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Economic valuation for water quality and river restoration in the Southeast of Spain

Abstract

The Water Framework Directive (WFD) aims at improving the ecological status of the European water bodies. In this context, some rivers restorations are been carried out in the present time. In accordance with this Directive, the restorations have to be evaluated from an economic and social approach. In the case of the rivers restoration, this work applies the Choice Experiment method to the rules of the WFD. It shows its applicability for the economic valuation of the restoration measures and, at the same time, it is a way of public participation for the society. In this sense, the water quality improvement has been defined as a priority action from a social point of view. Moreover, the method used has also allowed providing an answer to the basic questions of the WFD. Firstly, the economic value of the Segura River ecological flow has been estimated, which ecological flow decrease would mean an environmental cost. Secondly, the environmental income generated by this river has been calculated.

Classification System: D62, D71, Q25, Q57

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Introduction and objectives

The services provided by the hydrological ecosystems – in especial the rivers – are a development society source (Klessig 2001). These services can be classified in four big categories (Brauman *et al.* 2007): first of all, *provisioning services*, which provide goods such as food, freshwater, and irrigation water. Secondly, rivers offer *regulating services* as water purification or reduction of flood damage. Thirdly, rivers also supply cultural services, including recreational activities taking place in the river and its surroundings, and the cultural heritage connected to the river. Finally, *supporting services* are the ecosystem processes that produce the above mentioned services. Despite the social interest in order to maintain and protect the river ecosystems, in the whole world the goods and services that the rivers provide have been damaged due to the pressures and impacts caused by human activities (Sari *et al.* 2003; Fianko *et al.* 2008; EEA 2009), which make the available water quantity and quality decrease. Therefore, it is essential to maintain the ecological flow that allows preserving the ecosystem (EEA, 2009). The conservation of the rivers is especially important in the current context of climate uncertainty (Ormerod 2009) because the correct river management is fundamental for its future preservation (Palmer 2008).

Being aware of this, the United States and the European Union (EU), among others, have legislated in order to protect and preserve the rivers (Bouleau 2008). In the case of the EU, this interest is reflected in the Water Framework Directive (WFD), which was passed in the year 2000 (European Commission 2000). The main objective of this Directive is to achieve a good ecological status for all the water bodies by 2015. Some important innovations in relation with the water resources management have been introduced, such as taking a river basin approach for the water resources management and the need of public participation in the hydrological planification. Furthermore, one of the newest contents of the WFD is the outstanding role given to Economics (WATECO 2003). In the new Basin Management Plans, an economic analysis of water use must be made (article 5); the recovery cost of the water services must be achieved, including both resource and environmental costs (article 9); finally, a selection of a Programme of Measures for each River Basin District on the basis of cost-effectiveness criteria must be selected (article 11) (Almansa & Martínez-Paz 2008).

Among the accepted measures to improve the ecological status of the water bodies, depurating wastewater has to be highlighted as well as rivers restoration projects. In accordance with the WFD, both measures have to be evaluated from a social and economic perspective (Stemplewski *et al.* 2008). In this way, Economics changes into another tool in order to manage the environment (Bennett 2002).

The objective of this paper is to assess an economic and social valuation of water quality improvement and also of the environmental restoration projects in a stretch of the Segura River (Southeast of Spain). This valuation has to be made employing a hypothetical market by means of a Choice Modelling (CM). This method has been used for the economic valuation of non-market goods, such as environmental goods (Lourviere 1973; Hanley 1998; Carlsson 2003), and also to evaluate social preferences in the design of policies related to the environment (Jin *et al.* 2005; Martínez-Paz *et al*. 2009a). In general, applying CM to the water management is quite recent, and it is an important information tool for managers, as well as an useful instrument to make the society public participation easier (Morrison *et al*. 1999). This paper also aims at obtaining an economic value for the ecological flow of the Segura River. In a situation of desertification, as the one that the Segura River Basin is undergoing (Onate *et al.* 2005), this value is crucial to justify the environmental flow maintenance to the detriment of other economic uses (McFall 2002; Soler 2003).

With reference to previous studies, the work made by Mitchell and Carson (1993) is worth to be pointed out. In this work, the willingness to pay for different water qualities depending on their final uses (fishable, boatable and swimmable water) is estimated. One of the applications of the Choice Modelling for the study of the systems concerning water is the one of Carlsson *et al.* (2003), who identify the attributes, which make the value of the Swedish wetlands increase or decrease. On the one hand, Birol (2006) uses the CM method to value the management policies used in the case of the Cheimaditida wetland (Greece). On the other hand, Zhai *et al.* (2007) employ the CM approach to analyze the social preferences in relation to the flood prevention measures in the Toki-Shonai River basin sited in central Japan. Besides, Brouwer (2004) applies the prescriptions proposed by the WFD, and the public benefits resulting from the good ecological status of the Scheldt River (Belgium) are calculated by means of a Contingent Valuation. Another important study is the one carried out by Saz *et al.* (2009), who compare the Contingent Valuation Method and the Choice Experiment to obtain the economic value of the hypothetical water quality improvement in the Serpis River (Spain), which was chosen as the pilot basin for the implementation of the WFD. Within this group, the work made by Martínez-Paz *et al*. (2009b) estimates both the environmental and the resource costs associated with the overexploitation of an aquifer in the southeast of Spain.

Analytical framework

Choice Modelling (CM) approaches are a set of techniques to analyze the preferences based on the principle that a good can be described in relation to its attributes –defining characteristics- and the corresponding levels of each of them. Taking into account this characterization, people can choose among different combinations of attributes and levels. Thus, the total value assigned to a good by a person results from the values of the most relevant attributes composing that good. The application of this method consists of showing to the individual a series of alternatives in relation to a good. These are distinguished by the levels of each of the attributes. The individual has to choose among them and to express his own preference. In this way, the individual answers implicitly how each of the attributes of a particular good is valued (Viney *et al.* 2002).

The valuation can be monetary or not. If it is not monetary, it consists of classifying the options in accordance with the preferences or, on the contrary, to make a valuation in monetary terms, which requires the incorporation of the prices to be paid for each of the different alternatives presented. The payment vehicle has to be indicated too. Once the different alternatives -or profiles- have been designed, the type of CM is chosen. Basically, there are four different techniques: Choice Experiment, Contingent Rating, Contingent Ranking and Paired Comparisons (Pearce & Ozdemiröglu 2002).

The treatment of the data in a CM is based on the Random Utility Theory (Lancaster 1966). This theory states that the consumers take their decisions maximizing their utility, which is composed of a deterministic or observable component and another random or non-observable term. Considering that the attributes are linear, this utility function can be estimated by different statistical techniques as, for example, the discrete choice models and the conditional logistic models (McFadden 1984). In the case of Contingent Rating and Contingent Ranking, which have been employed throughout this work, the ordinary least squares or the Tobit model (Greene 1997) can be used.

In this paper, to estimate the utility function, the following Tobit model has been applied:

$$r_{ij} = c + \sum_{\forall k} \sum_{\forall m} \beta_{km} X_{km} + \varepsilon_{ij} \; ; \quad \varepsilon \in N(0, \sigma^2)$$

$$r_m \leq r_{ij} \leq r_M$$

Where c is a constant, r_{ij} indicates the ranking of preference on the *i*h alternative for the *i*th person –censored below r_m and above r_M-. β_{km} is the part-worth utility for the level *m*th of the attribute *k*th, and X_{km} is 1 if the attribute belongs to the alternative, or 0 if it does not. Finally, X_{km} takes the value of the attribute when it is a continuous variable.

A high part-worth value (β) means that the level associated to the attribute gives a high social benefit, while a low part-worth means that the associated level provides a low utility or a non-utility at all if the value is negative. Starting from the part-worths*,* the importance (in absolute and relative terms) that people give to the different attributes are part of the experimental design; it is based on the difference between the highest and the lowest part-worth in absolute terms (Pearce & Özdemiroglu 2002).

Regardless of the method used, the higher value β_{ij} has in the model, the more utility will be provided by the associated level. From these utility values, the relative importance of each attribute can be determined (Halbrendt *et al.* 1991). The importance of each attribute corresponds to this expression:

$$imp_k = \left| max(\beta_{km}) - min(\beta_{km}) \right|$$

The relative importance of each of them can be calculated in the following way:

$$Rimp_k = \frac{imp_k}{\sum_{k=1}^{K} imp_k} \cdot 100$$

If an ordered Logit model has to be estimated, the probability that the individual *i*th chooses the alternative *j*th (P_{ij}) is obtained following this mode, which aims at achieving a logistic distribution (McFadden 1984):

$$P(U_{i1} > U_{i2} > .. > U_{in}) = \prod_{j=1}^{J} \frac{e^{Vij}}{\sum_{j=1}^{J} e^{V_{ij}}}$$

The structure of this ordered model means that the probability that a *j*th alternative is selected by the *i*th individual is a function that belong to the systematic part (V_{ij}) of the utility function of that individual for that particular alternative (*j*) and all the others j (V_{jk}) belonging to the CM (Arriaza *et al*. 2007). This model can be estimated by maximum likelihood, where F is the logistic distribution and r^*_{ij} is a non-observable variable that quantifies the different categories from the real variable (r_{ij}):

$$r^*_{ij} = F(\beta_{km} X_{km}) + \varepsilon_{ij}$$

Starting from the β parameters obtained in this model, the marginal willingness to pay for any one of the attributes can be calculated according to (Pearce & Özdemiroglu 2002):

$$IP = -\left(\frac{\beta_k}{\beta_m}\right)$$

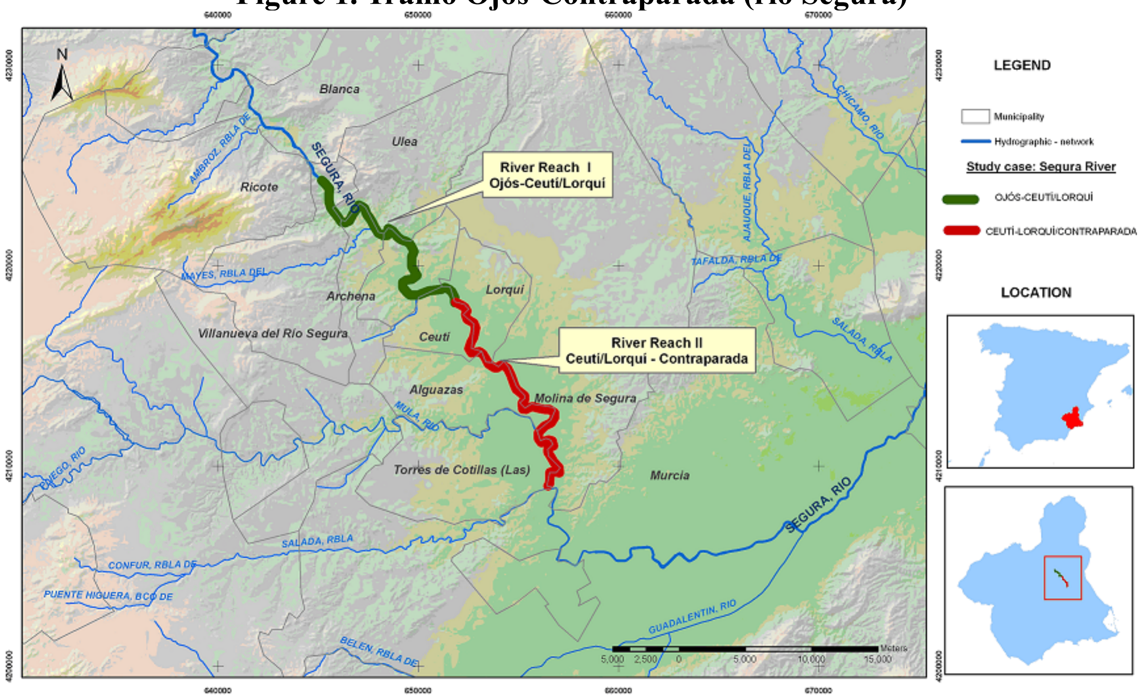
In this formula, the attribute k corresponds to any of the attributes proposed, and m is the one belonging to the monetary attribute. The implicit price (IP) indicates relatively the welfare state of the people. It shows the maximum willingness to pay that the respondents would have in order to pay for the valuated goods and services (Hanley *et al*. 1998).

Data

Study case: the Segura River

The studied area is located in the Segura River, in particular in the Vega Media zone that belongs to the Murcia Region (Southeast of Spain). The stretch studied is known as Ojós-Contraparada. This has 34.24 Km, and it traverses several municipalities (Fig. 1).

Figure 1. Tramo Ojós-Contraparada (río Segura)



In this area of the Segura River, there are mainly crops. These are, along its extension, combined with pasturelands, esparto fields and scrublands together with pine forests. Next to the river, species such as the *Chamaerops humilis, Tamarix boveana* and *T. Gallica* are commonly found. There is a particular place in this stretch of the river that is called Ricote Valley. In this place, there are many chaparrals with *Pistacia lentiscus* and *Rhamnus lycioides* together with traditional crops of Arabian origin (Mignot *et al.* 2007). These natural and cultural values have allowed the Ricote Valley to be proposed as a World Heritage Site in numerous occasions.

With regard to the fauna, the presence of the *Lutra lutra* is outstanding in the best preserved stretches. There are other mammal species that have been also identified; these are, among others, *Mustela nivalis, Vulpes vulpes* and *Martes foina*. In the case of the fish population 12 different species autochthonous from the Iberian Peninsula have been identified in the Segura River. These are, for example, *Barbus sclateri*, the *Chondrostoma polylepis, Leuciscus idus, Gobio gobio* and *Tinca tinca.* Most of these species can be found in the first kilometres of the Ojós-Contraparada stretch, where the water quality is good enough for their development (Andreu-Soler *et al.* 2006).

In spite of the natural and cultural heritage associated with the river, this area in particular has been damaged along history because of the human activity. The result of this fact has been the strong deterioration of the ecosystem because of the water pollution, disappearance of the riparian vegetation and the residues accumulation. An evaluation of the ecological status of the Ojós-Contraparada stretch is found in the reports elaborated by the Segura River Basin District on the score of the implementation of the WFD (DHS 2007). As it can be seen on the table 1, this report divides the stretch into two water bodies with different ecological status:

Table 1. Ecological Status of the Ojós-Contraparada Stretch (Segura River, Spain)

Water Body	Biological	Hydro-morphological	Physicochemical	Ecological status
Segura River from Ojós to Ceutí-Lorquí	Good	Good	Good	Good
Segura River from Ceutí-Lorquí to Contraparada	Bad	Bad	Moderate	Bad

The minimal ecological flow for this stretch of the Segura River is well-established in the Spanish National Hydrological Plan. Its flow has $3m^3/s$ for the ecosystem maintenance and the emissions dilution (MMA 2001). Note that the urban and industrial emissions to water are treated; although, some pollution events continue to take place due to the illegal emissions. In spite of the established rules, the minimal ecological flow maintenance is not always respected, and it causes an environmental impact on the water body (DHS 2008).

With regard to those ecosystems associated with the Ojós-Contraparada stretch, the riparian vegetation is visibly damaged. The reasons for this degradation are basically the occupation of the riverbanks, the canalization along the urban stretches, the reduction of the flow in the river because of their derivation to irrigation crop areas, the variation of the flow because of the dams located in the upper reaches of the river, and, finally, the invasion of the alien species, which compete with the autochthonous ones and modify the structure of the river. These are, for example, *Arundo donax* and *Phragmites communis* (figure 2).

Figure 2. The Segura River in the Stretch of Ojós-Contraparada

In order to confront the environmental problems concerning the Segura River, nowadays some projects, that aim at restoring and conserving the natural heritage and to foster the direct and indirect use of the Ojós-Contraparada stretch, have been implemented (MMA 2001 & 2004). Firstly, a revegetation with riparian species has been accomplished. The benefits from this riparian management are, for example, the nutrient retention, habitat enhancement multiple and sediment control (Larsen *et al*. 2009). Secondly, some other works are been undertaken, for example, the creation and signalling of routes, interventions in order to improve the connexions between the river and the populations reforming the roads and the accesses, fitting-out paths and restoring old waterwheels (Rojas-Sola & López-García 2007).

Additionally, the establishment of an ecological flow in agreement with its natural regimen and a precise control of the water quality are expected. Consequently, the social and ecological functions of the Segura River in the stretch analyzed shall be well-restored.

Figure 3. Restoration Projects

Survey Design and Implementation

The here applied valuation method is the Choice Modelling by means of Contingent Ranking (CR). The CR is included in a face-to-face survey that tackles with different aspects of the river management. The questionnaire consists of two parts. The first one deals with the existing relation between the people and the river, as, for example, the number of times they visit it, the activities made in its surroundings, the water quality valuation, the consideration of the management policies, etc. Moreover, some socioeconomic information about the people is also gathered. The second part of the questionnaire is the so-called CR.

The CR specially designed for this work is made up of three attributes: Water Quality Improvement, Restoration Measures and Annual Payment. The first two attributes are directly related to the river management. The "Water Quality Improvement" is a required condition for the ecosystem support. The attribute "Restoration Measures" is referred to the environmental recovery activities that are currently been employed to improve the riverbanks and the public use of the river conservation status. The third attribute represents the "Annual Payment", which function is supporting the two above. In this way, the respondents express their preferences in a hypothetical market.

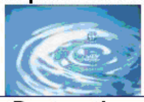
Table 2. Attributes and Levels of the Contingent Raking

Attributes	Levels of the Attributes		
Water Quality	Status quo	Quality associated to the ecological flow maintenance.	Fishable and swimmable quality water, etc.
Restoration Measures	Status quo	Riverbanks restoration, information boards, cultural heritage restoration, etc.	
Annual Payment	0 €	20 €	40 €

The table number 2 shows the different attributes and levels that take part in the CR. The "Water Quality" attribute has three levels. The first level has to do with the current situation of pollution and the irregularities in the ecological flow maintenance. The second level represents the quality of the ecological flow in this particular stretch, as it has been stated in the Basin Management Plan. Finally, the third quality level concentrates on achieving the best quality options, which would allow attaining the biggest number of goods and environmental services, such as swimming, fishing, canoeing, and it would also increase biodiversity. The second attribute, "Restoration Measures", has two levels. The first one represents the current degradation status of the surroundings. The second one reflects the environmental recovery previously mentioned. In the last attribute, "Annual Payment", three different levels are distinguished (0€, 20€ and 40€). These levels are based on the information collected from the pilot survey that was developed previously in this research. The payment vehicle is incorporated by means of an increment in the water bill. This contribution would be used for the environmental restoration of the Segura River. This payment vehicle has been chosen because it was the best valued one in the pilot survey, where 71% of the respondents selected this measure to help with the environmental recovery of the river.

The different number of possible management alternatives with the combination of these 3 attributes and their levels are 18. It makes up the complete design of the CR. Due to the difficulty of putting in order the 18 different combinations because of the extra time that the respondent would have to devote to it and the effort -that would make the number of random responses increase considerably -, it was decided to work with a Fractional Factorial design (Huber & Zwerina 1996) containing half of the possibilities (9). Although it is less explicit, it continues to inform the respondents about their preferences. It aims at estimating the utility function that underlies all their choices, which is, of course, the main objective of this process.

Figure 4. Choice Set Design

	ALTERNATIVES								
	A	B	C	D	E	F	G	H	I
Quality Water Improvement 	=	↑↑	↑↑	=	↑↑	↑	↑	=	↑↑
Restoration Measures 	=	↑	=	↑	=	↑	=	=	↑
Annual Payment 	20 € 1,66€ per month	20 € 1,66€ per month	40 € 3,33€ per month	40 € 3,33€ per month	0 € 0€ per month	0 € 0€ per month	20 € 1,66€ per month	0 € 0€ per month	40 € 3,33€ per month

The design that was finally implemented appears in the Choice Set that can be seen in the figure 4. Each one of alternatives obtained, which goes from “A” to “I”, should be put into order, as if it were a ranking. People have to do it taking into account their own desires. The 1 corresponds to the highest value, while 9 is the lowest one. The Choice Set has been designed to facilitate the comprehension of the CR. In this way, a red equal sign is employed for the two management attributes, which means that the corresponding attributes continue to be the same. Meanwhile, a blue arrow represents an improvement in the respective attributes. Lastly, the annual contribution quantity corresponding to each alternative is pointed out.

This design includes the *status quo* (H alternative). It allows also making a monotonicity or dominance test to the experiment. Among the alternatives presented in the experiment, some of them offer a bigger or equal improvement with a lower cost. These should be chosen at first by assuming the non-satiety consume hypothesis (Lancsar & Louviere 2006). Bearing in mind that the survey has been made by non-expert people and by people that were not familiarized at all with this kind of eliciting valuation, the study of possible inconsistency in the responses (due to mistakes, random responses, etc) is specially interesting in this case.

The survey was made by means of face-to-face interviews and also by means of a simple random sampling. It was made by people above 18 years-old living in Segura River riverside districts. The purpose was to obtain a number of responses based on a minimal knowledge or relationship with the river and with the stretch under consideration. Because of the age requisite, people under 18, which may not earn money, and therefore, do not participate in the market, were excluded. Given these conditions, the target population had 901828 people. Finally, 400 surveys had been made from May to June 2009. The error is between 3% and 5%, and the confidence interval is 95.5%.

Results

Before exposing the CR main results, it is worth to present the respondent profile, which is obtained from the rest of the enunciated questions. The individual is 39 years-old approximately. He -or she- is at work and has a university degree. The income of this individual is 746 €/person, and the number of members in his family is 4 people.

This individual considers the environmental problems really important. In particular, he cares about water scarcity in the Murcia Region, and he believes that the different Public Administrations are not concerned enough about the protection, preservation and restoration of the rivers. He knows the Ojós-Contraparada stretch, and he estimates that the quality of its water is not really good. Nevertheless, it shall be indicated that he neither possesses a direct relationship with this stretch of the river, nor knows the environmental recovery projects that are actually been implemented in this area. Even though, he valuates these projects in a positive way; thereupon, he decides to economically contribute in order to help with the projects. What is more, the individual has a certain degree of environmental sensitivity, and he considers that the environmental degradation is a problem to be solved; nonetheless, frequently he does not behave accordingly. The results that have been here presented are in consonance with those collected in the work of Martínez-Carrasco *et al*. (2009).

Previous to the analysis of the CR, as it was proposed in the section devoted to the experiment design, it is necessary to make a data depuration by means of a test for dominance of alternatives. Before surveying, it was considered that the two attributes related to management policies would be chosen in their highest levels, and the attribute related to the economic contribution would be chosen on the basis of the lowest quantity. However, during the pilot survey, and even more during the survey process, it was observed that the initial supposition was not always reflected in the responds of the people.

In the case of the attribute "Restoration Measures", some people disagree with this kind of projects because they do not believe that it is the best way to completely restore the river. Others also think that there will be an increase in the pressures that would mean a bigger number of people using the river. On the other hand, some people believe that it is necessary to face such projects. Thus, answers can not be predicted in relation to this attribute. In this way, in the Choice Set the inconsistent answers will be:

- To choose the alternative A before the alternative E.
- To choose the alternative D before the alternative I.
- To choose the alternative H before the alternative E.

There were 87 people who gave any of these inconsistent answers when ranking the options. These people have to be eliminated from the sample because the information that they provided to the experiment in relation to their preferences were not trusty (Johnson & Mathews 2001). Notwithstanding, before ruling their answers out, following the recommendations given by Ryan and Bate (2001), it was checked that the characteristics of the inconsistent group were not meaningfully different from the rest as for the basic socio-economic parameters (age, income, level of study, sex and locality). The inconsistent percentage goes up to 22% from the total of respondents. This result is similar to those obtained in similar essays (Foster & Mourato 2002). Finally, after deleting from the initial sample those surveys with inconsistent answers, a total amount of 313 surveys was available.

The Tobit analysis has been employed to calculate the total utility function, and also to estimate the partial utility provided by each attribute in each of their levels; that is to say, to quantify the preference of the surveyed people for each attribute. In order to adapt the CR to the estimation process, the "Water Quality" attribute has been divided into two variables (X_{ij}): “Quality I” and “Quality II” that have a binary nature, as it was explained in the methodology. By means of a Tobit model, the estimated utility function results as follows:

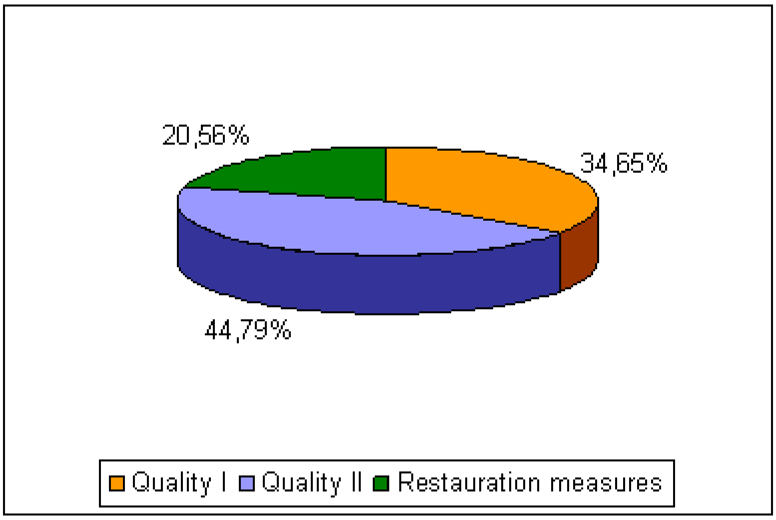
Table 3. Estimation of the Utility Function

Attribute	β	t-stat	Sig.	Confidence interval (95%)	
Constant	-6.635	108.539	0.000	-6.755	-6.515
Quality I	2.798	-28.316	0.000	2.605	2.992
Quality II	3.618	-44.814	0.000	3.459	3.776
Restoration measures	1.661	-23.521	0.000	1.523	1.799
Annual payment	-0.067	31.093	0.000	-0.071	-0.062
N = 2,817 Pseudo R^2 = 0.436 Log-likelihood = -5309.500					

The obtained adjustment is acceptable because of the R^2 value for the quantity of observations used (Greene 1997) and the fact that the Pearson correlation coefficient –between the observed and estimated preferences- has a value of 0.972 with a signification of 0.000.

All the scrutinized coefficients are statistically significant, and their coefficient signs coincide with the theoretical expectative existing about them. The actions dedicated to the environmental restoration of the Segura River are positively valuated by the respondents, while the “Annual payment” variable subtracts utility to the people. The attribute with the biggest part-worth associated is the “Quality II”, followed by “Quality I” and by “Restoration measures”. Eliminating the economic contribution from this decomposition, the levels of relative importance of each management attributes are directly obtained. These are shown in figure 5.

Fig. 5. Relative Importance of the Management Attributes



To achieve a “Quality II”, or what is the same, to make a complete recreational use of the river, which also provides an excellent support for the ecosystems, is a priority. Obviously, to get that quality level means to respect and also to maintain the minimal ecological flow. This is connected to the “Quality I” level. The amount dedicated to restoration measures is relegated to the background, while the opposite happens with that devoted to the naturalization of the surroundings, which absorbs almost the 80% the importance of the environmental proposed measures. A similar result is the one obtained by Morrison (2002), which in the evaluation of the wetlands of Australia detects that the inhabitants from Sydney were willing to pay more for the habitat protection of the aquatic species than for preserving employments connected to irrigation activities.

The second part of the analysis consists of calculating the Implicit Prices of the attributes. The table 4 shows the results obtained after examining the ordered Logit model. In order to obtain the confidence intervals for the coefficients of the ordered model (Mealli & Rampichini 1999), the estimation has been executed by means of bootstrap of 1000 repetitions (Gill *et al.* 2009). The elevated value of the pseudo R^2 indicates the good adjustment of this model (McFadden 1974).

Table 4. Estimation of the Logit model

Attribute	B	Z-stat	Sig.	Confidence interval (95%)	
Quality I	3.195	28.274	0.000	2.974	3.417
Quality II	3.901	36.706	0.000	3.700	4.118
Restoration measures	1.840	23.315	0.000	1.685	1.994
Annual Payment	-0.068	-25.936	0.000	-0.073	-0.063
N = 2817 Pseudo R^2= 0.498 Log-likelihood = -4926.051 Likelihood ratio test: $\chi^2(4)$ = 3213.93 [0,0000]					

All the coefficients are significantly different from zero and have the expected sign given the utility function previously estimated. The marginal willingness to pay for the management attributes has been estimated. Table 5 contents the implicit prices and 95.5% confidence intervals for Logit model.

Table 5. Implicit prices of the attributes

Attribute	IP (€/year/per)	Confidence interval (95%)
Quality I	46.99	47.21 – 54.24
Quality II	57.37	50.68 – 65.37
Restoration measures	27.06	23.08 – 31.65

As it can be observed, the value that the respondents have given to the “Restoration measures” action goes up to 27.06 €/year/person. On the other hand, as it is stated in the Segura Basin Hydrological Plan, the IP, which would mean guaranteeing the ecological flow of this stretch, would be 46.99 €/year/person. Besides, if the chosen option were increasing the water quality levels, so that the river would provide other goods and services (i. e. swimming), it would cost 57.37 €/year/person. The fact that the last IP is higher than the former one validates the estimated model because improving the quality until the second level proposed means necessarily to attain the first level previously.

The IP of the “Quality I” improvement (46.99€/year/person) can be used to calculate the ecological flow value (EFV) established in the Normative. This ecological flow has $3m^3/s$ ($94608000m^3$/year). Given the target population (901821people), an EFV of 0.45 €/m^3 is obtained.

In other respects, from the results relative to the water quality improvement levels, the Environmental Income that would generate the change of the water quality in the river can be measured. Reaching a level of water quality in relation to the establishment of a minimal ecological flow is demanded by the Normative (Quality I), but this decision does not belong to the field of Economics. However, achieving a superior quality status, which allows the development of other activities (swimming, fishing, etc), is already a socio-economic option (Quality II). Hence, the IP difference between both attributes (10.38€/year/person) and the population, which will potentially use the river, allow affirming that the Environmental Income generated by the change of the status of the Segura River in the stretch of Ojós-Contraparada is 9363097€/year.

Conclusions

To sum up, the most outstanding aspects of the social and economic valuation exercise on the environmental restoration of the Ojós-Contraparada stretch (Segura River) shall be exposed:

(1) As it was already explained in the introduction, the entry into force of the FWD has caused a change in the water management field and also in the associated ecosystems. Thus, efforts are now oriented to improve the efficiency in the use of water, the total emissions depuration and in the restoration of the flow systems values. Moreover, as it is specified in the Directive, it has to be made from a multidisciplinary approach, where the Economic Analysis and, to be more specific, the Environmental Economics play a remarkable role.

(2) In this sense, the Choice Modelling (CM), which has been used in this work, is presented as a supporting instrument to justify and/or design the management initiatives to be implemented. Besides, apart from being an economic valuation method, it is a tool for public participation.

(3) Analysing the CM presented via Tobit analysis, both the water quality improvement and the restoration measures are perceived as positive actions. Moreover, it is expected that the economic contribution is a negatively perceived attribute in the restoration plans designs. Apart from qualitatively evaluating the considered attributes, this fact shows the global consistence of both the experiment and the resulting answers.

(4) From the partial utilities of the attributes, a quantitative valuation of the preferences in the restoration plan design is obtained. The management priority is to assure the environmental quality of the river, followed by the restoration measures. In general, it can be said that designing a restoration plan should allocate an 80% of its budget to maintain the good water quality. The rest of the budget would be allocated to other measures.

(5) The Implicit Price (IP) calculated for each attribute has been estimated by an ordered Logit model. From this model, the marginal willingness to pay that the people would have in order to assure the minimal ecological flow is 47€/year/person. Nonetheless, improving the water quality in this stretch to the extent of enjoying the river in optimum conditions that allow the development of other activities means an IP of 57€/year/person. On the other hand, the restoration measures of the place are estimated in an IP of 27€/year/person. Operating with this IP prices, the economic value of the ecological flow value, rises 0.45€/m^3, whose lost would mean an environmental cost in the terms defined in the WFD.

(6) Finally, the Environmental Income calculated for this stretch of the Segura River (9363097€) must be considered in the Cost-Benefit Analysis of the current project as an environmental benefit. This means to restore both goods and services. Works like this could be applied to the Measure Programs evaluation designed in order to attain the objectives of the Water Framework Directive.

(7) These results are only the first step in the quantitative valuation -in monetary terms- of a resource so complex as water is. In the Segura Basin, the water and the use of water is a very controversy issue. The positive externalities that the good ecological status of the river has, which is the main objective of the here calculated values, have to be compatible with the economic uses of the resource. Note the water special capacity to generate income in the studied area. The non-consumptive use of the ecological flows are the key to this compatibility: a good flows circulation planning together with restoration measures plans shall allow the generation of both non-market and market income. Hence, the global welfare of each socio-economic agent would be maximized.

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