stay period before the beginning of the melioration (1958-1967) was of 133 days; therefore, it has increased by 25-35 days in the 1970-90s. However, in 2000-2007 this parameter was already of 55 days only!

The experts of the Research Institute of Water Resources Engineering and Melioration put the emphasis on the fact that the average over-year water stay period had almost doubled at the end of XX<sup>e</sup> century to reach 302 days; but their calculation was made based on two abnormally wet years – 1998 and 1999. There was then an inaccurate use and incorrect interpretation of the over-year water control data. It is more scientifically accurate to use longer periods, for example decades. The two abnormal years did not actually influence the over-year dynamics in the 1990s. In this decade, the average over-year water stay period was of about 185 days; while over 2000-2007 this parameter dropped. Therefore, there is not any increase trend in the duration of water stay; on the contrary, this duration is decreasing. We assume that these data were deliberately used in an inaccurate way to justify the funding by the state of the river-bed deepening projects.



[3] *Dynamic of water level at the monitoring plot « Pidgiryia » and waterpost « Lyubyaz » in the Pripyat valley.*

The water management experts did acknowledge that there were some problems in this part of the Prypyat after the draining of its upper part, even after the construction in 1987 of the Upper-Prypyat Drainage System. The longest average over-year duration of water stay occurred in 1985-1994 (the first years after the end of the construction). However, from 1995 onwards, this parameter started decreasing as the river was restoring itself.

### First stage

The first stage of the Pripyat river-bed deepening was carried out in 2004-2005 between the village of Schedrogir (Pidgiryia village) and the Turiya river mouth [2]. Nearly 5 km of river-bed were deepened. In 2006, the bed deepening resulted in a decrease of the water levels on some parts of the floodplain located more than 1 km away from the river, including, for example, the haymaking fields near Krupyne lake and on the other side, on the low part of the village of Pidgiryia. Sedge tussocks, among which there usually should be water, now are on dry ground. There is no water in the floodplain up to 4 km downstream from the bridge, though this part of the river always has a relatively high level of ground water. The level of water has reached 0.5-1.0 m below the ground. Despite the water-blocking influence of the bridge dam, the negative impact was

revealed in 2006, even on the upstream floodplain part located at 1.5-2 km from the Pidgiryia-Schedrogir road, where our monitoring plot is located.

USPB experts have been monitoring this part of floodplain since 1999. It has always been abundant in water, as there are numerous lowland sedge bogs which are mowed by local people. There are also small lakes and old channels in this area. All these features offer optimum conditions for the nesting of waterbirds; there is a high concentration of Coots and Mallards; there were also several nesting pairs of Graylag Geese. It has never been dry (at least since 1995). The main limiting factor for the nesting of Aquatic Warbler was the high level of water. In high water years, Aquatic Warbler did not nest there, for example in 1999 and 2002. In optimal years, there were 120-150 males nesting there (for example in 2004) [1].

### Second stage

The second stage: in December 2006, the river bed was deepened on 2 km upstream from the bridge in the village of Schedrogir. These works very strongly lowered the water level on the monitoring plot. But this deepening of the river has not affected the breeding sites which are located upstream of the river (area of lake Strybuzh) due to a small height in the floodplain.

Year	Breeding site			
	Pripyat valley between Richytsya and Pidgiryia (Shchedrogir)		Pripyat valley between Pidgiryia and Turiya mouth	
	Monitoring plot (30 ha)	Total	Plot (~20 ha)	Total
2004	24	300 - 350	20	120 - 150
2005	13	150 - 170	0	10 - 20
2006	20	240 - 270	10	40 - 60
2007	13	120 - 150	2	30 - 40
2008	13	80 - 100	2	15 - 20

**[4] Change in Aquatic Warbler numbers (singing males) in the habitats of the floodplain of the Pripyat river, where the river-bed deepening was carried out.**

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## Last stage

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In 2007 the last stage of the river-bed deepening was carried out in this part of the floodplain. The deepening of the river-bed was made on the part of the channel which crossed the height. As a result, the water level dropped very strongly (more than 0.5 m) on the sites of floodplain, including lake Strybuzh.

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## Results

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The water management experts claim in their materials that the river-bed deepening will not cause any floodplain draining – the last years were dry and the level of water of the river was low. However, some of the materials they provided show the correlation between river water level changes and ground water level at a distance of at least 500 meter from the river (rather 1,000 m, according to our data). In June 2007, the water level of the river was the lowest of the last 4 years [3]. But, in May and June 2008, the water level of the Pripyat river was at its highest. The water level was high on the sites where the channel deepening works were not carried out (in the inter stream of the Prypyat and Tsyra, in the mire « Zalissya », the parts of the floodplain to the west of the village of Shlapan, in the mire « Vizhery » in the Turiya river valley, etc.). However the water level in the floodplain between the village of Richytsya and the Turiya river

mouth was very low. It is interesting to compare the situation in 2005 (before the beginning these works) and in 2008. The water levels of the river at the Lyubyaz water control point were practically identical. But, on our monitoring plot they differed by 40-70 cm. This is a consequence of the deepening of the channel of the river.

After the beginning of the deepening works, the decrease in the numbers of Aquatic Warbler on these sites was marked [4]. The number of Aquatic Warbler on these sites was very low in 2008, despite the fact that this season was very wet.

In 2006, another river-bed part was deepened downstream from the village of Vetyly. The length of the dredged part is only of 1.5 km. This was enough to substantially lower the water level in the nearby floodplain, including the monitoring site. In 2008, the hydrological conditions were optimal (the season was very wet). Nevertheless, the deepening works lowered the water level on the monitoring plot by 10-30 cm.

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## Perspectives

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If the deepening of the river on this area continues (it is planned to deepen almost another 50 km of the river), most of the breeding sites in the valley of the Pripyat will be destroyed. It is the greatest breeding site of the Ukrainian population – almost 2,500 ha of biotopes suitable to the Aquatic

Warbler and nearly 2,000 males breed there some years. By the way, now all this territory belongs to a national park.

The activity of the Volyn State Department for Water Management does violate national environmental legislation. The deepening of the rivers is forbidden on the territories of the Nature-Reserve Fund of Ukraine (hydrological zakazniks, National Parks). The water management experts are aware of this violation, as they state in the report on « Scientific and Ecological Justification of the River Bed Restoration in the upper Prypiat of Volyn region » (2003). It is written in the report (p. 21) that, despite its protected status, the restoration of the river bed is still necessary. In their 2002 report, they confirm that its designation as a protected area (though nominal as there are no administrations so far) constitutes a barrier to the river bed restoration in the upper Prypyat (pp. 77-78 of the Report).

The Article 80 of the Water Code of Ukraine prohibits straightening and indentation of river beds below their natural level. According to the Art. 94 of this Code, no activity should be carried out within a protected area if it is in conflict with the goals of the protected territory.

Due to the activity of our society, in 2008, the deepening of the river works were not carried out. In July of this year, there were some catastrophic floods in the Carpatian region of Ukraine . these floods might be an opportunity to lobby for the continuation of these works in the Pripjat floodplain.■

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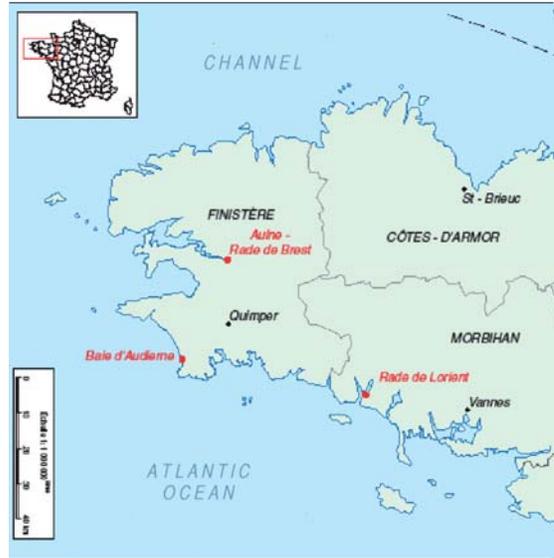
# Monitoring of the vegetation on three sites managed in favour of Aquatic Warbler

Cyrille BLOND



**W**ithin the framework of the Life project for the Aquatic Warbler, three sites have been managed in Brittany in order to favour the hosting of Aquatic Warblers during

their migratory stop-overs. There are two marshes located in the Finistère, the Rosconnec Marsh located in a loop of the Aulne river and the Trunvel Marsh located on the coast of the Atlantic Ocean, and a marsh located near the harbour of Lorient in Morbihan, the Pen Mané Marsh. This presentation reports on the observations made on the vegetation in each marsh, following the management operations carried out in order to favour the hosting of Aquatic Warblers.



[1] Managed sites' location within the Life for the conservation of the Aquatic Warbler in Brittany.

## The Characteristics of the Sites under Scrutiny

### The Rosconnec Marsh

It is an estuarian marsh under marine influences (flooded during spring tides). The predominant vegetation is made up of reed beds and subhalophilous meadows. The other types of vegetation found there are clubrush beds of *Bolboschoenus maritimus*, rush beds of *Juncus maritimus*, a pool with a grass bed of slender pondweed.

The patrimonial flora is represented by the slender pondweed (*Potamogeton pusillus*), the dotted sedge (*Carex punctata*), two taxons registered on the red list of rare and endangered vegetal species of the Armorican Massif. Other plants which are rare in Finistère are also to be

found there, like the gray clubrush (*Schœnoplectus tabernaemontani*) and the Parsley water-dropwort (*Cenanthe lachenalii*).

### The Trunvel Marsh

It is a back-dune marsh. The reed beds prevail as well as wet meadows. The other types of vegetation are sedge beds of *Carex riparia*, subhalophilous wet meadows, fen-sedge beds, etc.

A plant protected at national level, the *Anacamptys palustris*, is also to be found in the sector managed in favour of the Aquatic Warbler. [3 & 4].

### The Pen Mané Marsh

It is a confined marsh under marine influences. The dominant vegetation is



[2] Above left: aerial view of the Rosconnec Marsh.  
[3] Above right: Trunvel Marsh.  
[4] Below left: *Anacamptys palustris*, protected in Brittany and present in the Trunvel Marsh.

made up of reed beds and clubrush beds. The other types of vegetation to be found there are the drift rough grass communities of low levels (high Altantic slijkke), salt meadows of high schorre, Glasswort swards.

Its outstanding plants are the marsh helleborine (*Epipactis palustris*), the great fen-sedge (*Cladium mariscus*), the common smallreed (*Calamagrostis epigeios*), three plants which are rare in Morbihan. [5 & 6].



[5] The Pen Mané Marsh  
[6] The marsh helleborine (*Epipactis palustris*), a rare plant of the Pen Mané Marsh.



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[7] Right: Sluice set up in the Pen Mané Marsh.  
 [8] Left: Digging of the ditches in the Rosconnec Marshe.

## The Sites Management

The management applied to these sites consists in a summer mowing carried out between July and August [5]. The mowing is done while taking into account the imperatives related to the nesting of the birds, the impact the mowing will have on the vegetation, the local hydraulic conditions. Thus, for each site, the date of the mowing is chosen so as not to interfere with the birds' nesting period. The mowed matter is exported. The goal of the mowing is to maintain or obtain low and homogeneous vegetation heights on the site, as well as open vegetations which are favourable to the Aquatic Warbler.

Within the framework of the hydraulic management of the marshes, a sluice [6] and ditches [7] have been dug in the Pen Mané Marsh. In Rosconnec, ditches have also been dug, as well as some pools.

Secondarily, extensive ovine grazing is carried out in Trunvel by sheep of hardy breed, from the Ouessant island [8]. This

management is very localised, carried out in the western part, near the ringing station. The sheep frequent mainly sectors with mesophile vegetation and venture occasionally to the edge of the marsh, in the sectors of sedge beds and reed beds where the ground is dried-out in the summer.

## The Studying Method

On each site, study plots or 3x3 m permanent squares materialised by pegs have been set up in 2006 on various types of vegetation. In each square, a phytosociological record is performed every summer around the same date. It consists in recording all the vegetal species present in the square and to assign to them a cover-abundance coefficient according to the Braun-Blanquet scale. In fact, this coefficient represents the cover of each species on the ground [10], it varies between 5 for a cover above 75% to + for a cover under 1%. Other pieces of information are also gathered like the total cover of the vegetation in %, the maximum,



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[9] Ovine extensive grazing in the Trunvel Marsh.

cover abundance coefficient	cover interval
5	75 – 100%
4	50 – 75%
3	25 – 50%
2	5 – 25%
1	1 – 5%
+	< 1%

[10] The Braun-Blanquet cover-abundance scale, 1932.

average and minimum height of the vegetation. Locally, in Trunvel, a counting of the plants of a patrimonial species, the *Anacamptis palustris*, is also performed. These records have been made by Claudine Fortune in 2006 and 2007, and by ourselves in 2008.

## The Results of the Observations by Vegetation Type

### Dense reed bed with *Phragmites australis*

The annual mowing resulted in an opening of the environment, we went from a 100 % cover to a 75 % cover [11]. As early as the first year, we observed a fast and spectacular increase of the specific diversity with an appearance of meadow species. Thus, on the Rosconnec site, in the permanent square, which, before the mowing, was occupied by one species, reed, we counted 4 vegetal species a year after the mowing, and then 8 the following year.

It is also interesting to mention that after the mowing the reeds do not grow as high the following year.

In the end, a dense mono-specific reed bed became a diversified and open reed bed.

### Mixed or Diversified reed beds

The mowing allowed for the increase of meadow species diversity a year after it was carried out. Their number has doubled.



[12] Dense reedbed at Rosconnec Marsh.

The reeds are receding, going from a cover over 75 % to a cover under 50 %.

Just like for the dense reed beds, the reeds do not grow as high the following year. The result is spectacular in Trunvel, where the reed bed, which was initially 1.70 m high, is now only 55 cm high two years later, and is becoming a habitat favourable to the Aquatic Warbler.

### Fen-sedge bed

Alliance of the *Cladietum marisci*

It is a high fen-sedge bed covering a small area and which was initially included in a

Year the record was performed	2006	2007	2008
Total cover	100%	75%	75%
Minimum height	50 cm	1 cm	1 cm
Average height	1.8 m	1.5 m	1.6 m
Maximum height	2.7 m	1.9 m	1.94 m
Number of taxons	1	4	8
<b>Reed beds species and associated habitats</b>			
<i>Phragmites australis</i>	5	4	4
<i>Lycopus europaeus</i>			1
<i>Iris pseudacorus</i>			i
<i>Ranunculus cf. sceleratus</i>			i
<i>Œnanthe crocata</i> (plantule)			+
<b>Subhalophilous meadows species</b>			
<i>Agrostis cf stolonifera</i>			2
<i>Bolboschœnus maritimus</i>		+	
<i>Atriplex prostrata</i>		+	2
<b>Other species</b>			
Plantule (Cf. <i>Urtica dioica</i> )			i
<i>Sonchus asper</i>		1	

[11] At Rosconnec Marsh, evolution after mowing from a dense reedbed to an open and heterogeneous reedbed.

reed bed area. Following the summer mowing carried out in 2006, we observed a fast decrease in the cover of the great fen-sedge a year later. The mowing has had an impact on the global cover of the vegetation — it evolved from 100% to 80% —, and on the height of the vegetation which dropped from 2.20 m to 60 cm after two years of mowing.

The plants characteristic of the wet meadows developed as early as the first year, 5 new species joined the 2 species that were already present.

In the end, after two years of summer mowing, the dense fen-sedge bed which was not very favourable to the Warbler disappeared and made way to an open reed bed favourable to the Aquatic Warbler [13].

#### Subhalophilous Meadow

Several alliances: *Armerion maritimae*, *Glauco-Juncion maritimi*, *Agropyron pungentis*

#### Meadow of *Agrostis stolonifera*, *Juncus gerardii*, *Triglochin maritimum*

The maximum and average heights due to the *Juncus maritimus* decreased a



[14] Subhalophilous meadow monitored in the Rosconnec Marsh.

Year the record was performed	2006	2007	2008
<b>Total cover</b>	<b>100%</b>	<b>85%</b>	<b>80%</b>
Minimum height	10 cm	1 cm	1 cm
Average height	1.7 m	70 cm	60 cm
Maximum height	2.2 m	1.75 m	1 m
Number of taxons	7	14	12
<b>Reed beds species</b>			
<i>Cladium mariscus</i>	5	1	+
<i>Phragmites australis</i>	2	2	2
<i>Lythrum salicaria</i>	+	1	+
<i>Bolboschœnus maritimus</i>		1	2
<i>Lycopus europaeus</i>	+	+	+
<i>Calystegia sepium</i>	+	4	+
<b>Wet meadows species</b>			
<i>Galium palustre</i>	1	1	+
<i>Agrostis cf stolonifera</i>	1	1	1
<i>Bidens cf connata</i>		2	
<i>Potentilla anserina</i>		2	
<i>Eleocharis cf palustris</i>		+	+
<i>Hydrocotyle vulgaris</i>		+	+
<i>Atriplex prostrata</i>		+	
<i>Mentha cf aquatica ou arvensis</i>			i
<b>Other species</b>			
<i>Solanum nigrum</i>		+	
<i>Rumex sp.</i>			i

[13] The fen-sedge bed monitored in Trunvel, evolving towards a reed bed after one and two years of summer mowing.



[15] Clubrush bed in the Trunvel Marsh.

year after the first mowing was carried out, but they grow back the following year if no mowing is performed.

On the other hand, we observed a decrease in the cover of the red fescue, *Festuca rubra*, on several squares. The mowing might have destroyed old dense fescue tufts. In the meantime, the cover of the *Agrostis stolonifera* increased. [14].

#### Clubrush beds of Sea Clubrush

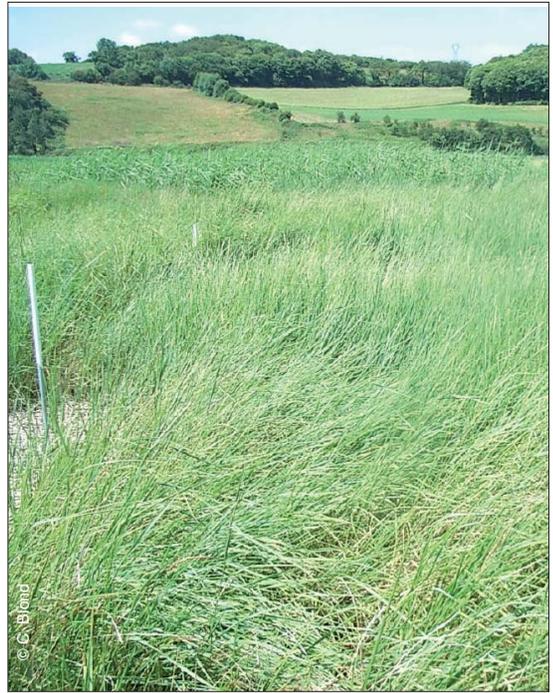
Alliance of *Scirpion compacti*

This habitat has been studied on the Rosconnec site where it comes in mosaic with subhalophilous meadow. It is thus mowed with the latter within the framework of the marsh management. It develops in small depressions which are signs of a brackish environment. After the summer mowing, we observed a decrease in the cover of the sea clubrush *Bosboschænus maritimus* which went from a cover over 75% to a cover below 50%. The height of the vegetation has also decreased. The floristic composition has not significantly changed [15].

#### Glasswort swards

Alliance of *Agropyron pungentis*

The Glasswort sward is a meadow vegetation made up of high herbs which are stiff, blue-green and dense. It has a



[16] Glasswort sward monitored in the Rosconnec Marsh.

low floristic vegetation linked to the dominance of the sea couch (*Elymus cf. athericus*). On the sites under scrutiny, it is only present in Rosconnec where it develops along the micro-canals and also in mosaic or in superposition with the subhalophilous meadow. It seems that, in Rosconnec, this vegetation developed to the detriment of the subhalophilous meadow because of the abandonment of traditional practices relative to the exploitation of the environment. On one of the monitoring squares, the summer mowing of the Glasswort sward made way for the settlement of three dependent species in the wet meadows the following year: *Festuca gr. rubra*, *Agrostis stolonifera* and *Poa trivialis*. The mowing has not had any impact on the vegetation heights which remain stable from one year to the other [16].

#### The Outcomes of the Monitoring

Management of the Sites in Favour of the Aquatic Warbler

The monitoring enabled us to gather information on the management of environments in favour of the Aquatic Warbler. The dense reed beds are becoming favourable to the Aquatic Warbler in terms of habitat structure and appearance after two years of mowing. And one year of mowing is enough to



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make diversified reed beds a priori favourable to the Aquatic Warbler.

It also put the emphasis on the hydraulic management problems. Indeed, for the Pen Mané Marsh, no mowing could be performed on the planned areas because of a belated flooding of the marsh. The flooding, which lasted too long, made the clubrush bed disappear in the monitored sector and the annual vegetation of drift rough grass could not develop at the end of July 2008. This first year, 2008, has been a running-in year regarding hydraulic management and it put forward the necessity to regulate: for instance, the necessity to leave the sluices open early in the summer, because, even if the water level of the marsh already naturally drops in the summer, there might be some

precipitation event maintaining too high a water level.

This monitoring brings useful information concerning the conservatory management of habitats, not only for reed beds, but also for other environments like the subhalophilous meadows which are among the habitats of Community interest listed in the Annex I of the « Habitats » Directive. The mowing of the marshes then makes it possible to restore and maintain them [17]. ■

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◀ [17] *Aster tripolium*, *Subhalophilous flora in the Rosconnec Marsh*.



# National action plan: the example of the Bittern

Sylvain HUNAUT



The Bittern is a threatened bird in Europe and especially in France. During a recent Life program for the protection of the Bittern in France, a National Action Plan has been decided for the period 2008-2012. This presentation reminds that it exists some similarities with the Aquatic Warbler according to the management of wetland for these species. So the Bittern's National Action Plan can be an example for the Aquatic Warbler one which is coming.



**T**he Bittern (*Botaurus stellaris*), an endangered species at European level, is especially endangered in France. At the beginning of the century, the species was considered as nesting in « most of the country: Lorraine, Sologne, Brenne, Brière, Camargue and probably in all the marshy regions of our country » (Mayaud, 1936). In 1970, the French

nesting population was estimated at 494 singing males (Duhautois, 1984). In 1976, the map of the French Nesting Birds Atlas shows a reduced distribution of the bird, but the Bittern is still observed nesting in all the eastern and northern part of the country, in Sologne, Brenne, Brière, Camargue, Languedoc-Roussillon and Aquitaine. The author of

the Atlas further mentions that « numerous partners insisted on the disappearance of the Bitterns which used to nest in their region » (Yeatman, 1976). However, these data invalidated the extinction of the species in the wetlands of Champagne and in Alsace. At that time, the population was estimated at less than 400 singing males.

In 1983, during the second national census, there were only 324 singing males (Duhautois, *op.cit.*). At the beginning of the nineties, according to Voisin (Yeatman-Berthelot & Jarry, 1994), the Bittern had disappeared from the Landes and was becoming rare in the Pays de la Loire and was increasing in Brittany. The author estimated the French nesting population at 300-350 singing males and considered the species was one of the most endangered species on the national territory. According to Rocamora (Rocamora & Berthelot, 1999), between 272 and 418 singing males nest in France. At the end of the nineties, after a collection of national data, and despite the absence of data for Picardie and Lorraine, the population was estimated at 217-244 singing males (Cramm, 2001).

During the national Bittern census in 2000, thanks to better prospecting, their numbers were raised to 272-315 singing males. According to Cramm, it appeared that « the estimation of the size of the national population was superior to the one given at the end of the nineties, comprised in a range from 270 to 320 singing males. The decrease in its numbers seemed to go on since 1970, but appeared to be less important in the 1983-2000 period. The size of the population had decreased by 35 to 45% over the last thirty years » (Cramm, *op.cit.*). In 2000, the breeding population was divided into 7 cores, the main one being the greater Camargue (the « Petite Camargue » in the Gard and Plan du Bourg included) with 99 singing males, the stronghold of the French population. Then came the Mediterranean coastal ponds outside Camargue (mostly in the Languedoc-Roussillon region) with 47 males, the Loire-Atlantique marshes (27 to 42 males, mostly in Grande Brière), Brenne (31 to 35 males), Lorraine (25 to 35), Picardie (17 to 21) and the Seine estuary (15 to 20 in 2000; and 24 to 27 on the North bank and 1 to 2 on the South bank, in 2001). The populations of the other areas favourable to the bird in the past, were either very small or close to extinction, the Bittern having almost

disappeared in Sologne and in the Rhône-Alpes region. The smallest numbers were registered in 2000 in the Champagne-Ardenne region.

A national restoration plan under the responsibility of the ministry in charge of the protection of nature had been considered in 2001. Because of insufficient knowledge on the species at the time, the actors of the project decided to first implement a Life program in order to complement their knowledge of the Bittern. It is in that context that the Life Nature program aiming at restoring and managing the Bittern habitats has been carried out from April 2001 until March 2006 on 5 sites crucial to the reproduction of the species and on one wintering site. The program made it possible to significantly improve the knowledge on the biology and ecology of the Bittern and to identify the optimal conditions on which the future conservation actions should be based, namely:

- maintain sufficient water levels (10 to 20 cm maximum), stable from April to the beginning of July
- proximity of small free-running water areas (water body, canals...): even if the Bittern is opportunist in its diet, it mostly eats aquatic preys (invertebrates, fishes, amphibians)
- presence of good-quality habitats, which implies the limitation of the natural process of alluviation of the reed beds through water management and adapted ligneous plants: indeed, the recent development of ligneous plants on some sites of the Life program has probably had an influence on the predation of nests, providing some observation stands to winged predators. A water management based on alternating filling and drying-out during the year to mineralise the mud should guarantee the sustainability of the reed beds and limit their afforestation.
- maintain a sufficient vegetal cover, especially in the great reed beds which are commercially exploited, via the conservation of unused patches allowing the females, and to a lesser extent the males, to settle down without having to wait for the reeds to grow again. The presence of a minimum vegetal cover is also crucial in the regions where the Bittern winters.

The outcomes of the Bittern Life project thus largely contributed to the reflection and elaboration of the national conservation strategy relative to the species via a « national restoration plan »—a tool used by the ministry in charge of the protection of nature in order to protect the endangered wild species.

The national restoration plan for Bitterns aims at setting up measures in favour of the conservation of the French Bittern population and at its ensuing expansion. The national conservation strategy for the Bittern must make it possible to eventually restore the population of the species to a good conservation status on the national territory and to implement the means to make it last. It has thus been decided to achieve the population level of 1970 (about 500 singing males, whereas there are currently close to 300 males) within the next 15 years.

The duration of the restoration plan has been set for 5 years. The goal, during this period, is to at least visibly reduce the threats the Bittern and its habitats face in order to maintain the current population; and to increase the sites favourable to the Bittern in order to launch the reconquest of the national territory by the species. Thus, during the 5 years the plan will last, a first rise in the numbers of singing males, of about 50, will have to be observed.

This goal will have to be pursued with high priority in the regions where the conservation status of the Bittern is deemed unfavourable, for instance, in the inland territory, whereas the objective of maintaining source populations will rather apply to the sectors where the conservation status is deemed more favourable like the Mediterranean region.

Given the fact that the spontaneous creation of reed beds is very marginal (abandonment of land use, etc.), it is preferable to focus on the sites which have offered favourable conditions in the past. The sites to be reconquered can then be those which were occupied by the species during the national survey of 1970 or new sites, in particular if those of 1970 are not favourable to the Bitterns anymore and if no restoration is conceivable there.

The plan's strategy is articulated around three main fields—action, protection, study and communication—making it possible to reach the 5 following goals.

### **1. Diagnosis and management recommendation**

The establishment of diagnoses (habitats, species, water management, etc.) and the drafting of management plans concerning

reed beds potentially favourable to the Bittern will be encouraged. Besides, the biological requirements of the Bittern will be taken in greater consideration at the drafting of the guidelines for the agri-environmental measures and of the documents relating to the goals of the Natura 2000 project.

### **2. Maintain and restore natural habitats**

The establishment of local partnerships resulting in the drafting of management conventions and in the setting up of water management tools will be supported on the sites favourable to the Bittern. The adaptation of the management modes (reed cutting) and the implementation of environmental engineering operations (struggle against afforestation) aiming at conserving the potentially favourable reed beds will also be encouraged.

### **3. Durably protect the major Bittern sites**

To top up the contractual incentives, land and land use management combined with the setting up of regulatory protections (National Natural Reserve, Prefectoral Order for the Protection of the Biotope) will have to make way for efficient protection and management of the sites favourable to the Bittern.

### **4. Reinforce the monitoring of the populations**

The implementation of the restoration plan will contribute to the continuation of the scientific research on the species and to the improvement of the counting of the species via a nation-wide census of the singing males.

### **5. Inform and spread awareness**

Informing the managers, farmers or land owners via various communication tools should make it possible to spread awareness of the stakes of the Bittern and its natural habitats conservation in order to further establish real partnerships between owners, users and manager ■

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# Economic valorisation of the management of sites of the Life programme

Arnaud LE NEVÉ



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The management of the habitat of Aquatic Warbler's staging areas implies a summer mowing of the reed beds. This maintenance depends on the existence of local economic sectors capable of valorising the exported reeds. But, the quantity and quality of the products resulting from the mowing may vary from site to site and from one year to the other, forcing the natural sites manager to have multiple economic opportunities adapted to this variability at his disposal.

## A demanding species

The Aquatic Warbler is a demanding species which frequents a very specific natural habitat. The disappearance of its habitat resulting from the abandonment of traditional agricultural practices or from the draining for intensive agriculture, makes it the most endangered passerine in continental Europe.

The Aquatic Warbler breeds in far-reaching, wet, lowly flooded and rather peaty meadows with high herbaceous vegetation [1]. In the winter, in tropical West Africa, it will search for the same habitat structure [2]. The study carried out thanks to radiotracking by Bretagne Vivante on the Trunvel site in 2001 and 2002 (Bargain, 2002) showed that the Aquatic Warbler, while migrating, also looks for habitats similar to its breeding and wintering sites.

Concerning our staging areas on the English Channel and Atlantic coasts, it is wrong to think that the Aquatic Warbler is to be found only in reed beds, the environment in which the ringing stations capture him. In fact, it will use those to rest upon arriving, but will forage and fatten in



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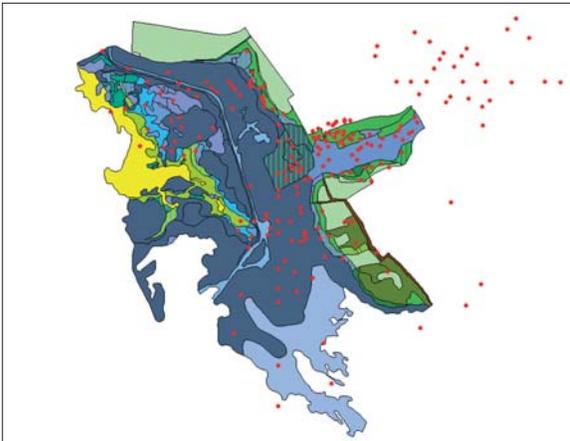
**[1] The Aquatic Warbler nests in Eastern Europe, on large wet meadows with a vegetation of a height of about 50 cm, made up of club-rushes, sedges, rushes, sometimes of sparse reeds and lowly flooded by 5 to 20 cm of water, like here in the Servech Marsh in Belarus.**



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**[2] In the winter, in the Djoudj National Park in Senegal, the habitat frequented by the Aquatic Warbler, as on its breeding sites, is made up of far-reaching and lowly flooded wet meadows.**

the high wet meadows, generally located at the periphery of the marsh [3] and [4]. From 2001 to 2005, a study on the diet of the Aquatic Warbler confirmed this selection of the habitat, because these peripheral wet meadows are providing it with large insects, its favourite prey which are not present in pure reed beds (Kerbiriou & Bargain, 2005). Whereas the reed beds have a resting function, the wet meadows will have a foraging function. Thanks to the presence of these two habitats, the marsh meets the vital needs of the species during its migration [5]. As for the central water body, it may make it possible for it to detect the wetlands at night thanks to its mirror effect seen from above.



**[3] et [4] The red dots correspond to the contact points obtained by radiotracking in 2002. Marked on a map of the vegetation, they show that, after their capture in the reed beds encircling the free-running water areas, the Aquatic Warblers move to the periphery of the marsh, where there are still some high wet meadows. They will stay there for the duration of their stay, that is to say 3 or 4 days (according to Bargain, 2002).**



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**[5] While migrating, the Aquatic Warbler will look for habitats similar to its breeding and wintering sites, like here, the Trunvel Marsh in the Bay of Audierne.**



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**[6] The Aquatic Warbler can forage on the edge of small and very open pools. An individual has been captured on this one in the Goulven Marsh; North Finistère in August 2008. But the existence of a nearby reed bed remains a sine qua none condition for it to rest.**

## The problematic of staging areas management

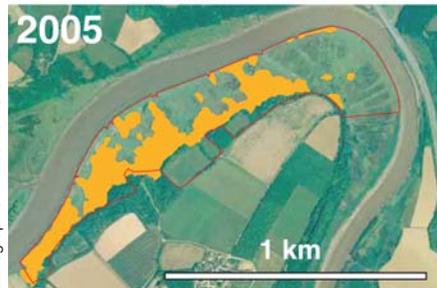
The problematic of staging areas management is then to know how to go from a homogenous, mono specific and closed reed bed to a more or less open wet meadow with high, heterogeneous vegetation [6].

## Managing vegetation: methods to be reinvented

The managing methods experimented within the framework of the Life programme from 2005 to 2008 were inspired by the traditional agricultural practices which used to maintain, without knowing it, habitats favourable to the species. These practices consisted in hay-making in the summer when the decrease in the water levels would make it possible for people to penetrate those wet environments. They consisted in manual work with a scythe carried out collectively. Their abandonment resulted in a fast and important development of the reed beds, then of the willows, to the detriment of wet meadows [7]. One also has to imagine that this summer mowing was not uniformly done. Inside a common exploitation frame, there were probably as many meadow management modes as there were plots, owners and expressed needs. And those were numerous [8]. Thus, it is likely that there existed, between the plots that were mowed yearly with low or clear-cut vegetation and the durably abandoned plots (both unfavourable to Aquatic Warblers), other plots mowed more or less irregularly and more or less well-mowed, thus having a high and heterogeneous vegetation fully favourable to the diet of the Aquatic Warbler.

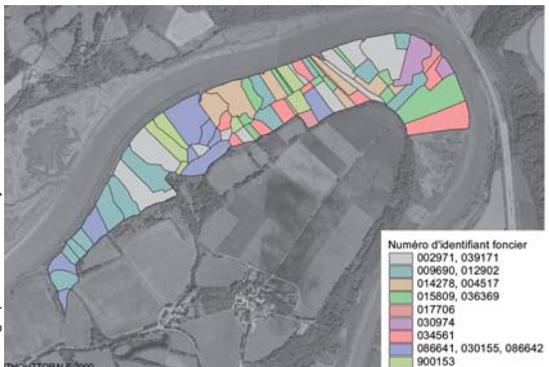
Today's experimental management consists in drawing from these traditional mowing practices to recreate, with adapted mechanical tools, the habitat mosaic which then existed—from the open meadow to the reed bed. Thus, three principles have been adopted to carry out experimental mowings:

**[8] The land parcel map of the Rosconnec Marsh illustrates the diversity of meadow vegetation structures that were to be found in these marshes when they were still being exploited.**



cartographie Arnaud Le Nevé / BV

**[7] The expansion of the reeds in an estuarine environment (rich in nutrients) in the Rosconnec Marsh (Dinéault, Finistère) following the abandonment of summer mowing practices.**



cartographie Gaëtan Guyot / BV



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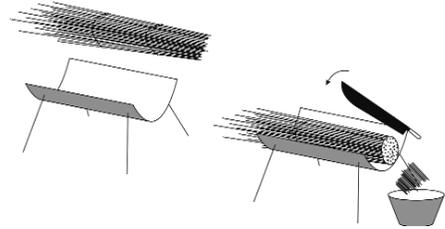
**[9] In 2005, the first bales of manually cut and packaged reeds made it possible to rapidly recreate an economic opportunity for the valorisation of reeds.**

- a summer mowing, preferably in August and September so that it will be compatible with the breeding of reed bed and wet meadow birds;
- an exportation of the mowed products to encourage the germination of a greater diversity of floristic species and to avoid the accumulation of organic matter;
- a pluri-annual rotation per plot.

### **It's easy to mow, but difficult to export!**

The reed beds are among the most productive ecosystems on earth in terms of organic matter, equivalent to the equatorial forests, for instance. 1 ha of reeds produces 4 to 10 tons of dry aerial biomass a year (Sinnassamy & Mauchamp, 2001). Thus, what is most difficult is not the mowing, even if it requires an effort and material adapted to the wetlands, but to export and then store the matter. Indeed, what to make of these reed bales when there is no local need for it, nor any existing sectors for that type of product?

In 2005, the first solution came from the « Centre d'Aide par le Travail » (Sheltered Work Centre) of Plonéour-Lanvern, near Trunvel in the Bay of Audierne, which agreed to collect the hand-mowed reed bales [9] to experiment mulching for gardens. The fabrication principle for this mulching is simple. The reed bales are placed in a gutter which makes it possible to trim them in chunks of about twelve centimetre lengths which are then put in bags [10]. A couple of mulching bags have been given to the parks service of the town of Quimper which was interested in



Drawing Arnaud Le Névé

**[10] Traditional fabrication principle for mulching made out of reeds.**

observing the qualities of this mulching and its evolution in time.

After a year of experimentation and observation, the result is positive. In addition to the absence of herbicides, common to all mulching, the reeds assure a good protection of the ground against drying out in the summer and against the cold in the winter. Contrary to the bark of acid conifers, their pH is neutral, their grip is better than mulch made out of bark or branches as they do not slide down on sloping ground. It is true that the raw material being subsidised, has not cost anything, but the result is encouraging for the future [11].

From 2007 onwards, the investments made within the framework of the Life project made it possible to mow thanks to the acquisition of adapted agricultural material [12]. The cut, withered and



© Ville de Quimper

**[11] The mulching made out of reeds used by the parks service of Quimper proved to be the most efficient and the most profitable of the 4 mulchings used by the town.**

windrowed reeds were then exported by a self-propelled loader unit and stored in bulk [13].

On the Trunvel site, the 6 ha of reeds, mowed in a rather oligotrophic sandy environment, produced 600 m<sup>3</sup> of dry matter, among which 300 m<sup>3</sup> of pure reeds where given to the town of Quimper [14] and 300 m<sup>3</sup> of combined reeds-hay were collected by a local farmer to make some compost. With the former 300 m<sup>3</sup>, the Quimper parks service spread a 10 cm thick layer of ground reeds on 1,500 m<sup>2</sup> of floor beds.

On the Rosconnec site, in 2006, the mowing was subcontracted to an agricultural entrepreneur. In this rather eutrophic estuarine environment with clay soil, 4 ha of pure reed beds had to be rejuvenated as well as 14 ha of dense subhalophilous meadows with creeping bent grass *Agrostis stolonifera* and red fescue, *Festuca rubra*, which had been abandoned for almost 20 years. These 18 ha produced 200 round bales collected by the « organic » farmers of the municipality of Dinéault [15]. They then used it as hay for domestic animals litter [16].



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## Towards an alliance between nature conservation and economy ?

The existence of economic agricultural sectors making it possible to sell off the product of the Aquatic Warbler's staging areas management, should not let us forget that the primary goal of this management is nature conservation.

Thus, the manager must keep in mind that the economic valorisation is only a means and must not be an end in itself. The primary assessment of the management must be a naturalist assessment before it can be an economic assessment.

Nevertheless, the Aquatic Warbler conservation depends on an annual intervention on its habitats, and that on the whole network of marshes punctuating its migration route. For it to last and be done on the scale of a territory as large as France or as its migration route, this management must find funds that go beyond subsidies, which can only be local and occasional. Because of the stakes regarding the funding of the management in space and time, resorting to various economic sectors may be the solution.

**[12] Withering of the reeds by a light 70 HP tractor equipped with broad wheels, after their being mowed by a cutter bar and before their windrowing.**  
**[13] Gathering and exportation of the reeds by a self-propelled loader unit .**  
**[14] Loading of 300 m<sup>3</sup> reeds by a farmer subcontracting for their transportation to Quimper.**

But the fact that the conservation funding depends on the existence of economic needs underlies a second problematic, namely, the variability of the offer. Indeed, because the sites are not being managed



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**[15] On the Rosconnec site, next to the coastal Aulne river, the mowing and exportation of hay and reeds takes into account, more than anywhere else, the natural environment's constraints, and must be done before the August spring tides which flood the subhalophilous meadows and could « spoil the harvest ».**

in a production perspective, the products resulting from this management will vary depending on the habitats obtained. Thus, the Trunvel reed beds mowed in 2007 evolved, within scarcely a year, towards an

optimum habitat for the species [17]. Therefore, almost no mowing has been undertaken on this site in 2008, thus depriving the parks of Quimper of the raw material they had benefited from in 2007.



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**[16] Two years later, there are only 7 bales left.**

The rapidity of the achievement in Trunvel could be explained by the oligotrophic nature of the ground. In environments more rich in nitrogen, of estuarine type, we can estimate that two or three years of summer mowing on the same reed plot will be necessary to get a heterogeneous herbaceous vegetation which can then not be valorised through mulching anymore.

The manager of a dynamic natural environment like a reed bed must have several solutions at hand to valorise the various stages of vegetation he obtained, from the wet meadow for hay-making to the pure reed bed, and with a mix in-between. At this level, the Life programme showed that at least four types of valorisation were possible:

- mulching,
- litter,
- compost,
- hay for fodder (in theory only).



[17] *Optimum habitat obtained in Trunvel, barely a year after the mowing of the reed bed.*

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## Conclusion

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This Life programme ends in April 2009, but the alliance between nature conservation and the local economy is not yet complete as the mowing products exported have been subsidised and therefore did not cost anything to their users.

For Bretagne Vivante, the final stage will consist in assessing the cost of this management and to try to offer competitive prices in order to have a chance to pursue the experimental work after the Life project comes to an end.

For the association, the future of this management might also depend on the integration of a new vocabulary into its associative strategy, associating the words

« economy, production, markets » with the words « conservation and nature »?

In a world where all ecosystems are threatened, even the most common fallow lands or agricultural plots, the evolution of the associative strategy could make it possible to intervene not only on a network of reserves, but on larger territories, to spread awareness and to give advice to more numerous and more diversified actors, just like nature protection associations across the Channel or in the countries of Northern Europe do. ■

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# ▶ Reed management and economic valorisation in the Seine estuary

Christophe AULERT, Christelle DUTILLEUL  
& Jérôme DUMONT



The Seine Estuary National Nature Reserve, created in 1998, stretches on 8,528 ha, located on both sides of the Seine mouth [1]. It is made up of 4 interdependent ecological compartments, characteristic of an estuary (marine, coastal, brackish and freshwater). At first sight, the reading of the vegetal landscape seems simple: 200 ha of salt meadows, wet meadows and more or less salty pools along a West-East gradient and 1,000 ha of reed beds.

In 1999, the management of the reserve, which encompasses 2 regions (Upper and Lower Normandy) and 3 « départements » (Seine-Maritime, Eure and Calvados), was entrusted to the association « La Maison de l'Estuaire » (The House of the Estuary). It is also characterised by a multiplicity of human activities: maritime industrial activity at the periphery, professional fishing, reed exploitation, agriculture, tourism, activities of full nature, naturalist activities, etc. The first management plan, elaborated in concert with these various actors, and validated in July 2001, is still operating. It has been assessed in 2006 and the validation of a new management plan is currently in progress.

Among the estuarian habitats of the reserve, the reed bed makes up an exceptional environment for the palustrine avifauna and for the flora it holds. It is one of the largest contiguous bed at the national level. Through the implementation of the first management plan and of a Life programme on the Bittern (*Botaurus stellaris*) (2001-2006), management measures have been set up for this reed bed in order to organise at best the activities while respecting its biodiversity. In parallel to these management measures, research on the economic valorisation of reeds unsuitable for



[1] Location of the Seine Estuary National Nature Reserve.

thatched roof construction, has been launched in order to reduce management costs which are often prohibitive.

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## An outstanding estuarian context

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Listed for its exceptional natural fauna (its birds, in particular) and flora patrimony, three-quarters of the reserve are under the influence of the tide which conditions a great diversity of environments [2]. Among the latter, the reed beds are most particularly interesting.

Just as for all the environments found in the estuary, the facies and evolution of the reed beds depend both on mesological conditions (water salinity, time spent under water, swell, current) and on management modes (annual mowing, grazing, non-intervention). The diversity of these factors implies a multiplicity of reed bed types and associated habitats:

- the subhalophilous water-fringe medium-tall waterside communities with sea club-rush,
- the subhalophilous reed bed with reed and sea aster,
- the pool edges water-fringe medium-tall waterside communities with flowering rush,
- the « inland » freshwater reed bed,
- the vegetation of the coastal subhalophilous meadows with grounds ranging from waterlogged to liable to flooding, where the reed is less competitive because of intensive management and thus gives way to meadow species.
- The eutrophic estuarian tall herbs on mineral sediment. Without management, (mineral and organic) sedimentation continues and the salinity and time spent under water at high tide both decrease; tall herbs then appear.

In these reed and tall herb beds, we find outstanding vegetal species like the sea aster, the garden angelica, the hemlock water-wort or the marsh-mallow.

The goals regarding the management of these reed beds are multiple. They are divided into 5 main axes:

- preserve the different vegetation at various dynamic stages,
- maintain their liability to flooding,



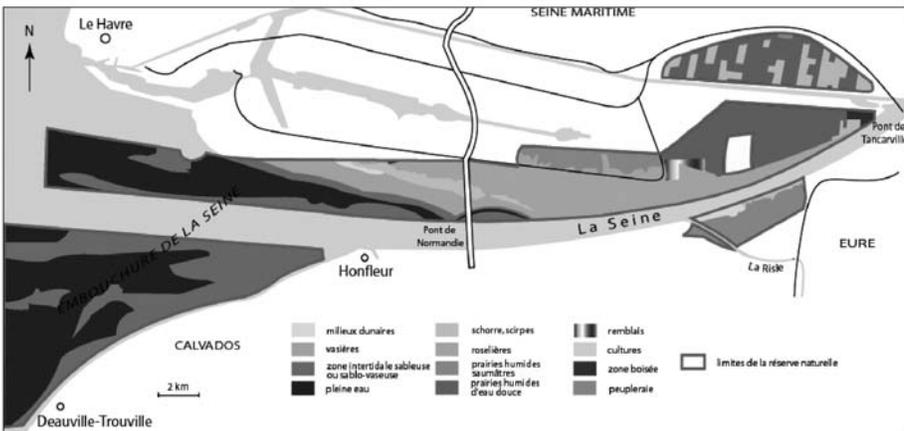
**A subhalophilous water-fringe medium-tall waterside communities with sea club-rush.**

- master the reed beds' progression in certain areas in order to protect the subhalophilous meadows,
- experiment various management modes,
- adapt and make the annual mowing practice by reed cutters durable.

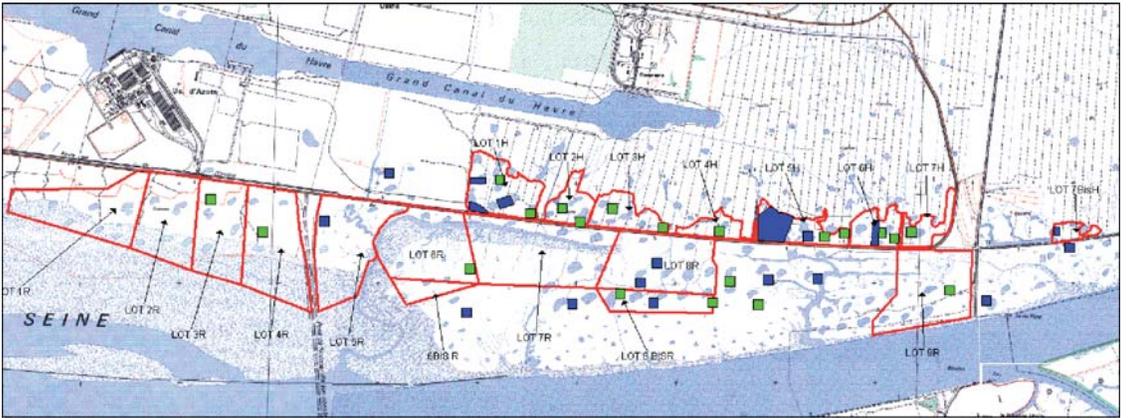
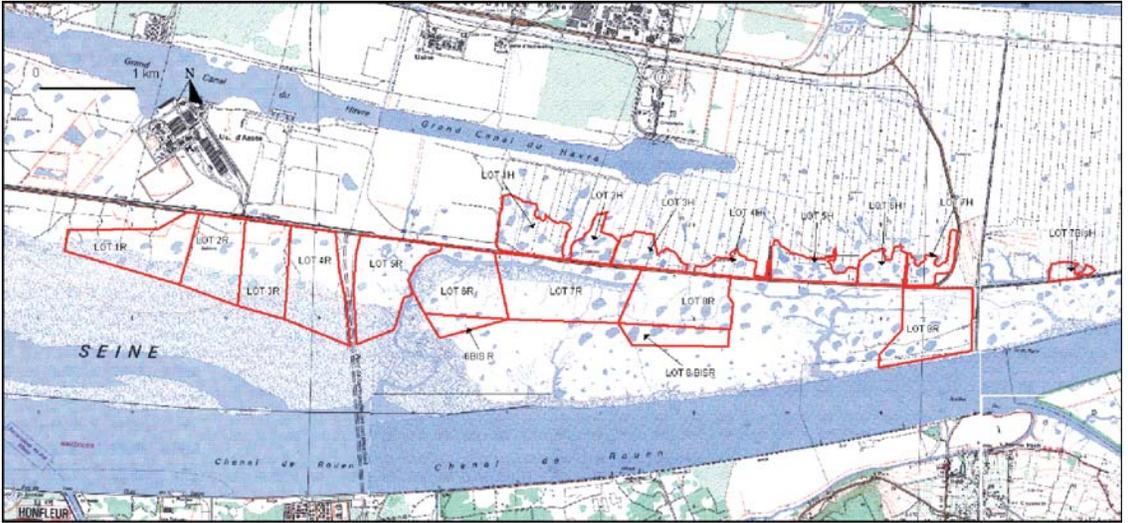
## Management Modes Diversity

### The wet reed bed annual maintenance carried out by reed cutters from Normandy

This reed bed management makes it possible to maintain its liability to flooding by fighting alluviation, which accelerated in the last years because of numerous embankment works and maritime industrial constructions.



**[2] The large habitats that are to be found in the Seine Estuary Nature Reserve.**



**[3] Above: Allotment of the reed plots in the Seine Estuary National Nature Reserve (2001-2008 management plan).**

**[4] Below: Example of the marking of the patches to be left standing during a mowing season (in blue, the fixed patches, in green the moving patches).**

About 700 ha of reed beds are divided into 19 plots of various sizes [3] to organise the reed cut on the territories of the autonomous ports of Rouen and Le Havre. These plots are parcelled out among 6 reed cutters.

In the first management plan for the nature reserve, the specifications for the annual exploitation of the reeds proposed 3 main measures:

- Reed harvest from the 15<sup>th</sup> of November until the 15<sup>th</sup> of March. In fact, the cutters do not intervene before the first frosts during the month of January
- Removal of the products of the mowing without quality preference in order to limit alluviation.
- Reeds left standing:

- 20% of the area of each plot on the territory of the autonomous port of Rouen (plots located in the South on map [3]) in moving strips (which are established every year).

- 10% of the area of the reed bed in fixed strips (for the duration of the management plan) and 10 % of the area of each plot on the territory of the autonomous port of Le Havre (plots located in the North on map [3]) in moving strips (which are established every year).

The moving strips are chosen either according to the singing or nesting sites of the Bittern the preceding season, either according to the presence of patrimonial fauna or flora species. These isolated patches have a minimum size of 1 ha. For

reed plots without isolated patch, the reed cutter leaves the same proportions of reeds standing, but with no obligation regarding their location. Before each mowing season, the patches are marked by bamboo poles directly on the plot. A cross-visit with the reed cutters and the reserve manager is also organised.

In order to make sure that these specifications are observed, an aerial fly-over coupled with aerial photographs (digitalised afterwards on GIS) is carried out each year in May. On this cartography, one can identify the mowed areas as well as the patches or strips left standing. The Bittern's singing or nesting locations are then marked on the map in order to check if these patches are left untouched. Later, an assessment meeting with the manager, reed cutters, port officials and the Upper Normandy DIREN is organised.

After 8 years of implementation of these specifications, one has to admit that they are more and more overlooked, because of a lack of sanctions taken against their violators. Their non-compliance is characterised by several deeds:

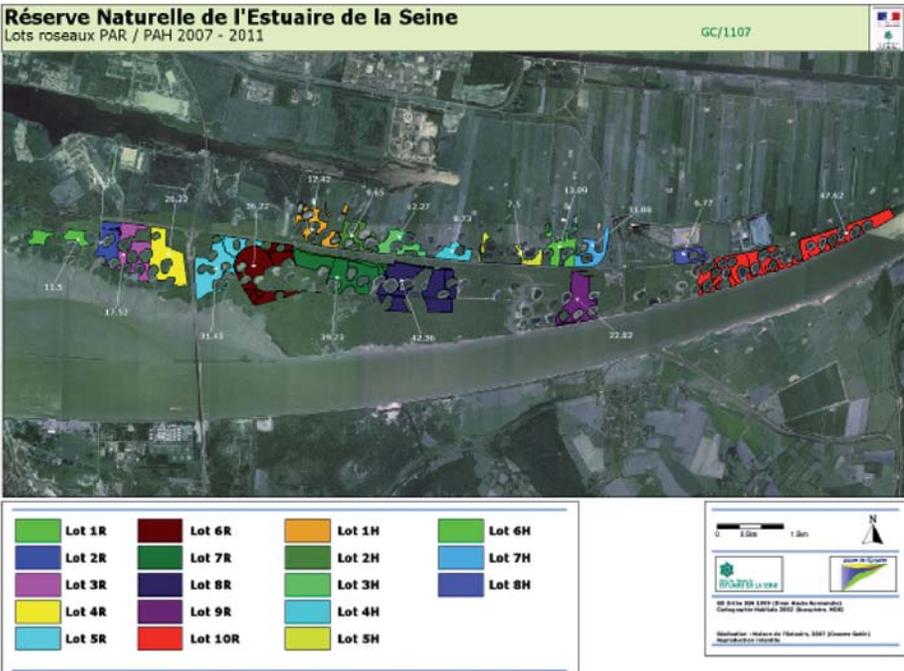
- mowing the patches that were to be left standing,
- patches of too little size,
- patches being moved,

- mowing outside the allotted areas,
- and secondarily, overrunning the mowing dates.

In view of this situation and thanks to a better knowledge of the Bittern's biology via the studies set up within the framework of the Life programme, the coming specifications plan to modify the allotment [5]. Circa 450 ha of reed beds will then be allotted (instead of 700 ha). These areas correspond to the reed bed sectors and the Bitterns' usual nesting sites have been left out of the plots. Thus, the commercial reed plots may be clear-cut every year. In compensation, older reed beds, favourable to the settlement of the Bittern once they reach the age of 3 to 5 (Provost, 2007), will be preserved. However, to avoid their senescence, a periodical management consisting in a cut followed by the exportation of the products of the mowing is necessary. In order to limit the management costs and to use this large volume of biomass unsuitable for thatched roof construction, a search for possible valorisation sectors has been launched.

**The other reed beds management modes set up in the nature reserve**

Other management modes affecting the conservation status of the reed beds have



[5] The new allotment proposed in the coming Seine Estuary National Nature Reserve management plan.

been changed. The hunting pools management is regulated by specifications. Regarding reed beds, these specifications make provision for:

- the interdiction to enlarge the pools so as not to alter the area covered by reeds and to avoid land-use conflicts with reed cutters;
- the limitation of the reed cutting on a 30 m strip around the pool (for the same reasons that have been mentioned above);
- the interdiction to use plant protection products to treat the vegetation;
- the set-up of an authorisation procedure regarding works;
- the set-up of operation dates.

Specifications regarding water management have also been implemented, water levels and flood periods being defined according to the various hydraulic sectors of the reserve. Ditches and sluice clearing and maintenance works are carried out at the end of the summer.

Since 1991, an extended grazing by geldings from the Camargue is carried out in reed beds located on the Seine shores in order to open the environment and to create a mosaic of habitats as shown on the picture. This type of management might be favourable to the alimentation of the Aquatic Warbler (*Accrocephalus paludicola*) during its post-nuptial stop-over. Our results, for the time being, do not allow us to assert it.

In March 2002, the turf-stripping on a reed bed in the process of alluviation has been experimented on an area of about 1 ha. This operation has been carried out in cooperation with the SIAAP (Inter-departmental Syndicate of Sewerage and Waste Treatment for Greater Paris). These reeds were meant to be used for the creation of an experimental lagooning plant.



[6] Geldings from the Camargue grazing in the Seine Estuary (MDE).

Lastly, 6 to 14 ha of non-allotted reed beds are mowed each year under the aegis of the manager. The sector is divided into rotational areas mowed every 5 years (5-year mowing). These mowings have been carried out at times by farmers (in exchange for the matter which they use as litter), at times by reed cutters (provision of a service) or at times under local government control.

This management mode, which is without doubt the most adapted to the nesting palustrine avifauna, meets feasibility problems:

- high costs: 1,000 to 1,300 €/mowed ha with removal of the biomass;
- available, but unvalorised biomass.

Again, the search for alternative valorisation modes in order to reduce management costs and valorise a natural matter unsuitable for thatched roof construction is essential to allow for these operations to last in time.

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## Reed valorisation

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Regarding this subject, the reed uses are particularly diversified. Some of them retained the attention of the manager: sugars, alcohol, starch, glycerine, resins of synthesis, furfural, cardboard, paper, combustible, fertiliser, fire briquettes, textile material, fabric, viscose, synthetic fibres, cellophane, pressed sheets, mats, carpets, folding screens, doormats, mulch, compost, garden stakes, walls, roofs, boats [8].

- **Agricultural sector:** litter, mulching for animals, combination with liquid manure. The reed does not seem to be a good material given its poor absorbing power. The sector has been abandoned.

- **Horticultural sector:** composted green waste (mould), mulching for vegetable gardens and hedges. In order to meet the requirements pertaining to this use of reeds, contaminant analyses have been performed on the aerial part of the *Phragmites australis*. The reed does not appear to store any contaminant and can thus be used as compost or mulching. The sector remains to be developed.

- **Building sector:** thatched roofs, to use in building or insulating materials (cob). For thatched roofing, it is essential that the reed be young (of the year), thin,



[7] Location of the sites maintained by a five-year mowing during the 2001-2005 period.

straight and of homogenous quality. Thus, the reeds from the five-year mowing cannot be used to this end. On the other hand, it is possible to use them in cob or as insulating material.

- **Water purification sector:** vegetal filter for the treatment of sewage. As seen earlier, an experimentation in cooperation with the SIAAP has been carried out in 2002, without feedback. Certain purification plants use reeds in « natural » lagooning systems. This is the case for the purification plant of the municipality of Honfleur which imported reeds from the Netherlands.

However, this sector is interested in the reeds' rhizomes and not in the dry vegetal matter.

- **Food sector:** animal or human food, distillation. The reed does not have a high digestibility for cattle. Regarding human food, in some countries, people eat its young sprouts. Distillation has been considered, but not tested.

- **the use of reed as green oil is subject to numerous fundamental and applied research.** The harvest and transport cost for 100 km is 0.15 €/ kg of reeds. One kilogram of gathered reeds corresponds to 0.5 l of fuel, that is to say 0.17 €. The profit of the operation represents 0.01 €/kg. For 1 ha of reed bed, the net product is then 0.01 €10 tons = 100 €. There is a problem regarding the high concentration in silica of the reed which fills the boilers' burners.

- **Biomaterials sector:** this sector has been tested by the ESITPA. The roughly ground reeds increase the resistance of the biomaterial, but decrease its elongation capacity and cause weakness points within the strip. Thinly ground reeds make the material less resistant, increase its elongation capacity, homogenise the test strip and reinforce its cohesion. On the whole, the reeds increase the biomaterial's resistance.

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## Conclusion

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The multitude of management modes is favourable to the habitats and landscapes diversity of the reserve. Their complementarity is also favourable to many animal species, among which the Aquatic Warbler in post-nuptial migration.



[8] The communal reed broom in Asia.



However, the management of these areas is often very expensive and making it durable requires search for innovating and sustainable valorisations for the mowing products coupled with an economic assessment of the various sectors. From the start, two substantial problems limit our field of action:

- the difficulty in setting up a new sector;
- the difficulty in providing the raw matter in sufficient and regular quantity in order to make sectors like wood energy or biomaterials durable.

Making the management of fragile natural environments like reed beds durable requires, in addition, an improvement of the current management practices and techniques. ■

#### **Acknowledgement**

We wish to thank all our partners, who made it possible for us to set up this experimentation: the French Ministry for Ecology and Sustainable Development, the autonomous port of Le Havre, the ADEME, the ESITPA and Life.

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# The Aquatic Warbler Life project in Poland and Germany

Lars LACHMANN



**T**he Aquatic Warbler is the rarest, and the only globally threatened passerine bird found in mainland Europe, with a very small world population of only 10,200-14,200 pairs. Once widespread and numerous on fen mires and wet meadow, this habitat specialist has disappeared from most of its former key range in northern Germany and Poland due to habitat loss and degradation. With its habitats nowadays dependant on human land use, and being extremely susceptible to changes in traditional land use, it is now effectively a conservation dependent species with an acutely threatened and genetically distinct population along the German-Polish border (Pomerania) and a larger one in north-eastern Poland (Biebrza region). Most range states including Poland and Germany have signed an international MoU on the species under the Bonn Convention for Migratory Species (CMS) in 2003, committing themselves to the implementation of an International Action Plan for this flagship species of its habitat.

Since 2005, OTOP-BirdLife Poland is coordinating the implementing of the European Union Life funded project « Conserving Aquatic Warblers in Poland and Germany », which is contributing to the implementation of the MoU, targeting the breeding sites of 81% of the remaining Polish and German populations in the two named regions (c. 2,800 pairs), equalling 76% of the European Union population.

The project with a budget of 5 m € and a duration of five years aims to stabilise the population of Aquatic Warblers in key areas of its range in Poland and Germany, by simultaneously improving and increasing the habitat at the main European Union stronghold of the species (Biebrza) and preventing the extinction of the distinct remnant population in Pomerania.

An international partnership of four NGOs and two protected area administrations from three European Union member states are implementing the project in nine project sites covering 42,000 ha, with key activities focusing on active habitat management, experimental management, management plans, bird and habitat monitoring, as well as on the development of sustainable and cost effective solutions for ongoing habitat management.

Key successes of the project to date are the introduction of an attractive agri-environmental programme specifically targeted at the Aquatic Warbler in Poland, large-scale habitat management in the Biebrza Valley thanks to the introduction of suitable new machinery and the development of concepts for the use of biomass derived from management activities. 500 ha have been purchased to date for Aquatic Warbler conservation. The project receives major co-funding from the RSPB (BirdLife in the UK), Swarovski Optics and Cemex Polska. ■

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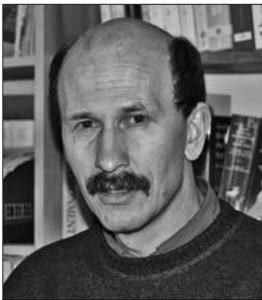
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# Biomass, business and the conservation of Aquatic Warbler in Poland

Jaroslaw KROGULEC



ronment programmes, large areas of high-nature-value grasslands are currently managed for nature conservation. The condition is to remove the biomass cut from the sites in order to prevent the accumulation of nutrients and the creation of a layer of dead biomass. However, agricultural demand for this type of rather low-quality biomass is much lower than the offer, so that the success of the conservation measures is seriously threatened in large areas.

**S**ince European Union accession, with the associated change in agricultural market conditions and practices and the introduction of agri-envi-

Therefore we decided to develop Life+ project and test solutions for the sustainable use of biomass derived from the management of Aquatic Warbler habitats in eastern Poland



© A. Le Névé

***Problematic of the management for Aquatic Warbler breeding habitats in Poland is similar of these met in migration stop over sites in Brittany: what to do with the huge quantities of mown vegetation?***



### ***Sunrise on Biebrza Marshes.***

This project is aiming to test and set-up a best-practice example for an alternative use for the biomass created: The biomass is to be used as sustainable source of fuel in a local large power plant of Cemex Polska in Chelm (SE Poland)

All project sites are Natura 2000 sites, qualifying for support from Life+ Nature. Apart from the Bug Valley, they are all key sites for the Aquatic Warbler in eastern Poland. Together they hold 96% of the Polish population of the Aquatic Warbler.

- Chelm Marshes SPA
- Biebrza Marshes SPA, including the National Park and the NP buffer zone.
- Middle Bug River Valley: This site is very close to Chelm (c. 30 km), but does not have Aquatic Warblers, but does have other priority species, e.g. corncrake. The rationale behind including this site is that it could provide additional

biomass for the Chelm plant.

- Narew NP
- Poleski NP: This site will also serve as an additional provider of biomass for the Chelm plant.

In a first stage of the project, various types of biomass from different vegetation types and sites and prepared in different forms (wet, dried, shredded, pelleted, bailed) will be tested for its suitability as fuel in the power plant (calorific value, emissions produced, best mixing ration to traditional fuel, maximum capacity for use of biomass, economic aspects, maximum economic distance for transport of biomass for each of its different forms, economic viability for the organization running the power plant).

Here, Otop would make sure that the biomass is sourced from areas, where it

serves conservation purposes, organizes the supply and monitors its effect on nature conservation.

Cemex would lead on the technical testing and economic calculations. It will be crucial for Cemex to calculate the real costs of the testing (e.g., does the burning facility have to be stopped in order to test the biomass burning).

In a second stage, after the most advantageous form of biomass processing has been identified, the best-practice example is (rolled) carried out over a larger area. This may involve the

employment of a mobile pelleting machine etc.).

In a third stage, the feasibility of copying the system to other sites and companies in Poland is researched, and the results publicized.

During the duration of the project, several smaller and one final big conference will be held to discuss the topic with experts and other practitioners. ■

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# Records of Aquatic Warbler in Latvia

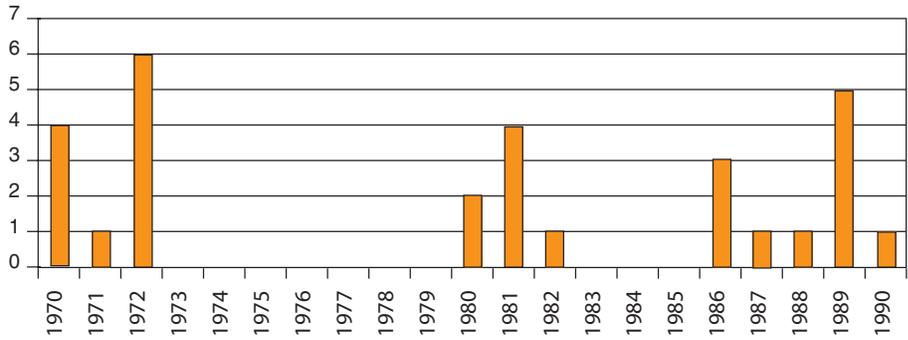
Oskars KEISS



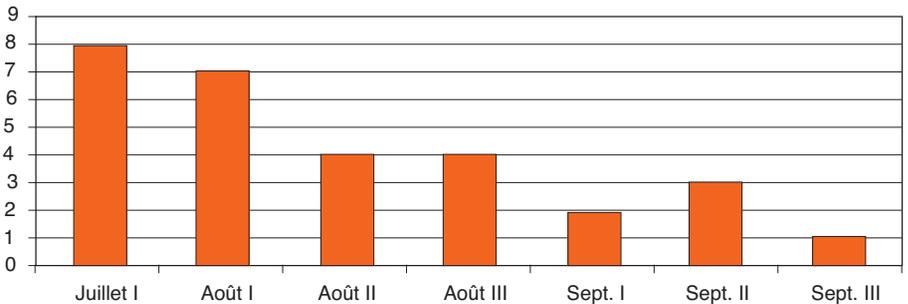
**T**here are 41 confirmed records since 1940 – 29 captures at Lake Pape, 3 captures at Lake Liepaja (Lipsbergs, 1971, 2000) 7 observations at Lake Pape and Liepaja (Celmins *et al.*, 1993; Celmins, 2003), 1 observation at the coast near Lake Engure in 2005, but only one proof of breeding in 1940 at Lake Babite (Roms, 1942), the male is collected on July 21, 1940 and is in the collection of the Latvian Museum of Natural

History (Collection Nr.: LDM Z 11/1300). J. Viksne (1994) is mentioning also Sarnate/Uzava Bog as a breeding site for the species, however, there are no actual observations in Sarnate Bog or Uzava marshes, although habitat in Uzava marshes might have been suitable for Aquatic Warbler before the large scale drainage in the middle of 19<sup>th</sup> century (Strazds, 1997). Collections of Zoological Museum of University of Latvia contained two clutches of this species, collected at Bīrzaune (Madona district, Eastern part of Latvia) in 1919, and near Riga in 1923 (Baumanis, 1983), however the first clutch (1919) could not be found any more in 2000 and the identification of the species for the second clutch (1923) could not be confirmed (K. Schulze-Hafen, *pers. comm.*). Special searches for breeding populations of the species in 1997 at the ten most promising sites in the whole country remained unsuccessful (O. Keiss,





[1] Number of Aquatic Warblers (n=29), captured with mist-nets at Lake Pape (21°02'E; 56°09'N). The trapping was done without attracting of birds by playback.



[2] Seasonal distribution of Aquatic Warblers (n=29), captured with mist-nets at Lake Pape (21°02'E; 56°09'N). The trapping was done without attracting of birds by playback.

unpublished report), despite some suitable habitat areas being found. However, in 2000 and the following years (2001 and 2002) 1–3 singing males were observed at Lake Liepaja (Celmins, 2003). In 2003 the site was not occupied, but one male was observed again in 2004, the following years up to 2008 the site was not occupied. This only Latvian site is heavily threatened by overgrowing by reeds and willow-bushes, as well as unfavourable hydrological regime – it is becoming too dry. Thus the breeding occurrence of Aquatic Warbler in Latvia is sporadic and the population is very small (0–3 males).

Stopover at Lake Pape and Lake Liepaja might be more common – up to 6 males are captured per year in mistnets at Lake

Pape without playback [1]. Most of the birds have been captured at the third decade of July [2], but migration continues until the end of September – the latest individual is captured on September 26, 1970 (Lipsbergs, 1971). On passage the species might move from Belorussian breeding grounds West to the Baltic Sea coast and then follow the coastline – the only record (capture) in Estonia in 1992 (Leibak *et al.*, 1994), seems to follow this pattern. ■

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## Workshop C

### **Conservation of the species: which policies, projects and points of view?**

- ▶ **The measures for the conservation of Aquatic Warbler in the Djoudj Birds National Park, Senegal.**

Ibrahima DIOP

- ▶ **The CMS Aquatic Warbler MoU and the International Species Action Plan**

Lars LACHMANN

- ▶ **National action plans for wild fauna**

Sabine MORAUD

- ▶ **New Aquatic Warbler Group and theme in France**

Pascal PROVOST & Franck LATRAUBE



# The measures for the conservation of Aquatic Warbler in the Djoudj Birds National Park, Senegal

Ibrahima DIOP



**T**he Djoudj National Park is located over 60 km north of Saint-Louis, on one of the meanders of the Senegal river, in the Northwest of the country, near the border with Mauritania. This wetland is a former natural branch of the river and is one of the ten protected areas of the country's Directorate of National Parks and the third site for birds conservation in the world. The Park is registered on the UNESCO list of World Heritage Sites since 1981 and is a biosphere reserve since 2005! It stretches over 16,000 ha. Its geographical position, at the edge of the desert, makes it one of the first sanctua-

ries for migrating birds after they cross the Sahara.

Its water management is based on a system of hydraulic structures (the Djoudj structures, the Crocodile, Gorom and Ndeupelou canals) which allows for the flooding of the park by the Senegal river. The setting up of water level monitoring tools (water level indicators) is urgent.

In the winter, the aquatic warbler occupies the far-reaching wet meadows with low herbaceous vegetation making up a very open landscape. This environment, which is lowly flooded from November to March, is managed by the Park employees and by local people by means of traditional agricultural activities.

Aware of the threats the aquatic warbler faces (nesting areas and wintering quarters), the Senegalese authorities, through the State minister in charge of environment, entrusted the monitoring of the species conservation after the signature of the Memorandum to the officers in charge of the National Parks management.



*Local human populations help to manage habitats thanks to their traditional activities.*



*When they are dry enough, wet meadows are used by grazing cattle.*



**In June and July, before the raining season, Park employees burn meadows where typhas and tamari have increased.**



**In June 2008, hydraulic works (canal management) have been done to improve the water flow into the park.**

For that purpose, and following several studies, we proposed several actions in order to achieve that goal which have been carried out on the field:

• **Dredging of pools and backwaters**

Thanks to the financial support received from the WEF through the COMPACT programme, the backwaters of Tiégel, Crocodile and Khoyoye have been dredged by heavy machinery to facilitate the water flow and the proper flooding of the Débi and Tiguet areas which are archetypal Aquatic Warbler areas. Thus, many individuals of the species have been captured and ringed at Tiguet. Indeed, this area is naturally grazed by cattle, which contributes to the maintaining of better habitat conditions for the species.

• **Early burnings**

Within the framework of the maintaining of better habitat conditions for the species, early burnings have been carried out in the areas of the Grand Lac, of the lac Lamantin and of Khar. The dry herbaceous vegetation, accumulated over several years, thus made way for a nice vegetation, about 50 cm high, interspersed with water bodies favourable to the Aquatic Warbler.

• **Firewood and *Tamarix senegalensis* cutting**

To further achieve a good water supply in the Warbler areas, the guards of the Djoudj carried out tree- and bush-cutting

operations in order to open up the water passage. This action will improve the water movement in order to maintain the habitats of the species.

All these actions will be repeated in 2009 in order to maintain the benefits. The cost of these works amounts to 12,000,000 CFA francs.

In addition to the management actions mentioned above, other tested initiatives were also fruitful: the maintenance of the hydraulic system, the burning of invasive plants (typhas, tamaris), the bovine extensive grazing, the mowing of typhas, reeds and sporobus for fence-, roof- and mat-making. All these make up a set of actions which contributed to the restoration of the habitat favourable to the Aquatic Warbler.

This habitats management must be carried on in order to protect, or even extend, the areas favourable to the Aquatic Warbler..■

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# ▶ The CMS Aquatic Warbler MoU and the International Species Action Plan

Lars LACHMANN



**T**he Aquatic Warbler is the rarest, and the only globally threatened passerine bird found in mainland Europe, with a very small world population of only 10,200-14,200 pairs. Once widespread and numerous on fen mires and wet meadow, this habitat specialist has disappeared from most of its former range due to habitat loss and degradation. It is estimated that the world population declined by 95% throughout the 20<sup>th</sup> century.

This is why this species is qualified as globally threatened in the category « vulnerable » on



***The AWCT expedition which discovered the first Aquatic Warbler wintering area in the Djoudj National Park in 2007, was undertaken in the frame of the International Memorandum of Understanding.***

the IUCN red list. This fast decline has been largely stopped since 1996, but the species remains in the same threat category due to its very small area of occupancy (the sum of the areas of all currently occupied breeding sites) of clearly under 1,500 km<sup>2</sup>.

The European Union had produced and accepted an International Species Action Plan for the Aquatic Warbler in 1996, but this plan covers only the European Union members states, including the new members states that joined the European Union in 2004. However, c. 75% of the world's breeding population of the species and 100% of the wintering population are located outside the European Union.

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## The Aquatic Warbler Memorandum of Understanding

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Therefore, BirdLife International led by their UK partner RSPB advocated for a separate international agreement for the conservation of the Aquatic Warbler that will cover all range states. The Bonn Convention for the Conservation of Migratory Species of Wild Animals (CMS) offered a suitable platform for this. Hence, on 30 April 2003, the « International Memorandum of Understanding concerning Conservation Measures for the Aquatic Warbler » (Aquatic Warbler MoU) was signed as a sub-agreement to the Bonn Convention during a meeting hosted by the Belarusian government in Minsk, making this the first and to date only international treaty for the conservation of a « little brown bird ».

Integral part of the memorandum is an international action plan for the species, detailing amongst other things priority actions for each country that is classified as range state. Due to the fast advancing knowledge

about the species, this 2003 action plan differs slightly from the earlier 1996 European Union action plan.

By 2008, the Aquatic Warbler MoU was signed by 12 out of the 15 officially identified range states of the species plus the CMS secretariat and BirdLife International as cooperating organisations. Three range states have not yet signed the MoU: France has now committed to do this soon and there are new initiatives in The Netherlands to join the MoU. Russia has not signed the MoU as it is not a party to the Bonn Convention.

Latest knowledge about the species wintering and migration sites suggests that in the future Mauritania, Morocco, Mali, Portugal, Switzerland and possibly also Gambia should become recognised as range states of the Aquatic Warbler.

The official coordination of this MoU is a duty of the CMS secretariat. However, an agreement has been met between CMS and BirdLife transferring the responsibility for everyday active support of the implementation of the MoU to BirdLife. To be able to provide this support, BirdLife employs an International Aquatic Warbler Conservation Officer based in the office of APB-BirdLife Belarus in Minsk. This position is partly funded by CMS and partly by external funds raised by BirdLife.

One of the tasks of this coordinator is the production of regular issues of the « Aquatic Warbler Flyway Newsletter », the maintenance of the website of the BirdLife International Aquatic Warbler Conservation Team (AWCT) ([www.aquaticwarbler.net](http://www.aquaticwarbler.net)), and the organisation of regular meetings of the signatory states, which coincide with the tri-annual reporting periods of the MoU. The first meeting of signatory states took place in June 2006 in Criewen/Germany and was preceded by a scientific workshop. The current suggestion for the second range state meeting is May 2010 at Biebrza /Poland.

While signing the MoU does not formally oblige the signatory states to comply with its recommendations, it is still a useful tool that raises the profile of the species and puts the Aquatic Warbler on the political agenda of

the signatory countries and provides a certain level of political obligation. It also facilitates funding from richer range states for actions in less affluent range states as it points out the conservation links between the countries and provides guidelines for international action.

The action plan that is attached to the MoU guides and informs national and international conservation action. This plan is the only action plan for this species that applies outside the European Union.

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## The International Aquatic Warbler Action Plan

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At present, two slightly different International Action Plans for the Aquatic Warbler exist: the European Union Action Plan from 1996 and the CMS Action Plan from 2003, which is an updated version of the former.

The European Union has recently contracted BirdLife International to prepare an updated version of the European Union Action Plan by the end of November 2008. BirdLife is using the occasion to also include all non-European Union range states into this updated action plan in order to prepare a plan that can be accepted as European Union Action Plan as well as during the next MoU meeting of signatory states as CMS Action Plan.

A draft version of this updated International Action Plan for the Aquatic Warbler has been prepared and is published for expert discussion on [www.birdlifeforums.org](http://www.birdlifeforums.org). The action part of this plan includes the recommendations made by experts during the meeting of the AWCT that preceded the Aquatic Warbler conference in Quimper/France in September 2008.

The final draft of the document will be prepared by the end of November 2008, after which it will be presented to the relevant European Union authorities for discussion and approval. ■

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# National action plans for wild fauna

Sabine MORAUD



**B**oth the French government and the European Union are strongly committed to the battle against biodiversity loss. Its transposition in the national, Community and international policies and agreements is growing.

This results in both regulatory and incentive plans pervading everyday more and more multiple aspects of human activities having an impact on natural areas and the species living in them.

Among the tools of this policy, we find the national restoration plans for species whose conservation status is not favourable. These tools are becoming essential in the policy of the French Ministry for Ecology and Sustainable Development (Ministère de l'Ecologie, de l'Energie, du Développement Durable et de l'Aménagement du Territoire – MEEDDAT), be it regarding the implementation of voluntary actions for the protection of endangered species or the consideration of these species in development and infrastructure projects requiring administrative authorisations.

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## What is a national restoration plan?

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The national restoration plans are in line with the « Action plans for the conservation of biodiversity » initiated by the ministry in charge of the environment in the beginning of the nineties in order to improve the

knowledge of wild fauna and flora. The national restoration plans, however, go beyond that goal and put forward a list of operational actions, organised into a hierarchy, to encourage the restoration of endangered species on the national and European territory. These operations are defined on the basis of the threats that these species face and complement the existing legislative and regulatory package relative to the protection of endangered species. The national restoration plans thus establish a real strategy to restore the species to a favourable conservation status.

The national restoration plans are non-binding documents. They are here to inform the concerned actors as well as the public and to facilitate the integration of the protection of species in human activities and public policies.

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## The strategic framework of the national restoration plans

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From the first plans set up at the end of the nineties to the last plans drafted in 2008, changes have been made in the national restoration plans in order to reinforce their role and their appropriation by the concerned actors.

These improvements are the result of various national discussions, especially in the national strategy for biodiversity, passed in November 2004, and in the « Grenelle de l'environnement » (a multi-party debate reuniting representatives of government and organisations), organised in 2007.

The assessment made at the elaboration of the national strategy for biodiversity thus considered the national restoration plans as « a lever which undeniably contributed to the rationalisation of the conservation actions developed for the

benefit of the species they apply to » and emphasised the necessity to renovate and reinforce that tool especially to encourage its appropriation by the actors and its integration in the pertaining territorial and sectoral policies (land management, urbanism, agriculture).

As for the « Grenelle de l'environnement », in its programme aiming to « bring the biodiversity loss to a halt », it asks for the implementation, within the next 5 years, of conservation and restoration plans for the 131 species living on the French territory which are considered in critical danger of extinction on the IUCN red list updated in 2007, giving thus a new dimension to the national restoration plans.

The national restoration plans are also in line with the Community and international strategies relative to the protection of biodiversity. Thus, they take into account the action plans that have been elaborated within the framework of international agreements, ratified by France, and will take into consideration, as soon as they will be implemented, the action plans for the species present in Europe which will be established on the initiative of the European Commission as early as 2009.

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## **The legal framework of the national restoration plans**

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At national level, the rules on the protection of fauna and flora endangered species, adopted pursuant to the Articles L.411-1 and L.411-2 of the Environment Code, aims at assuring the maintenance or the restoration to a favourable conservation status of these species. The package, established accordingly, consists in a series of interdictions of activities or operations which can affect these species.

However, the conservation status of certain species requires specific actions, voluntary ones included, to restore the populations and their habitats. The national restoration plans have been set up to meet that need and to thus complement the national regulations pertaining to the protection of biodiversity.

Concerning the strict protection of species, national regulations make provision for a system of derogations granted under terms fixed by 4° of the Article L.411-2 of the Environment Code. These derogations

are only granted provided that the authorised operations do not damage the conservation status of the concerned species and, therefore, sometimes require the setting up of accompanying measures. Within this framework, the national restoration plans can provide useful elements to assess the impact a project will have and, most of all, help define the actions to be set up in order to lessen and/or compensate that impact. These actions will then partake in the improvement of the conservation status of the concerned species.

At the same time, as a consequence of the outcome of the « Grenelle de l'environnement », the legal basis of the national restoration plans will be reinforced. One of the « Grenelle » law draft plans to insert an Article L. 411-7 relating to those in the Book IV of the Environment Code.

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## **The selection of the species which will benefit from a national plan of restoration**

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Before 2008, the selection of species which would benefit from a national restoration plan would take into account the importance of the threats they faced and the appropriateness of acting upon them. Following the outcome of the strategy for biodiversity and of the « Grenelle de l'environnement », the selection of the species which will benefit from a national restoration plan is henceforth done according to two methodologies depending on whether the species are identified as eligible to benefit from a plan by the « Grenelle de l'environnement » or whether they appear on the red lists established by the International Union for Conservation of Nature (IUCN).

Concerning the species identified by the « Grenelle de l'environnement », the National Museum of Natural History has differentiated between the species which need to benefit from national restoration plans, that is to say from interventions in various fields (environment restoration, population reinforcement, monitoring of the population numbers...), and requiring a reinforced co-ordination of the actions, and the species which need to benefit from action plans, that is to say from specific actions within a particular field (knowledge acquisition, environment management...). This differentiation has been carried out on the basis of the pieces of knowledge currently available.

Regarding the other species, the National Museum of Natural History has established a methodology making it possible to organise the species of the French IUCN red lists into a hierarchy and thus to determine the species eligible to a national plan of restoration. This methodology rests on three main criteria: the status of the species as defined according to the IUCN categories, the French patrimonial responsibility toward the species and its Community engagements. Added to these are other decision-making criteria such as our knowledge of the threats the species faces or our capacity to act upon them.

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## **The elaboration, implementation and assessment of a national restoration plan**

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Every year, the Ministry for Ecology and Sustainable Development identifies the species which need to benefit from a national restoration plan in priority on the basis of the elements provided by the National Museum of Natural History, and according to the aforementioned methodologies.

The plans are drafted by external contractors chosen after an invitation to tender, who are helped by the plan elaboration monitoring committee made up of scientists, State services and future actors of the restoration plan. This committee is set up by the ministry in charge of ecology.

During the elaboration of the plan, all potential partners, among which the State services, are consulted in order to encourage a better appropriation of the actions which will be implemented.

In the end, the plan is validated at national level by the ministry in charge of ecology after consultation of the various concerned ministries and of the national council for the protection of nature.

The monitoring of the plan's elaboration and, later on, the co-ordination of its implementation is done by a regional directorate for environment more particularly concerned by the species, working on behalf of the ministry in charge of ecology. This decentralised service of the ministry in charge of ecology is then called « co-ordinating DIREN » (« DIREN coordinatrice »).

The « co-ordinating DIREN » attends to the implementation of the actions defined by the

plan and the respect of the strategic orientations.

It is assisted by an operator in charge of the technical and scientific co-ordination of the plan. This operator is chosen by the ministry in charge of ecology and can be of diverse nature (nature protection associations, natural area managers, public institutions...).

The operator is the contact person for the field actors who implement the actions defined in the plan. These actors can be nature protection associations, natural area managers (regional conservatories of natural areas, regional natural parks), public institutions (National Parks, National Office for Hunting and Wildlife, National Office for Water and Aquatic Environment, National Forests Office...), socio-professional actors (farmers, foresters, fish farmers...), scientific partners (National Centre for Scientific Research, Cemagref...) or State services.

The « co-ordinating DIREN » plays its role in close connexion with the steering committee of the national restoration plan, formed at the elaboration of the plan and made up of State services, natural area managers, nature protection associations, socio-professional actors, territorial and scientific collectivities.

This committee proposes the strategic and budgetary orientations of the plan and it is in charge of the follow-up and assessment of the execution and financial means of the plan as well as of defining the actions to be implemented in priority.

To facilitate the follow-up of the implementation of the plan, a report of the actions is done every year by the operator under the responsibility of the « co-ordinating DIREN ».

At the end of the plan, it is assessed by an external contractor, chosen by the ministry in charge of ecology after an invitation to tender. The goal is to determine the effects of the plan on the conservation status of the one or several species for which it has been established. Based on these elements, the assessment must define the follow-up of the plan, especially the opportunity to pursue actions in the framework of a new national restoration plan.

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## **The content of a national restoration plan**

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A national plan of restoration is made up of three parts.

The first part sums up the acquired knowledge on the subject and, in particular, the biological and ecological constraints peculiar to the one or several species under scrutiny, the causes of its/their decline and the actions which have already been carried out.

The second part describes the needs and issues relative to the conservation of the one or several species concerned by the plan and includes the definition of a long-term strategy in order to restore and maintain the one or several species under scrutiny to a favourable conservation status.

The third part specifies:

- the goals that are to be achieved at the end of the plan;
- the conservation actions to be carried out in the three fields of protection, study and communication. They are presented in order of priority and for each, the terms of their implementation, monitoring and assessment are specified;
- the organisational terms of the implementation of the national restoration plan.

A national restoration plan is usually implemented for a 5-year period. However, exceptions can be observed, for long-lived species for instance.

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## The national restoration plan for the Aquatic Warbler

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The Aquatic Warbler (*Acrocephalus paludicola*) is considered as highly endangered at the world level. It is protected in France and at Community level (Annex I of the « Birds » Directive) as well as at international level (Annex II of the Bern convention and Annex I and II of the Bonn convention). Besides, a memorandum of international agreement has been established in 2003 within the framework of the Bonn convention.

This small passerine is only present in France during two months in the summer for its post-nuptial migration. A very big part

of the European population thus passes through France, which plays an major role in the conservation of the species.

In this context, the ministry in charge of ecology decided to launch the elaboration of a national restoration plan for the Aquatic Warbler.

After an invitation to tender, the drafting of the plan has been entrusted to the association « Bretagne Vivante », coordinator of the Life project « Conservation of the Aquatic Warblers' staging areas ».

The Regional Direction for environment of Brittany has been appointed « coordinating DIREN ».

In accordance with the procedure established for the elaboration of a national restoration plan, all potential partners of the plan for the Aquatic Warbler will have to be consulted.

The finalisation of the plan is scheduled for the autumn of 2009.

The elaboration and implementation of the national restoration plan for the Aquatic Warbler will largely take into account the knowledge and experience acquired during the Life project « Conservation of the Aquatic Warblers' staging areas ». It will require an involvement from every actor and the contribution of the actors of the Life project constitutes, an asset regarding its successful accomplishment.

Through this national restoration plan, the ministry in charge of ecology wishes to partake in the efforts made at international level to restore this species to a favourable conservation status and in particular to provide it with migratory conditions meeting its needs. ■

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# New Aquatic Warbler Group and theme in France

Pascal PROVOST & Franck LATRAUBE



France plays an important role in the conservation of the Aquatic Warbler. Most of the population passes through France every summer during the post-nuptial migration, from July to October. Until now, there was no nation-wide co-ordination in the study of the species.

A work group made up of ringers and of the CRBPO proposed a new « ACROLA » programme. This theme included in the National Ornithological Research Programme of the CRPBO (MNHN Paris) is open to the registered ringers who wish to partake in the study and conservation of the species in France and contacts will also be established with the international research team (the Aquatic Warbler Conservation Team).

**T**he first studies on the Aquatic Warbler broached its nesting areas (for instance, Dyrz, 1994; AWCT, 1999) and, more recently, its wintering quarters. The studies on migration are fragmentary and the pieces of information on its numbers and ecology are rarely comparable. And yet, most of the world population passes through France every summer [1]. If the migration phenology and the main staging areas are rather well-known in France (Bargain *et al.*, 2002; Julliard *et al.*, 2006), to this day, there was no national co-ordination (no reflection group or common protocol) to compare the various sites combining a qualitative approach of the habitat with the numbers of birds in transit.

A work group made up of ringers and of the CRPBO was then set up on the 9th of November 2007 in order to propose a standard scientific protocol for the following year. This protocol is addressed to the 320 generalist ringers who want to partake in the study and conservation of the

species in France. The goals of the group are:

- to estimate the numbers of birds passing through France
- to assess the relative importance of each post-nuptial staging area
- to characterise the habitat of capture (at local and regional level)
- to assess the ringing site's food supplies

In order to reach these goals, the work group proposes various protocols (mandatory or optional) which are applicable in most of the reed beds where the species is likely to migrate (inland reed beds included).

The protocols are based on a capture unit characterised by three nets arranged in a line, from which the data is then collected under a common identifier. This unit can be repeated as often as possible on each site. A playback set-up broadcasting the Aquatic Warbler's song is (ideally) placed at the centre of each line of three nets, the collect of invertebrates, and the records on

the habitat structure are done on the same basis. The details of the protocol entitled ACROLA can be downloaded on the CRBPO website:  
[http://www2.mnhn.fr/crbpo/IMG/pdf/THEME\\_ACROLA.pdf](http://www2.mnhn.fr/crbpo/IMG/pdf/THEME_ACROLA.pdf)

## Material and Methods

Some axes of the protocol are mandatory and others are optional depending on the availability and goodwill of the ringing teams. This programme is made up of three parts:

### The Capture Part (mandatory)

#### • Capture Period and Pressure (mandatory)

The nets are opened before dawn, so between 6 and 7 o'clock (that is to say, about 30 minutes before sunrise in the beginning of August at the earliest). The capture duration should vary as little as possible throughout the season. It will obviously depend on the weather conditions. The closing of the nets will be

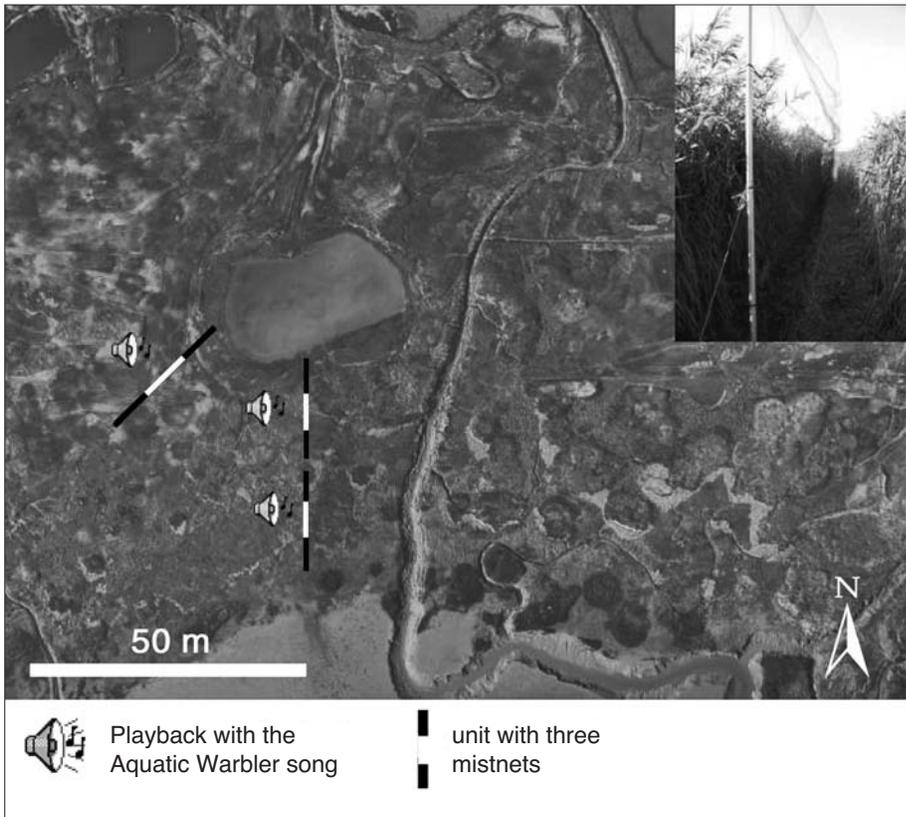
made at noon, so the capture duration will be of 5 or 6 hours. The total length of nets is left open but it must be mentioned and be a multiple of three nets of 12 meters within the framework of the Acrola theme. The total length of nets will depend on the surface of the reed bed, and on the number of ringers and interns.

The duration of the capture period will depend on the ringers' availability. However, in order to get a homogenous and constant national rendering, it is recommended to work throughout the whole month of August, as it is possible to capture a great majority of the Aquatic Warblers passing through France during that month. The Trunvel biological station is open as early as July and until the end of October, which makes it possible to study the whole phenology of the post-nuptial migration.

In France, it is agreed that the migration peak occurs between the 10<sup>th</sup> and 20<sup>th</sup> of August. The ringers willing to participate in the protocol but having little free time are thus encouraged to capture during this period.



**[1] Aquatic Warbler migration fly way in autumn.**  
**Black dot:** breeding area  
**White dot:** supposed wintering area  
**Black line:** autumn migration  
**Dotted line:** theoretical spring migration



[2] Example of location for three Acrola units in Seine estuary.

• **Capture Station / Capture Unit (mandatory)**

A capture unit corresponds to three nets of 12 meters each arranged in a line = 36 meters [2]. It is possible to multiply this unit as many times as possible, be it in the continuation of the first unit or not, but each unit must be identified carefully by a letter or number.

A capture station can then have several capture units which will have to be georeferenced. The distance between each capture installation (made up of one or several units), the location and orientation of the nets are left open and determined in relation to the site configuration and to the prevailing winds.

The nets must be adapted to the capture of small species: thin, solid and durable. Their length, thickness as well as the number of pockets is not imposed. The nylon nets of the Ecotone® brand are strongly recommended to carry out this theme: L 12 m ; H 2.5 m ; 5 pockets ; D : 16x16 mm ; E : 110/2 denier.

The poles must make it possible to stretch the nets up to the limit of the reed bed's canopy. Each capture unit must be located in an environment which is rather homogenous (sample one or several types of habitats representative of the capture station).

In addition to the mandatory biometric measures such as the folded wing length and the weight, other measures are to be made on the Aquatic Warblers only. These measures include the tarsus and bill length, the length between the head and the tip of the bill, the tail length, as well as the primary remige number three (Editor's note: French codification, equivalent of the number 7 for the Anglo-Saxons).

The required material for the measures include a 25-30 cm end-stop ruler for the folded wing, a 15 cm thin flat ruler without end stop for the primary remige number 3, a caliper and a precise scale accurate to 1/10<sup>th</sup> of a gram.

The playback will be monospecific and unique throughout the whole season. Only



the Aquatic Warbler's song will be broadcasted. A (copyright free) sound file is available on the CRBPO discussion forum.

The type of material to be used is left open (volume, frequency, sound file format, support...). Experience has shown that it is not necessary to broadcast it very loud; but it is important to multiply the playback systems within one station to get a chance to attract a maximum of Aquatic Warblers present in the environment of the station. If possible, one broadcasting set-up per capture unit will be used and placed in the middle of the unit of three nets. If a single playback system is used within a capture station with several units, the playback system should preferably be placed on the central unit. It will then be possible to test the effect of the playback while recording the distance from the units without playback to the broadcasting set-up. The playback starts at dawn and at the earliest 1,5 hour before the legal sunrise time and ends at noon.

### **The Habitat Part (optional)**

The nocturnal migratory birds establish a staging area in a reed bed depending on its expanse, on the presence or absence of free-running water and other landscape factors (proximity of the coast, topography, rivers, etc.). Two levels of analysis are required in order to characterise the environments frequented by the species: analysis at landscape level (the environment of the station) and at habitat level (the exact capture location).

#### **• Macro-habitat Records (optional)**

A landscape analysis can be made from an aerial photography (orthophotography or fitting of an aerial photography of the area) and with the use of geotreatment under a Geographic Information System (GIS). In order to assess the selection criteria of the species, an analysis of the landscape components can be made within growing concentric circles (buffer) each time more distant from the capture station. This analysis work can be made later on by the local operator (for instance, for the protected areas with precisely characterised ecological units on a GIS) or by the CRBPO. In addition, an aerial photograph may give some information on the total surface of the area under study ; a data which is useful to estimate the number of birds passing through (via an extrapolation based on the sampled area).

#### **• Micro-habitat Records (optional)**

The records are made during the capture season at the rate of three replicates per capture unit (records made on only one side of the capture unit, 1 meter back from it and behind each of the three nets). They are made in a reed bed or on a meadow on the basis of a 50x50 cm quadrat, the height of the green reeds is measured with a 4-meter survey rod, stretching the last leaves upwards. The height, density and diameter as well as the number of green and dry stems are for instance recorded [3].

### **The Food Supply Part (optional)**

The sampling consists in making one sample per capture unit, that is to say one sample for three nets and per week (a frequency which can be modified). Other samples can be made on other potential foraging areas. The replicate is made up of three PVC tubs of different colours (yellow, blue and white) in which water will be poured with a drop of non aromatic dish-washing detergent. The samples will be kept and then sent to the CRBPO for an ulterior analysis of the samples (dry weight and counting). A sampling method is also proposed to study the aphids. These



[3] Example of a micro-habitat record.

records allow us to study the global quality of the reed bed which probably has an influence on the numbers and period of stay of the migratory palustrine warblers.

## Conclusion

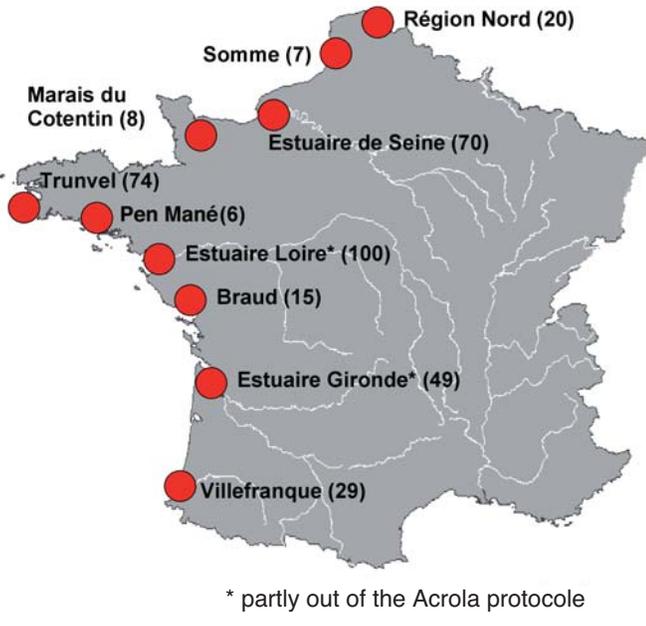
The newly set up programme had to be simple and generally applicable in order to invite numerous capture stations to partake in it. In this Acrola programme, we differentiate two major elements, namely

the capture pressure and the broadcasting of the bird's song.

On the 10<sup>th</sup> of September 2008, a dozen (of) ringing stations in France implemented the programme, which lead to the ringing of a minimum of 380 warblers, a record in France [4]! This interest for the new Acrola programme is promising and the national cover is already satisfying! These data will be analysed, partly on the same basis proposed by Julliard *et al.* in 2006 (indexes calculation).

With this Acrola programme, we thus want to put the emphasis on the importance of France in the palustrine warblers' migration and, in particular, regarding the conservation of the Aquatic Warbler. With the intention of having a large scale homogenisation of the results, this new programme is also proposed to foreign colleagues working along the Aquatic Warbler's post-nuptial migration route.

This monitoring can be experimented as early as 2009 on the foraging sites favourable to the species, such as hygrophilous meadows, at the edge of reed beds, or in free-running water areas. This can also be tested on spring migration staging areas.



[4] Location of the main Aquatic Warbler captures' sites in France in 2008 (between brackets, number of Aquatic Warbler captured in 2008 before the 11<sup>st</sup> September).

In addition to the three parts of the study presented in this article, the communication part which is also featured in the programme aims at making the scientific results accessible to the public and at spreading awareness on the conservation of this rare species among political decision-makers and wetlands managers. Indeed, such a programme should be accompanied by coherent conservation measures at national, not to say international level. A fine knowledge of the ecological requirements of the Aquatic Warbler during its migration will contribute to its conservation. ■

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## Notes

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<sup>1</sup> Research Centre for the Ringing of Bird Populations

<sup>2</sup> National Museum of Natural History

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# A last word

**T**he articles gathered in this « Aquatic Warbler » special issue of *Penn ar Bed*, coming from the papers of the seminar which took place on the 11<sup>st</sup>, 12<sup>nd</sup> and 13<sup>rd</sup> avec September 2008 in Quimper. They sum up our knowledge on the status of the species – the most endangered passerine in Europe – and on its needs at various times of the year, namely, during the nesting, migration and wintering periods. But they are not limited to the sole knowledge of the species, which would be manifestly insufficient for a Life project. A large part of them also broaches the environments' management modalities and experiences making it possible to meet the Aquatic Warbler's needs. In order for these management modes to last and to be carried out not just in a few reserves, they have to be economically valorised. This was the goal of the experimentation which has been carried out in Brittany and in the Seine estuary. This must be extended while keeping in mind that the essential goal is the conservation of environments favourable to the Aquatic Warbler, and without drifting towards a sheer economic approach, which must remain a secondary goal. Now that we have the knowledge, or at least sufficient knowledge, so as not to postpone urgent actions any further, what role must an association like Bretagne Vivante now play? Today, the role we played as awareness raisers among the specialists of the species and the administration – at least in the services concerned with species protection – is now filled and acknowledged, but we should not leave it at that. Our primary mission is to develop management modes favourable to the Aquatic Warbler on potentially favourable sites, and to make these experiences known so that other nature reserve managers will follow the same path. But, most of all, nothing essential will be achieved unless we manage to convince a large part of the population and, beyond that, to make policy-makers aware of the necessity to preserve a few thousand of passerines weighing each a dozen of grams! And we especially need to convince them that biodiversity conservation is just as vital as the improvement of water quality or the limitation of climate deregulation. On this subject, let us not forget that we are not defending the environment alone anymore. To be heard, we have to rely on other naturalist and environment protection associations and work in synergy with them. In order to accomplish these missions, we will have to rely on the national restoration plan for the Aquatic Warbler whose elaboration has been entrusted to us by the State. And these goals, precisely, will have to guide us in its elaboration.

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*Bretagne Vivante - SEPNB President*

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## Recommended mention for those proceedings

• for the whole publication *Penn ar Bed* :

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# Conservation of the Aquatic Warbler in Brittany

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