VALUING THE RECREATIONAL BENEFITS OF WETLAND ADAPTATION TO CLIMATE CHANGE: A TRADE-OFF BETWEEN SPECIES' ABUNDANCE AND DIVERSITY.

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Climate change will further exacerbate wetland deterioration, especially in the Mediterranean region. On the one side, it will accelerate the decline in the populations and species of plants and animals, this resulting in an impoverishment of biological abundance. On the other one, it will also promote biotic homogenization, resulting in a loss of species' diversity. In this context, different climate change adaptation policies can be designed: those oriented to recovering species' abundance and those aimed at restoring species' diversity. Based on the awareness that knowledge about visitors' preferences is crucial to better inform policy makers and secure wetlands' public use and conservation, this paper assesses the recreational benefits of different adaptation options through a choice experiment study carried out in S'Albufera wetland (Mallorca). Results show that visitors display positive preferences for an increase in both species' abundance and diversity, although they assign a higher value to the latter, thus suggesting a higher social acceptability of policies pursuing wetlands' differentiation. This finding acquires special relevance not only for adaptation management in wetlands but also for tourism planning, as most visitors to S'Albufera are tourists. Thus, given the growing competition to attract visitors and the increasing demand for high environmental quality and unique experiences, promoting wetlands' differentiation could be a good strategy to gain competitive advantage over other wetland areas and tourism destinations.

Keywords: climate change, wetland adaptation, species' diversity, species' abundance, recreational benefits, choice experiment.

JEL classification: D6, Q51, Q54, Q57.

Introduction

Wetlands –including marshes, fens, peatlands or coastal areas– are not only among the richest ecosystems in biodiversity, but also among the most fragile environments (Russi et al. 2013). Indeed, they are subject to a process of continuous deterioration driven by anthropogenic pressures such as infrastructure development and land conversion, water withdrawal, eutrophication and pollution, overharvesting and overexploitation (Elliott et al. 2014; Seilheimer et al. 2009). Recent studies show that most of these impacts will be exacerbated under climate change (CC), especially those related to alterations in water quantity and quality (Cross et al. 2012; Krauss et al. 2014; Tong et al. 2014). The increase in temperatures and the change in precipitation rates forecasted at a global level are projected to perturb hydrological equilibria in wetlands, this resulting in variations in the seasonal pattern of water levels, altered flooding, recharge and discharge of aquifers, and sea level rise (IPCC 2013). Given wetlands' dependence on water conditions, CC-derived impacts will further accentuate the deterioration of these ecosystems (Erwin 2009).

This is especially true for wetlands located in the Mediterranean region, as it represents a CC hotspot (Giorgi and Lionello 2008). Further degradation of humid lands is expected to intensify current negative repercussions on wetland-dependent species. On the one hand, it will accelerate both the decline in populations of plants and animals and the extinction of species, this resulting in an impoverishment in biological abundance (Amezaga et al. 2002; Cuttelod et al. 2008; Johnson et al. 2005). Indeed, most of organisms will be unable to adapt to the environmental perturbations, thereby they will not naturally develop sufficient physiological and behavioral responses to cope with changed conditions (Doney et al. 2012). On the other one, it will also promote biotic homogenization, that is, the process through which many 'specialist' species are replaced by few 'generalist' ones (Araújo et al. 2011; Dawson et al. 2003; Garssen et al. 2014; Lemoine et al. 2007; Lougheed et al. 2008; Mediterranean Wetlands - Outlook 2012; Willis et al. 2008). Indeed, CC-induced degradation will alter species' composition by accentuating the current differences across species in terms of their capacity to adapt to disturbances. In this sense, Clavel et al. (2010) state it will constraint the adjustment potential not only of the species relying on few environmentally stable habitats ('specialist' species), but also of those occupying a wider habitat range ('generalist' species). As the former are less resilient and hence more vulnerable to environmental disturbances, this will result in a substitution pattern leading not only to a quantitative but also, and even more importantly, to a qualitative loss of species, which will generate a loss of species' diversity.[1] This phenomenon is forecasted to reduce the original heterogeneity of wetlands, thus accentuating the current process of homogenization particularly experienced by Mediterranean humid lands.

In this context, welfare losses are expected especially for visitors, who increasingly appraise wetlands for their biological abundance and diversity (Millennium Ecosystem Assessment 2005). To avoid or minimize these welfare losses, that is, to secure wetlands' public use and conservation, the design of adaptation policies should be of high priority for wetlands' managers.[2] In this sense, and by strengthening efforts on current management practices, decision-makers can opt for different strategies to counteract the abovementioned CC-induced impacts on wetland-dependent species. Indeed, they can pursue to recover species' abundance, thus taking action to avoid a quantitative loss of species, regardless of the species' type. Also, they can seek to preserve original wetlands' heterogeneity, thus acting against biotic homogenization by undertaking measures to avoid the quantitative loss of many 'specialist' species. Although both strategies contribute to the goals of conservation and public use, the latter type of policy has been argued to be more desirable from an ecological point of view. Indeed, it contributes to achieve more complex and healthier, hence more resilient, ecosystems (Norberg et al. 2008; Robledano et al. 2010). In addition, it allows promoting wetlands' differentiation which could represent a good strategy to gain competitive advantage given the growing competition among wetlands to attract visitors and their increasing demand for high environmental quality and unique experiences (Secretariat of the Ramsar Convention on Wetlands & World Tourism Organization 2012). In this context, adaptation policies should be not only feasible but also socially acceptable. Thus, knowledge about the economic value users assign to species' diversity and abundance in wetlands is crucial to guarantee the design of welfare-maximizing interventions.

Unfortunately, research on adaptation to CC-derived impacts in the context of wetlands has mainly focused on the issue of species' abundance rather than diversity. Most of studies have been concerned with policies aimed at counteracting the loss of species from a quantitative perspective without consideration of the species' type (Ayache et al. 2009; El-Raey 1997; Jeppesen et al. 2011; Mortsch et al. 2006; Nicholls and Hoozemans 1996; Snoussi et al. 2008; Withey and van Kooten 2011). Wetland adaptation studies dealing with the loss of species' abundance and diversity have been scarce (Anthony et al. 2009; Kingsford 2011; Palmer et al. 2009). Also, it seems that wetland adaptation literature has paid little attention to the analysis of the social acceptance of policies, thus overlooking efficiency issues in their design. To our knowledge, research on the economic valuation of wetlands' benefits has only

[1] Throughout the manuscript, a loss of species' diversity refers to the qualitative rather than the quantitative implications of species' loss.
[2] Note that we refer to adaptation policies as planned measures engineered by human interventions on the environment. This should not be confounded with the concept of environmental adaptation, which refers to the autonomous responses to CC by organisms and ecosystems through natural physical and biological processes (Hobday et al. 2009).

given guidance on welfare-maximizing management practices outside the context of CC adaptation. Examples of this are Birol et al. (2009) and Rolfe and Windle (2010), which have focused on species' diversity, and Luisetti et al. (2011) and Birol et al. (2010), which have dealt with species' abundance issues.

In this framework, this study analyses visitors' preferences for two types of adaptation policies: those oriented towards a quantitative recovery of species and populations and those pursuing a restoration of the species' diversity. This way, it not only adds to the scarce adaptation research focusing on a loss of species' diversity but also it includes a welfare-based analysis of adaptation measures. More specifically, it allows prioritizing socially desirable wetland management practices due to the joint economic valuation of species' abundance and diversity, which is of great relevance when budgets allocated for environmental conservation are shrinking (Christie et al. 2006). By assuming policies aimed at preserving original wetlands' heterogeneity are more desirable, the hypothesis that visitors assign a higher value to 'specialist' species-abundant rather than to 'generalist' species-abundant wetlands, is tested for. To do this, preferences of visitors to s'Albufera wetland (Mallorca), an outstandingly vulnerable site to CC stresses in the Mediterranean (Candela et al. 2009), are examined through a choice experiment (CE).

The structure of the paper is as follows. Next section describes S'Albufera wetland case study. Then, the methodology is highlighted, with a description of the main steps of the CE design and the statistical model employed for data analysis. Afterwards, sample descriptive statistics and model results are reported. A discussion and conclusions section ends the paper.

Case study description

S'Albufera is the largest wetland in the Balearic Islands, with 1646.38 ha protected by law.[3] It is placed at the coastal plain of an extensive water catchment area in the North East of Mallorca and it is nourished by surface runoff waters, precipitations, underground springs and sea water (Parc Natural de S'Albufera de Mallorca 2005). The prevalently freshwater nature of this wetland makes it different from most Mediterranean coastal humid lands[4] at the time it supports diverse and abundant flora and fauna species of international importance (Sato and Riddiford 2008). Bird species are its major natural asset. In this sense, there is a community of 'specialist' species that find in S'Albufera their ideal habitat, including both sedentary and migratory birds regularly moving to this site for breeding during spring or stopping over during winter. Additionally, 'generalist' bird species can also be watched which are not exclusively found in S'Albufera but migrate to this wetland or even establish there sedentarily, as they are better adapted to the growing salinization process of the site.

Indeed, S'Albufera ecosystem has been experiencing considerable human-induced stresses over the years, which have mostly affected its hydrological conditions. Water quantity and quality reaching the wetland are influenced by (i) the nitrates from intensively used agricultural fertilizers in the surrounding areas; (ii) the waste waters from inefficient –and sometimes saturated– watershed's sewage treatment plants; (iii) the sea water spilling through the underground pipes responsible for the cooling system of the thermal power station Es Murterar, placed near the park; and (iv) the unsustainable freshwater extraction for agricultural, residential and tourism consumption. In specific, this latter source of stress has been considerably increasing over the last years mainly due to the sustained growth in tourist arrivals to Mallorca, one of the leading Mediterranean tourism destinations (Riddiford et al. 2014). The human-induced pressures affecting S'Albufera are common sources of stress in Mediterranean wetlands

[3] Decree-Law No. 4/1998 of the Ministry of Agriculture and Fisheries of the Balearic Islands (January 28th)
[4] [http://www.medwetlands-obs.org/node/33 accessed in December 2013]

and have generally been responsible for an increasing process of eutrophication and salinization of their waters (García-Ruiz et al. 2011; Marco-Barba et al. 2013).

Especially salinization, one of the major threats for freshwater ecosystems (Jin 2008), is expected to be further intensified in S'Albufera under CC. Indeed, increased temperatures and decreased precipitations forecasted for the western Mediterranean region are anticipated to lead to an additional decline in freshwater volumes (Candela et al. 2009). This, coupled with an increased sea water intrusion, is expected to elevate the concentration of salt in waters with repercussions over plant and animal species. Overall, current impacts in terms of declines in flora and fauna richness and biomass, shifts towards salt-tolerant communities and the inhibition of seeds germination are anticipated to be accentuated in the future (Waterkeyn et al. 2008). However, the most serious effect on S'Albufera ecosystem is expected to be the decrease in the number of 'specialist' bird species, which will generate a loss in the site's species' diversity.

CC will also be responsible of increasing stresses over migratory bird species –especially spring ones– by growingly shifting their migration timing (Tingley et al. 2009). This phenomenon has been well documented for the case of the Mediterranean (Robson and Barriocanal 2011). The projected rise in temperatures at their origin place is expected to stimulate their advanced departure, such that they will arrive earlier to S'Albufera for resting and breeding. In this context, they might not find the optimal nesting conditions, such as peak food availability, thus being forced to abandon the site. As a result of this, the abundance of both 'specialist' and 'generalist' migratory bird species in S'Albufera is expected to decline.

Drops in both bird species' abundance and diversity under CC are expected to generate welfare losses especially for visitors. Indeed, visitors to S'Albufera have steadily grown in number since the declaration of the wetland as a Natural Park in 1988 (Espais de Natura Balear – Conselleria de Medi Ambient 2008), attracted by a wide range of nature-based recreation activities (contemplation of nature, sport, bird watching, etc.). In this context, management practices aimed at counteracting the human-induced stresses experienced by the park have been implemented by managers to guarantee the wetland's conservation and hence wetland's demand by visitors. In particular, over the last 15 years, water management interventions have been undertaken to control for seawater intrusion and to favor the diffusion of freshwater throughout the channels of the park, as the best way to recover 'specialist' bird species. Additionally, managers have undertaken policies oriented to creating optimal nesting and breeding conditions to increase the chances of attracting migratory bird species to S'Albufera, regardless of whether they are 'specialist' or 'generalist'. Vegetation diversity actions –through the use of cattle and horses– have also been carried out to maintain landscape heterogeneity and restore the environmental conditions in sensitive areas, such as the riverbank wood and the dune system.

Methodology

Measuring visitors' welfare changes associated with CC-derived impacts requires the use of stated preference (SP) methods. This is because SP techniques allow valuing non-market goods by constructing hypothetical scenarios that have not been previously experienced by individuals, as it happens when it comes to projected variations in climate and their derived impacts. In this context, among the SP techniques, the choice experiment (CE) is considered to be more appropriate than the contingent valuation (CV) method. Indeed, the CV only allows assessing the effect of a single attribute on utility. In contrast, the CE allows estimating the value of a set of multiple attributes simultaneously considered. In specific, for each attribute or a combination of them, it allows measuring the related welfare changes over a range of possible outcomes (Hanley et al. 2001), thus better informing policy-makers. In a CE, each attribute takes different levels, whose combination allows generating diverse hypothetical scenarios or alternatives, which are grouped into choice sets presented to respondents. From each choice set, individuals are asked to select their most preferred alternative and, through the statistical analysis of responses, preferences for different attributes can be inferred. In case the cost of the alternative is also presented to respondents, the monetized value individuals assign to each attribute can be obtained (Hanley et al. 1998).

Choice experiment design

The first step in the development of the CE study consisted of the identification of the relevant management attributes and their levels, which were selected after consultation with S'Albufera managers and experts. Agreement was reached on the fact that, unless current management efforts are strengthened, CC will mainly provoke a reduction in the number of 'specialist' and 'generalist' bird species of the wetland. Thus, two environmental management attributes were considered: 1) the change in the number of 'specialist' bird species to reflect the effects of CC-induced salinization on species' diversity; and 2) the change in the number of 'generalist' migratory bird species to capture the impacts on species' abundance of CC-intensified shifts in migration timing.

Additionally, based on the results of previous visitors' satisfaction surveys in S'Albufera, the levels of efforts to manage congestion and facilities in the wetland were found to be relevant for users, this motivating the inclusion of two non-environmental attributes in the CE. As a proxy for the degree of congestion, the waiting time for a seat in an observation cabin set to facilitate birds' viewing was used – with longer (shorter) waiting times associated to a greater (smaller) number of visitors and hence to higher (lower) congestion levels. To reflect wetland services, the number of rest-stop benches in the park was employed. Finally, a cost attribute was included, consisting of an entrance fee for adult visitors. The appropriateness of the selected attributes and levels was tested in focus group sessions with park visitors. Table 1 describes the attributes and their levels used in this application.

Table 1 Description of the attributes and their levels

Attribute	Description	Levels
'Specialist' bird species	Change in the number of 'specialist' bird species (with respect to current level)	+5 [a] 0 [b] -10 [c]
'Generalist' migratory bird species	Change in the number of 'generalist' migratory bird species (with respect to current level)	+5 [a] 0 [b] -10 [c]
Waiting time	Waiting time for a seat in an observation cabin	About 3 minutes [a] About 7 minutes [b] About 15 minutes [c]
Rest-stop benches	Number of rest-stop benches throughout the park	Triple current number [a] Double current number [b] Keep current number [c]
Entrance Fee	Entrance fee per adult visitor and trip (in euros) (BAU level: 0 euros)	4, 8, 12, 16, 20, 24

Attribute levels resulting from a high ([a]), moderate ([b]) or no increase ([c]) in management efforts.

After the identification of the relevant attributes, experimental design techniques were employed to combine the attribute levels to generate the alternatives and the choice sets. Among the different methods, the D-efficient Bayesian design was considered as the most superior approach (Rose and

Bliemer 2009) and it was employed to create 18 profile combinations.[5] Each choice set consisted of three options: two alternatives showing improvements in at least one attribute, as a result of strengthened management efforts; and a third option, kept constant across choice sets, representing the business-as-usual (BAU) scenario that would occur in 10 years under CC if management efforts were not strengthened.[6] The number of choice sets per individual was reduced by blocking the 18 profile combinations into 3 groups, randomly assigned across respondents, such that only 6 choice sets per person were considered.

To present choice sets to respondents, a questionnaire was designed consisting of 5 sections. The first one was aimed to identify the visitors' profile, with specific questions designed for Mallorcan residents and tourists. The following section was focused on gaining knowledge about the visitors' recreational behavior in S'Albufera. The third block described the CC-induced environmental impacts and the possible solutions park managers could adopt to counteract them. Next block was devoted to the choice of alternatives. Follow up questions were also included to identify possible protest answers within the sample. The survey concluded with some questions about the individual's socio-demographic profile.

Data were collected through on-site individual interviews addressed to the visitors' population of S'Albufera of 18 years of age or older. Individuals were randomly drawn from some pre-defined strata, discriminating users according to their place of origin. To maximize visitors' participation, the surveying process was conducted during the peak visitation season of the park –i.e. between April the 15th and June the 30th, 2013– by trained interviewers. Taking into account a population of 23,172 individuals, 4 representative sub-samples were drawn. To each of them a different probabilistic scenario of CC impacts' occurrence was presented. A total of 1,271 surveys were collected across the 4 subsamples. For the purposes of this study, and following common practice in the SP literature, the sub-sample assuming certain the CC impacts described in the BAU scenario, was considered. Hence, the sample size for this application accounted for 322 visitors, with a sample error of 5.47% and a 95% confidence interval.

Statistical modelling

Preference analysis in a CE is performed through the use of statistical models relying on the random utility maximization (RUM) theory (Manski 1977). In this sense, individuals' choices are modeled by assuming respondent *n* chooses the alternative *j* providing him with the highest utility level (U_{nj}) from among a set of options. Given that U_{nj} is only partly observed by the researcher, it is specified by considering a stochastic (ε_{nj}) in addition to a deterministic component (V_{nj}):

$$U_{nj} = V_{nj}(x_{nj}, x\_cost_{nj}, \beta) + \varepsilon_{nj} \tag{1}$$

where x_{nj} and x_cost_{nj} are respectively the non-monetary and monetary attributes of the alternative, β are the parameters to be estimated and ε_{nj} represents the error term capturing all the unobserved factors affecting individuals' choice but unknown to the researcher. In a CE, it is common to first model preferences by considering the conditional logit (CL), the simplest RUM model, identified under the assumption that the error follows a type I extreme value distribution and is independently and identically distributed (McFadden 1974).[7] Under the usual premise that utility is linear-in-parameters, the probability of choice of the j alternative within a set of C options under the CL is:

[5] D-efficient designs were created in Ngene (version 1.1.1).
[6] An example of choice set is shown in the Appendix.
[7] Under the CL, the independence from irrelevant alternatives (IIA) property holds, this involving that the relative probability of choosing one option over another is independent of the presence or absence of other alternatives.

$$P_{nj} = \frac{exp^{V_{nj}}}{\sum_{k \in C} exp^{V_{nk}}} \qquad (2)$$

However, the random parameter logit (RPL) model is increasingly used as a superior modelling approach with respect to the CL due to its higher flexibility. Its major advantage over the CL is that of dealing with individual-specific preference heterogeneity, which is accounted for by incorporating random parameters in the utility specification (McFadden and Train 2000; Train 2009). For each parameter specified as random, a vector of individual-specific coefficients is estimated, where each coefficient (β_n) is defined as the sum of a population's mean and an individual-specific deviation from this mean. The vector of individuals' coefficients is described by means of a continuous random density function, $f(\cdot)$, provided that the RPL assumes that the source of heterogeneity affecting the parameter is unknown. To identify the distribution of $f(\cdot)$, both a mean and a standard deviation parameters need to be estimated. Given that, the probability for individual n to choose alternative j under the RPL is:

$$P_{nj} = \int \frac{exp^{V_{nj}(\beta_n)}}{\sum_{k \in C} exp^{V_{nk}(\beta_n)}} f(\beta_n)\, d\beta_n \qquad (3)$$

Due to the superiority of the RPL model over the CL, only the results of the former will be reported in this study.[8]

To specify the utility function in both models, main effects and two-way interactions have been considered. Concerning the main effects, both the environmental attributes (change in the number of 'specialist' bird species and 'generalist' migratory ones) and the cost attribute have entered the utility function as continuous variables. However, only this latter has been assumed to have linear effects on utility.[9] In contrast, the non-environmental attributes (waiting time and rest-stop benches) have been specified as dummies. As these two attributes have three levels each, it has been possible to test for the presence of non-linear effects on utility.

Regarding the interaction effects, a squared term for each environmental attribute has also been incorporated to test for the hypothesis of non-linear attribute effects on utility (Luisetti et al. 2011; Torres et al. 2011). Additionally, an interaction term between the 'specialist' bird species attribute and the 'generalist' migratory one has been included to check whether the expected benefits obtained from a marginal increase in one bird category depend on the level of the other one. Interactions between environmental and non-environmental attributes have also been considered. In particular, an interaction between 'specialist' bird species and waiting time reduction has been specified to check whether the level of congestion affects preferences for environmental improvements, as shown in Torres et al. (2009). Estimating the utility effect of this interaction can provide policy-relevant information, given the increasing number of users to S'Albufera and the fact that the peak visitation period of the wetland partly overlaps with the high season of tourist inflows to Mallorca.

Equation 4 describes the utility function used to model CE responses in this study:

$$U_{nj} = \beta_1 X_{SPEC_{nj}} + \beta_2 X_{GEN_{nj}} + \beta_3 X_{TIME(less)_{nj}} + \beta_4 X_{BENCHES(double)_{nj}} + \beta_5 X_{BENCHES(triple)_{nj}} + \beta_6 X^2_{SPEC_{nj}} + \beta_7 X^2_{GEN_{nj}} + \beta_8 X_{SPEC_{nj}} \cdot X_{GEN_{nj}} + \beta_9 X_{SPEC_{nj}} \cdot X_{TIME(less)_{nj}} + \beta_{10n} X_{COST_{nj}} + \varepsilon_{nj} \qquad (4)$$

where $X_{SPEC_{nj}}$ and $X_{GEN_{nj}}$ reflect the levels of the 'specialist' and 'generalist' migratory bird species attributes; $X_{TIME(less)_{nj}}$ is a dummy variable taking value 1 for less than 15 minutes waiting time, and 0

[8] The estimation results for the CL model are available from the authors upon request.
[9] Note that quadratic effects have also been specified for the two environmental attributes.

otherwise; $X_{BENCHES(double)_{nj}}$ and $X_{BENCHES(triple)_{nj}}$ are dummies, taking value 1 for doubling and tripling the number of benches with respect to current level, respectively, and 0 otherwise; $X_{COST_{nj}}$ is the cost attribute.

To value welfare changes associated to a variation in a given non-monetary attribute, the willingness to pay (WTP) formula for compensating variation presented in Hanemann (1984) has been considered. To test for the hypothesis of this study, welfare estimates needed to be compared. To this aim, T-tests have been employed based on simulated WTPs, which have been obtained by means of the bootstrapping technique due to its advantages over alternative methods, as discussed in Hole (2007). Given that the focus of this study is on 'specialist' bird species, Equation 5 reports the WTP formula for a unit increase in $X_{SPEC_{nj}}$, based on the utility specification in Equation 4. Superscripts ^{1} and ^{0} indicate the attribute levels after the change and in the initial reference situation, respectively.

$$WTP_{X_{SPEC}} = -\frac{1}{\beta_{10n}}\Big[\beta_1\left({X_{SPEC_{nj}}}^1 - {X_{SPEC_{nj}}}^0\right) + \beta_6\left({X^2_{SPEC_{nj}}}^1 - {X^2_{SPEC_{nj}}}^0\right) + \beta_8 \cdot {X_{GEN_{nj}}}^0\left({X_{SPEC_{nj}}}^1 - {X_{SPEC_{nj}}}^0\right) + \beta_9 \cdot {X_{TIME(less)_{nj}}}^0\left({X_{SPEC_{nj}}}^1 - {X_{SPEC_{nj}}}^0\right)\Big] \qquad (5)$$

Results

Descriptive statistics

As common when it comes to the analysis of wetlands' users (Lee 2011), the descriptive statistics of the sampled individuals shows they can be viewed as nature-based visitors in the terms described by Arnegger et al. (2010), Luo and Deng (2008) and Shrestha et al. (2007). Indeed, most of them were non-residents (84.47%), mostly motivated to travel to Mallorca for nature enjoyment (44.12%) and displaying a longer mean length of stay (10.79 days) than that of the average traveler to the island over the same period (6 days).[10] On average, S'Albufera visitors tended to be mid-life (53 years old), had a high education level (50.16% finalized university or post-graduate studies) and belonged to the upper middle class (monthly average net household income was between 3,000 and 4,000 euros). They also showed repeat visitation rates to the park (69.39% of residents yearly visited S'Albufera an average of 2.26 times and 53.73% of non-residents had visited the park an average of 3.67 times over the last 5 years) and to other humid lands, especially within their region (with a mean of 25 visits per year). Most of users visited S'Albufera to 'contemplate and enjoy nature' (42.86%), while 29.19% engaged in a more specific activity like 'bird-watching'.

Visitors were also found to generally travel in small groups (52.17%) and they were environmentally aware: 37.27% of them were members of environmental groups, 23.29% belonged to a birding organization, 53.11% regularly consumed organic food, 98.14% separated waste for recycling and 36.95% collaborated with some non-governmental organizations.

Choice experiment results

After invalid and protest questionnaires were eliminated from the sample, 298 out of 322 surveys were considered for estimation.[11] These provided a total of 1,788 observations for estimation purposes, as

[10] Data provided by the *Agència del Turisme de les Illes Balears* for the II trimester of 2013 [http://www.caib.es/sacmicrofront/archivopub.do?ctrl=MCRST865ZI154103&id=154103 accessed in December 2013].
[11] Surveys were considered invalid when some missing responses were detected in the section concerning the choice of the alternatives due to the respondent's lack of cooperation or when the surveyor considered the respondent was insincere. Protests

each individual faced 6 choice sets. CE responses were initially modeled by means of a CL, but the rejection of the IIA property suggested the use of the RPL.[12] The RPL model was specified by considering all coefficients to be fixed, except for the cost parameter (β_{10n}), which was assumed to be random and to follow a lognormal distribution,[13] as commonly done in the literature (Torres et al. 2011). Table 2 presents the RPL model results based on Equation 4. Model estimation was performed in Matlab 7.12 based on a Halton sequence with 100 draws.

Table 2 RPL model estimations

	coefficient [a]	standard error
Fixed parameters		
X_{SPEC}	2.113***	0.286
X_{GEN}	1.245***	0.236
$X_{TIME(less)}$	0.455***	0.139
$X_{BENCHES(double)}$	0.584***	0.150
$X_{BENCHES(triple)}$	0.276	0.173
X^2_{SPEC}	-0.780***	0.274
X^2_{GEN}	-0.758***	0.255
$X_{SPEC} \cdot X_{GEN}$	-0.290*	0.165
$X_{SPEC} \cdot X_{TIME(less)}$	-0.684***	0.167
Random parameters [b]		
X_{COST}_mean	1.371***	0.065
X_{COST}_st. deviation	0.718***	0.043
Log-likelihood		-1050.601
R^2		0.461
Observations		1,788
N		298

[a] Note: *** 1% significance level; ** 5% significance level; * 10% significance level;
[b] Reported estimated parameters are those of the normal distribution associated with the lognormal one. Mean and standard deviation of the lognormal distribution are, respectively, 5.094 and 4.155.

Concerning main effects, the sign of the estimated coefficients for the environmental attributes indicated that visitors displayed positive preferences for a marginal increase in the number of both 'specialist' and 'generalist' migratory bird species. However, the coefficient of 'specialist' bird species was almost double in magnitude. On the other side, they showed preferences for lower waiting times (with respect to the current level), even though they seemed to be insensitive to the magnitude of congestion reduction.[14] In other words, a decrease in waiting time had a linear effect on utility. Regarding rest-stop benches, visitors displayed positive preferences for doubling the number of resting places, while being indifferent to tripling it. According to expectations, and due to the assumption of a lognormal distribution for the cost coefficient, the estimated parameters for the mean and standard deviation were positive and significant.

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included those questionnaires in which the choice of the BAU alternative was motivated by one of the following reasons: "I don't perceive any environmental problem to justify extra management efforts", "I am already paying for wetlands' conservation", "Others should pay" and "I don't trust the local authorities".

[12] The null hypothesis that the IIA property holds was rejected at 1% significance level based on the Hausman-McFadden test.

[13] The lognormal distribution was considered to constrain the coefficient to have the same sign across individuals.

[14] A Wald test was performed under the null hypothesis of parameters' equality between the coefficients of two separate dummies initially created for different waiting time reductions (from 15 to either 7 or 3 minutes). Results of the Wald test (0.10) suggested not to reject the null hypothesis at the 5% significance level and hence to create a unique variable ($X_{TIME(less)_{nj}}$) for waiting time reduction, as seen in Equation 4.

Looking at the coefficients for the quadratic terms, the benefits from a marginal increment in the number of both types of bird species increased at a decreasing rate. The individuals' utility function was concave with respect to the number of 'specialist' bird species and 'generalist' migratory ones. Therefore, it was possible to identify a specific number of both types of bird species for which the associated individual part-worth utility was maximized. The negative sign of the coefficient of the interaction between both environmental attributes showed visitors perceived them as substitutes, thus assigning a higher value to 'specialist' bird species when the number of 'generalist' migratory ones is lower, and vice versa. As expected, congestion was also found to affect the part-worth utility of 'specialist' bird species: the negative coefficient of the interaction between 'specialist' bird species and decreased waiting time suggested that visitors valued more 'specialist' bird species when congestion was high. In other words, when the overall chances of viewing all types of birds from the observation cabins are reduced, due to the higher number of users and the longer waiting time, visitors prioritized seeing a 'specialist' over other types of species.

Other interactions were also initially included in the model because they were expected to explain choices, but they were later excluded for the insignificance of their effect. Indeed, likelihood-ratio (LR) tests showed that none of these interacting variables could be retained in the model.[15] This was the case for the interaction between the reduced waiting time and the 'generalist' migratory bird species attributes, included to test whether the level of congestion significantly affected preferences for the environmental attributes (Torres et al. 2009). Additionally, both 'specialist' and 'generalist' migratory bird species attributes were also interacted with a dummy variable indicating whether the visitor was a birdwatcher or not to test if preferences for environmental goods changed according to the type of visitor, as in Christie et al. (2007).[16] The rejection of this latter hypothesis was probably due to the high environmental awareness and nature-based profile displayed by all visitors to S'Albufera.

The WTP for a change in each non-monetary attribute was calculated by following the Hanemann (1984)'s formula, which is provided in Equation 5 for a marginal increase in the 'specialist' bird species attribute. The WTP was measured for an attribute change with respect to the policy-off (BAU) situation. A unit change was considered for the environmental attributes and a discrete change for the non-environmental ones. The BAU level was assumed for the interacting variables. This way, the marginal attribute values were measured. Given the cost coefficient was assumed to be lognormally-distributed, the estimated marginal WTP for each attribute followed a lognormal distribution reflecting the individual-specific marginal attribute values. Table 3 reports the mean and standard deviation describing each attribute's WTP distribution. According to it, the individuals would be willing to pay, on average, for all the proposed improvements in the attribute levels.

Table 3 Mean and standard deviation of the marginal WTP per attribute

	Mean	Std. deviation
X_{SPEC}	1.31	1.12
X_{GEN}	1.00	0.86
$X_{TIME(less)}$	3.84	3.29
$X_{BENCHES(double)}$	1.97	1.69

[15] The LR statistic (2.51) did not exceed the identified χ^2 critical value of 11.34 (for α=0.01). Hence, the null hypothesis that the joint effect of these interacting variables did not significantly contribute to improve model fit, could not be rejected.

[16] A specific question was included in the survey to identify respondents' interests in visiting S'Albufera, thus allowing to distinguish between birdwatchers and non-birdwatchers.

According to Table 3, the mean marginal WTP for 'specialist' bird species (€1.31) was higher than that for 'generalist' migratory bird species (€1.00). To test for the significance of this difference, a T-test for mean equality was performed, after simulating mean marginal values for both attributes through the bootstrapping technique. This latter procedure consisted of repeating the estimation of the RPL model 1,000 times, each one over a different sample of individuals drawn with replacement from the original sample (N=298). From each replication, a lognormal distribution of individual marginal attribute values was derived and its mean, retained. After all replications, a distribution of 1,000 mean WTP estimations for each attribute was obtained. Results of the T-test, performed over the bootstrapped mean marginal WTP for 'specialist' and 'generalist' migratory bird species, indicated that the former was significantly greater than the latter.[17] This finding can be summarized in Figure 1 by presenting the bootstrapped mean marginal values for X_{SPEC} and X_{GEN} over 1,000 replications.

Fig. 1 Bootstrapped mean marginal WTP for X_{SPEC} and X_{GEN} over 1,000 replications

Based on this result, it would be suitable to particularly safeguard 'specialist' bird species under CC and hence to protect the heterogeneous character of S'Albufera. However, any intervention in this direction requires taking into account that the benefits from incrementing the number of 'specialist' bird species depend on the levels of efforts that managers might implement on X_{GEN} and $X_{TIME(less)}$. To inform planners about the effect that their decisions concerning other policies might have on the benefits from 'specialist' bird species preservation, Table 4 analyzes the sensitivity of the mean marginal value of the 'specialist' bird species attribute under different levels of X_{GEN} and $X_{TIME(less)}$.

Table 4 Mean marginal WTP for X_{SPEC} under different levels of X_{GEN} and $X_{TIME(less)}$ [a]

	$X_{TIME(less)} = 0$	$X_{TIME(less)} = 1$
$X_{GEN} = -10$	1.31	1.08
$X_{GEN} = 0$	1.21	0.98
$X_{GEN} = +5$	1.16	0.93

[a] To check if the mean marginal value of X_{SPEC} was sensitive to changes in the levels of the interacting variables (X_{GEN} or $X_{TIME(less)}$), T-tests for mean equality were undertaken. Each time, a T-test was performed by comparing a pair of vectors of 1,000 bootstrapped mean marginal values of X_{SPEC}, which only differed from each other in the level of one of the interacting variables. When changing the level of X_{GEN}, T-test statistics ranged between 5.89 and 31.10; and when different levels of $X_{TIME(less)}$ were considered, t-statistics varied between 28.26 and 53.99. In all cases, t-statistics exceeded the critical value of 1.96 (for α=0.05), thus suggesting that different levels of X_{GEN} and $X_{TIME(less)}$ significantly affected the mean marginal value of 'specialist' bird species.

Results of this sensitivity analysis show that the mean value for a marginal increment in 'specialist' bird species was found to significantly decrease by €0.01 for each extra 'generalist' migratory bird species, in line with the results in Table 2, showing 'specialist' bird species and 'generalist' migratory ones acted as substitutes. Furthermore, findings indicated that the value of one additional 'specialist' bird species was significantly higher by €0.23 under current congestion levels with respect to a reduced congestion scenario, supporting the idea that visitors appreciated more 'specialist' bird species under high congestion.

The sensitivity analysis in Table 4 was then employed to provide policy-makers with useful information concerning the optimal number of 'specialist' bird species that should be preserved under various possible scenarios, characterized by different levels of efforts on the interacting variables (X_{GEN} and

[17] The t-statistic (46.29) exceeded the critical value of 1.96 (for α=0.05), such that the null hypothesis of equality between mean marginal values was rejected.

$X_{TIME(LESS)}$). For each scenario, this information can be obtained by identifying the number of 'specialist' bird species making the mean marginal value equal to zero and, hence, maximizing the effect on the utility visitors get from this attribute (i.e. part-worth utility of the 'specialist' bird species' attribute). Overall, results of this analysis, shown in Table 5, indicated that visitors wished an increase in the number of 'specialist' bird species with respect to the current level. This means that the implementation of adaptation policies oriented to maintaining the present number of 'specialist' bird species would be sub-optimal. However, the required increment in the number of species for this avian group was also found to vary according to the level of the interacting variables considered. Visitors would demand a lower increase in the number of 'specialist' bird species (1 less) in a scenario of higher availability of 'generalist' migratory bird species (5 more). Similarly, they would require a lower increase in 'specialist' bird species (5 less) under a reduced congestion scenario.

Table 5 Partworth utility maximizing number of 'specialist' bird species under different levels of X_{GEN} and $X_{TIME(less)}$ [a]

	$X_{TIME(less)} = 0$	$X_{TIME(less)} = 1$
$X_{GEN} = -10$	+ 16	+ 11
$X_{GEN} = 0$	+ 14	+ 9
$X_{GEN} = +5$	+ 13	+ 8

[a] Partworth utility maximizing number of 'specialist' bird species is reported as a variation with respect to the current level.

Discussion and conclusions

This study has focused on wetland management in a context of increasing need for adaptation to CC. Indeed, adaptation in wetlands should represent a priority for managers to avoid the welfare losses that especially visitors are expected to suffer due to CC-induced negative impacts on wetland-dependent species (Millennium Ecosystem Assessment 2005). Under the recognition that welfare-based analysis can better inform policy-makers in the design of socially efficient interventions, this work has examined, through a CE application, the preferences for two types of adaptation policies of a sample of visitors to S'Albufera wetland (Mallorca).

Results show the importance of preserving species' diversity under CC. In this sense, they acquire special relevance because the loss of species' diversity has represented a largely neglected impact in mainstream wetland adaptation literature. Indeed, the existing studies have almost exclusively focused on policies aimed at avoiding the loss of species' abundance, thus dealing only scarcely with species' diversity (Anthony et al. 2009; Kingsford 2011; Palmer et al. 2009). To provide evidence of the value of species' diversity, this CE study has used two separate management attributes: the change in the number of 'specialist' bird species to reflect the loss of species' diversity and the change in the number of 'generalist' migratory ones to reflect the loss of species' abundance. Findings show that visitors display positive preferences for both 'specialist' and 'generalist' migratory bird species, though the first ones have a significantly higher mean marginal value than the second ones (€1.31 vs. €1.00). Thus, results highlight a higher desirability of adaptation policies oriented to avoiding the loss of 'specialist' species and hence of species' diversity, thus suggesting the need for reversing current trends and adaptation management practices in wetlands. These findings contribute to an emerging literature drawing similar conclusions in contexts other than wetlands. Indeed, Lundhede et al. (2012) and Lundhede et al. (2013) also outline people tend to prefer actions targeted at native instead of immigrating species under CC when it comes to conservation of bird species in Denmark. However, the results of this study acquire special relevance when the focus is on humid lands, as they are among the biodiversity-richest ecosystems. Thus, prioritizing the preservation of species' diversity in wetlands will not only positively contribute to maintain the local but most importantly the global level of biological diversity, which represents one of the major goals set by the International Community (Araúlo et al. 2011; Ramsar Convention Secretariat 2010).

The importance of preserving species' diversity has been further reinforced by the fact that visitors not only found it desirable to maintain but even to increase the level of species' diversity. Indeed, they were found to maximize their utility under CC when the number of 'specialist' bird species was incremented with respect to the current level. Though, the achievement of this target will be progressively harder given the growing homogenization process in wetlands, especially in the Mediterranean region, through which many 'specialist' species will be substituted by few 'generalist' ones (Clavel et al. 2010). For this reason, just the maintenance of current levels of these species would already represent a challenge. In this sense, the results highlight that managers might also consider combining policies to protect specialist' bird species with measures to increase 'generalist' migratory ones or to reduce waiting time. This is because the analysis shows that a lower increase in the number of 'specialist' bird species would maximize visitors' utility under these scenarios.

The findings of this CE application have important implications not only for wetland management in a context of adaptation to CC, but also for tourism planning. Indeed, higher preferences for preserving 'specialist' bird species and hence species' diversity reflect the tastes of a sample of visitors to S'Albufera mostly being nature-based tourists (84.47%), coming to Mallorca for nature enjoyment (44.12%) and being repeaters to this wetland (53.73%). Under this light, it is to expect that the implementation of policies oriented to increasing the heterogeneous character of wetlands would attract more nature-based tourists to the destination. Given that nature-based tourism is a fast growing segment (annual rate of increase between 10% and 30%), this is believed to represent a good strategy of differentiation and creation of a long-term competitive advantage, allowing the wetland and the destination to achieve a better position over competitors. In these terms, promoting the preservation of environmental quality seems to be desirable both as a wetland management measure of adaptation to CC and as a tourism plan.

As a matter of fact, in a framework of increasing environmental awareness and tourist demand for high environmental quality, tourism has the potential to positively contribute to wetland and environmental protection and, in turn, to benefit from that. However, there is a number of bidirectional influences, both positive and negative (Ballantyne et al. 2011), characterizing the binomial tourism-environment, which need to be carefully considered to make this relationship work favorably (Marton-Lefèvre and McCool 2008). In this sense, environmental planners need to incorporate more the anthropogenic dimension into the management of ecosystems, while tourism planners are required to design more sustainable tourism activities, which implies including the consideration of the environment in policy-making processes. This involves not only undertaking measures oriented to promoting environmental conservation, research and divulgation; spreading cultural values associated to the local environment; and sustaining the local community (Fischer et al. 2014; Walpole and Thouless 2005), but also doing it on the basis of welfare-maximization. In turn, and to meet the goals of strict planning and collaborations between the stakeholders set by the RAMSAR Convention and the UNWTO (Secretariat of the Ramsar Convention on Wetlands & World Tourism Organization 2012), the use of decision tools such as social Cost-Benefit Analyses and Multi-criteria Decision Analyses becomes crucial to ensure the chosen policies are socially desirable.

Despite the contributions of this study, some limitations and recommendations for future research need also to be outlined. On the one hand, further research is encouraged to investigate preferences for adaptation policies addressing both the quantitative and qualitative implications of CC impacts on wetland-dependent species to check for the robustness and generalizability of our conclusions. On the other one, the analysis of this study has been developed under the assumption of environmental certainty, which is common in the SP literature. However, important sources of uncertainty are associated with CC impacts. Indeed, it is difficult to predict the increase in the planet's average temperature and its associated consequences on climate due to either unforeseen variations in the ocean and cloud systems or the outbreaks of unexpected extreme events (IPCC 2013). In this framework, extending the analysis to a context of environmental uncertainty would be recommended, as the assumption of certainty might not be without consequences in social welfare terms.

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APPENDIX

ATTRIBUTES	POLICY L	POLICY M	NO POLICY INTERVENTION (C)
'SPECIALIST' BIRD SPECIES	+5 Increase the current number by 5	= Keep the current number	-10 Decrease the current number by 10
'GENERALIST' MIGRATORY BIRD SPECIES	+5 Increase the current number by 5	+5 Increase the current number by 5	-10 Decrease the current number by 10
WAITING TIME	≃3' Wait about 3 minutes for a seat in observation cabins	≃7' Wait about 7 minutes for a seat in observation cabins	≃15' Wait about 15 minutes for a seat in observation cabins
REST-STOP BENCHES	x2 Double the current number throughout the park	x3 Triple the current number throughout the park	= Keep the current number
ENTRANCE FEE	€16	€8	€0

Fig. 1 Bootstrapped mean marginal WTP for X_{SPEC} and X_{GEN} over 1,000 replications