Analyzing the social factors that influence willingness to pay for the management of invasive alien species under two different strategies: eradication and prevention.

Abstract

Biological invasions are a worldwide phenomenon, which have been object of ecological and socio-economic research for years. However, there is a limited understanding regarding how different stakeholder groups perceive the problem and how they confront its management under different policies. In this paper, we conducted an econometric analysis of the social factors influencing willingness to pay for invasive alien species management under two different regimes: eradication and prevention in Doñana Natural Protected Area (SW Spain). Controlling for the participation of local residents, tourists and conservationists, face-to-face questionnaires were conducted. Overall, we found that respondents were more willing to pay for eradication than for prevention. Results showed that public support to invasive alien species management was influenced by: knowledge and perception of respondents regarding the effects of species, active interest in nature, and socio-demographic characteristics. We concluded that invasive alien species management research should confront the challenge to include stakeholder engagement and the tradeoffs among different management policies. Finally, our willingness to pay estimations suggest that the Department of Environment of Andalusian Government has enough social support for the expenditures done on invasive alien species management and even to justify an increase in this budget.

Keywords

Contingent valuation; Doñana; Eradication; Invasive alien species; Prevention; Willingness to pay

For several decades, invasion biologists have addressed invasive alien species (IAS) impacts by analyzing community structure, ecosystem processes, and exploring the ecological mechanisms underlying their impacts (Levine and others 2003). However, more and more, different studies explore the socio-economic dimension in biological invasions (e.g., Bardsley and Edward-Jones 2006; Bremner and Park 2007; Andreu and others 2009). The motivation for this change is in part due to the recognition that IAS are one of the greatest threats to biodiversity, and a substantial contributor of global change (Sala 2000), and have effects on a range of ecosystem services essential for human well- being (Charles and Dukes 2007). Consequently, the scientific community recognizes the necessity to apply interdisciplinary approaches and promote a better understanding of the dynamic relationships between humans and the ecosystems services provided by biodiversity (Carpenter and others 2009).

In recent decades, there has been rapid development in the understanding of the economic consequences of IAS. An overview of IAS economics reflects two major trends. One analyzes the overall cost of IAS damage. Public awareness regarding the cost of IAS management is vital, and can serve as an important tool to engage the public in the management process (e.g., Pimentel and others 2005; Xu and others 2006). The other is focused on evaluating cost-effectiveness of management options for IAS, which could provide support for the decision-making process (e.g., Cook and others 2007; de Wit and others 2001). Another important contribution of the economics of biological invasions is quantifying the effects of IAS on ecosystem services, which are not measurable through market data. The contingent valuation (CV) is a non-market technique that uses stated preference methods to estimate the social benefits or loss for improvements or deteriorations in the quality and/or quantity of a good or service (Mitchell and Carson 1989). Although CV has been subject to criticism and has certain limitations, it is a promising method that can be applied to derive valuable information. In fact,

some studies have used this technique to analyze IAS effects not measurable through market data (Jetter and Paine 2004; Nunes and Van den Bergh 2004, McIntosh and others 2010).

Non-market values are useful in providing a comprehensive account of social benefits or damages related to IAS, and serve to obtain accurate information on the social consequences of biological invasions (Leung and others 2002). It is known that IAS cause severe impacts and pressures on ecosystems and biodiversity conservation, however, some IAS exhibit positive economic effects, including use in horticulture (Sanz-Elorza and others 2009), food production (Prescott-Allen and Prescott-Allen 1990), and commercial forestry (Richardson 1998). Ewel and others (1999) found introductions of IAS can be both a boon and bane to society. IAS have the potential to generate services and disservices; understanding disservices as the environmental bads borne by one party without active compensation (Mooney 2005; Zhang and others 2007). From a utilitarian perspective, not all IAS effects are damaging (Binimelis and others 2007). For example, the European catfish (*Silurus glanis*), the largest European freshwater fish, which was introduced in the lower River Ebro (NE Spain) 30 years ago, is described by environmentalist groups as a problem, because it affects the biodiversity of autochthonous species; meanwhile, it is perceived as highly beneficial by municipalities, tourist operators and fishermen, who highlight its economic benefits (Binimelis and others 2007). It is also the case of the zebra mussel (*Dreissena polymorpha*), which main disservices related to: 1) removing planktonic organisms and particulate matter by filtering water and 2) attaching the solid surfaces in very high densities (Johnson and Padilla 1996); could be also consider as services such as: 1) the generation of water clarity through filtration in terms of human enjoyment (Limburg and others 2010) and 2) the economic benefits perceived by the companies managing the damaged infrastructures, respectively. In our study area, species such as the red swamp crayfish (*Procambarus clarkii*) and *Eucalyptus* spp. have socio-economic benefits related to provisioning services such as food, wood, beekeeping, and medicinal uses

(Dana and others 2005; Habsburgo-Lorena 1983). Other species such as *Lepomis gibbosus* and *Micropterus salmoides,* which are used as recreational fish, provide tourism services. However, these species have negative impacts on the hydrologic cycle (Dana and others 2005), competition and predation of native species, and/or have serious impacts on endangered species (Fernández-Delgado and others 2000). Always that it does not compromise a quickly action (Simberloff 2009), the positive or negative effects on different society sectors by IAS introductions should be addressed at the beginning of any decision-making process to consider the tradeoffs involved in IAS management and facilitate successful implementation of management practices (García-Llorente and others 2008).

It is important to be aware about the difference between ecological and socio-economic impacts of IAS from perceived impacts. Damages to ecosystems by IAS have often been less visible to the public. When IAS limit access to resources, or are limited as resources, those people most directly affected are prone to perceive that some aspect of "themselves" is threatened and take action based on this perception (Reaser 2001). For this reason, there is a need to understand the views held by managers and the subsequent implications regarding biological invasions as well as those of society in general, ensuring the coordination and synchronization of management practices (Roura-Pascual and others 2009) and the involvement of all stakeholders impacted by the presence of IAS (Andreu and others 2009). Any opposition from different elements of society (Bertolino and Genovesi 2003), or the lack of awareness about IAS impacts by the general public (Veitch and Clout 2001) and administrations (Bonesi and Palazon 2007) could result in the failure of a management initiative (Stokes 2006).

Furthermore, any decision in IAS management has important financial implications for any conservation budget. For example, over the last 15 years the European Commission has contributed to financing almost 300 projects addressing IAS, for a total budget exceeding 132

98 million € (Scalera 2009). In Spanish NPAs', the main goal of management activities focus on
99 invasive plants are containment, or the complete eradication of the species. Prevention through
100 legislation, education, or communication of the general public has been used less frequently. In
101 terms of monetary cost, the total expenditure on management amounted to 50492.4 € over the
102 last decade, where prevention cost amounted to <1% of the total cost (Andreu and others
103 2009). In this sense, the Convention on Biological Diversity proposes three successive steps in
104 IAS management: prevention, eradication and, if neither of the other steps is possible, control
105 (Secretariat to the Convention on Biological Diversity 2001). The ultimate goal of such actions
106 should be the conservation or restoration of ecosystems to preserve or re-establish native
107 biodiversity and functions. Other possible strategies included containment, which should limit
108 IAS spread either from an invaded region or alternatively exclude species from and uninvaded
109 area or control, which should aim to bring about the long-term reduction in IAS population size
110 towards an acceptable level (Myers and others 2000). If an IAS cannot be eradicated, it should
111 at least be contained, if not contained at least controlled and if not controlled then managers
112 must learn to adapt to or mitigate any harmful impacts (Hulme 2006). Furthermore, the
113 prevention of IAS introductions into and also within a region is widely promoted as being a far
114 more cost-effective and environmentally desirable strategy than actions undertaken after IAS
115 establishment (Leung and others 2002). Taking into account that we conducted our research in
116 Doñana Natural Protected Area (SW Spain), we only analyzed the social preferences for
117 eradication, which involves removal of the whole IAS population from a specific area, and for
118 prevention, which here was conceptualized through communication and education strategies.

119 Therefore, any evaluation of IAS management policies should include an assessment of the
120 non-market cost (Charles and Dukes 2007; Gutrich and others 2007) and social perceptions of
121 IAS (Binimelis and others 2007) for different stakeholders and strategies. We present a method
122 to address this issue by: (1) exploring the motivations that influence support or not for different

IAS management strategies, (2) analyzing the social factors underlying economic support for IAS management, accounting for different stakeholder groups; and (3) assessing the willingness to pay (WTP) estimation results in the context of two different management strategies: eradication and prevention. Influence of stakeholder type on the economic support for IAS management was also analyzed.

We present an empirical case study in which the impact of social factors on WTP for IAS management was analyzed. In addition, the impacts of two different management regimes were explored by a random sample selection, controlling for the participation of local residents, tourists and conservationists. Together these data should be representative of public views on the value of IAS management, the conflicts of interest in IAS management among stakeholders and among different management policies.

Materials and methods

Study area

The study was conducted in the Doñana area (Andalusia, SW Spain), a highly valued biodiversity hotspot in the Mediterranean, supporting many threatened and endemic species (García-Novo and Marín-Cabrera 2005). The Doñana area includes a National Park (54252 ha) and a Natural Park (53835 ha), and their socio-economic influenced zone (Figure 1). Despite the numerous protection and conservation measures adopted (Martín-López and others 2009a), Doñana is suffering from the pressures of IAS, which have markedly changed the ecology of this area (Fernández-Delgado 2006).

In Spain, the responsibility for IAS management falls to the administrative regions, in this sense, Andalusia is the only region with a specific plan running from 2004 (*Andalusian Plan for the Control of Invading Exotic Species*), which is focused on assessing the introduction, establishment, spread, and impact of IAS. Also, Andalusia is the Spanish administrative region

147 with more budget invest on IAS management, with an inversion in the last decade of 29479527
148 € for tackling invasive plants. In particular, IAS management in Doñana began more than
149 twenty years ago with *Eucalyptus* spp. removal plans. Since then, the budget has exceeded 4.5
150 million €, assigned specifically to eradication plans (76% of the total budget) and directed
151 against 17 plant taxa (*Acacia* spp.*, Asclepias curassavica, Agave americana, Arctotheca*
152 *calendula, Arundo donax, Azolla filiculoides, Carpobrotus edulis, Datura stramonium,*
153 *Eucalyptus* spp., *Guizotia abyssinica, Gomphocarpus fruticosus, Ipomoea imperati, Nicotiana*
154 *glauca, Oenothera drummondii, Riccinus comunis, Xanthium strumarium,* and *Yucca* spp.),
155 and one invertebrate (*Trachemys scripta*). The remaining budget is basically invested in
156 research (18% of the total budget) of particular species, such as: *Azolla filiculoides*, and *P.*
157 *clarkii* (for more details about the budget invest in the selected target species of this study see
158 Table 1).

159 ***Sampling strategy and data collection***

160 In order to reflect the variety of opinions and concerns regarding the economics of IAS
161 management, the sample population included residents, visitors, researchers, and individuals
162 involved in public policy. This sample was chosen to reflect the heterogeneity of stakeholder
163 and public views regarding IAS impacts on ecosystem services provided by the biodiversity of
164 Doñana.

165 The questionnaires were conducted at 19 sample points in Doñana, including visitor centers,
166 villages, recreational areas, beaches, and agricultural fields (Figure 1), and in the Department
167 of the Environment of the Andalusian Government located in Seville, Spain.

168 The population was randomly sampled, with the exception of the questionnaires answered by
169 researchers. These questionnaires were emailed to different experts with high-level knowledge
170 of the IAS problems in Doñana. One hundred and thirty seven questionnaires were distributed

171 to researchers, and 51 were completed (37% response rate). The responses obtained in these
172 questionnaires would have been more homogeneous if we had conducted face-to-face
173 questionnaires, but because of the importance of including researchers and because they were
174 located throughout Spain, we developed and administered their questionnaires via email.

175 In total, 472 respondents completed the questionnaire. Data were collected between June 2006
176 and September 2007. Respondents had to be over 18 years of age to be interviewed.

177 ***Questionnaire survey***

178 The questionnaires were divided into two sections. The first was comprised of questions
179 addressing the public's knowledge and perception of IAS social-ecological impacts and
180 attitudes toward IAS introduction. It also included questions regarding the respondent's active
181 interest in nature, and socio-demographic inquiries (for more details see appendix A). This first
182 section was designed to engage respondents in the issue, to consider their preferences, for us to
183 gauge the respondents existing knowledge of the concepts, and to include answers to these
184 questions as explanatory variables of their WTP for IAS management. In fact, in a previous
185 study (see García-Llorente and others 2008 for more details), three latent variables were
186 created with the information obtained in the first section, through a principal component
187 analysis, and used in the econometric analysis. These latent variables named social factors
188 related to the knowledge and perception of the impacts of IAS were: *active interest in nature*
189 *and IAS knowledge, impact of IAS,* and *sense of place*.

190 The second section presented the economic valuation exercise and served to illuminate the
191 public's perception of IAS non-market costs by addressing willingness to pay for IAS
192 management under two different strategies: eradication and prevention of new introductions.
193 Under the eradication regime, respondents received an explanation of several IAS (Table 1)
194 that reportedly have a direct or indirect impact on the respondent's use of the area. The IAS

were selected according to ecological, social, and management factors recorded in previous studies (for details see García-Llorente and others 2008). Each IAS was illustrated with a picture and a short description summarizing the ecological and socio-economic impacts the species has on biodiversity and ecosystem services of Doñana (Table 1). We asked whether the individual was prepared to make an economic contribution to ensure that an eradication program focused on these species was implemented (for more details see appendix A). Finally, following an information summary of IAS impacts, and to evaluate public awareness of the importance of prevention as a tool for IAS management, each respondent was asked whether they we prepared to make an economic contribution to implement a prevention program. Border controls and quarantine measures are often the first opportunity to respond to IAS incursions (Hulme 2006). However, quarantine regulations are currently limited in extent and application in the European Union. Spain follow a procedure where a limited number of known problem IAS are placed on a black list and cannot be imported freely from outside the European Union (Shine and others 2000). For this reason and considering our study area characteristics, the suggested prevention regime in our study was focused on communication with the general public and environmental education strategies (for more details see appendix A).

After each WTP question, if respondents answered 'No' to any of the two conditions, they were asked the reason for not contributing, in order to differentiate between protest answers and real zero values. If respondents answered 'Yes', we asked the maximum amount of money they would be willing to pay (€).

All respondents were told in advance they would have to answer two WTP questions. Furthermore, we informed them of independence between questions. In other words, the amount of money donated in each regime started at zero and the amount given to each scenario was not aggregated.

220 ***Data analysis***

221 We applied the CV approach to determine the economic importance people award to IAS and
222 their management. An open-ended elicitation format was used to generate a more realistic and
223 direct measure of the maximum WTP without anchoring bias. A common problem in open-
224 ended CV-bids analysis is a large number of responses with zero values. WTP variables have
225 an asymmetric distribution, with a large mass of data centered on zero (Mitchell and Carson
226 1989). This result is due to the respondents that chose not to contribute, which is given a zero
227 monetary value, and a continuous positive distribution of WTP amounts for those respondents
228 who were willing to contribute. When a dependent variable has a concentration of observations
229 at a specific limit, conventional multiple regression is not an appropriate statistical method
230 (Lee and Maddala 1985). Therefore, it is necessary to use a censored model such as the
231 Heckman (Heckit) model (Heckman 1979). Heckman uses two different equations, the first
232 explains the respondent's decision to pay or not to pay, and the second explains the positive
233 value of WTP (Sigelman and Zeng 1999). The model maintains the assumption of dependence
234 between the two decisions by analyzing the covariance between the error terms. Furthermore,
235 the Heckman model assumes a distribution for the second stage variable (the amount of WTP)
236 exists, but is not observed when the dependent variable is beyond some threshold (e.g., when
237 WTP < 0). This may be the case if some respondents see certain IAS as a benefit.

238 Following Sigelman and Zeng (1999), the Heckman model is a response to sample selection
239 bias, which arises when data are available only for cases in which a variable reflecting 'pay',
240 z^*, exceeds zero.

241 $$z_i^* = w_i\gamma + \mu_i \qquad (1)$$

242 $$y_i^* = X_i\beta + \varepsilon_i \text{ observed only if } z_i^* > 0 \qquad (2)$$

243

where for the *i*th individual, w_i and X_i are vectors of explanatory variables, y and β are parameter vectors common to all individuals, and μ_i is a random disturbance term. The error terms are assumed to follow a bivariate normal distribution with means 0, variances $\sigma_\mu = 1$, and $\sigma_\varepsilon = 1$, and correlation coefficient ρ. The observed variable is $z = 0$ if $z^* \leq 0$ and $z = 1$ if $z^* > 0$; $y = 0$ if $z^* \leq 0$ and $y = y^*$ if $z^* > 0$. The expected Y is:

$$E(y \mid z^* > 0) = X\beta + \rho\sigma_\varepsilon \lambda(-w\gamma) \qquad (3)$$

where $\lambda(-w\gamma) = \frac{\phi(-w\gamma)}{1-\Phi(-w\gamma)}$ is the inverse of Mill's ratio, ϕ is the standard normal density function, and Φ the standard normal function.

Equation (3) implies that the conditional expectation of both decisions, the probability to pay in the hypothetical market and the economic contribution, are related. Then, y is equal to $X\beta$ only when the errors of Eqs. (1) and (2) are uncorrelated ($\sigma_\varepsilon = 0$); otherwise, the expectation of y is affected by the variables in equation (1).

In the first stage, we obtained a probit estimation of Eq. (1) from γ, where $z = 1$ if $z^* > 0$ and 0 otherwise, and calculated the Mill´s inverse ratio for each observation of the sample. Pseudo R^2 was calculated according to Veall and Zimmermann (1992). In the second stage, we estimated Eq. (3) using ordinary least squares (OLS) regression, including the Mill´s inverse ratio as a variable. The variables used to identify consumers preferences in relationship to IAS management under different regimes were: a) three latent variables obtained by a principal component analysis in a previous work to identify and characterize stakeholders' perceptions regarding IAS impacts (see García-Llorente and others 2008 for more details), b) five stakeholder groups identified previously in relationship with IAS in Doñana: *local users*, *generalist* and *nature tourists*, and two types of *conservation professionals* (for more details see García-Llorente and others 2008), and finally, c) income and household size as two socio-

267 economic variables (Table 2). We selected the best model from among all possible
268 combinations of variables, guided by Akaike information criterion (AIC) statistics (Burnham
269 and Anderson 1998). In contrast to the typical statistical paradigm, which usually defines
270 significance at an alpha (α) level of 0.05, we defined significance as $p \leq 0.1$ since our results
271 were focused on conservation management decisions (Field and others 2004; 2005).

272 Respondents with a minimal understanding of the questionnaire or an unreceptive attitude
273 during the follow-up questions were excluded from the analysis. Furthermore, protest zero
274 respondents were excluded to avoid strategic behavior bias, which could distort the overall
275 results (Bateman and others 2002). Overall, 229 and 192 questionnaires were used for the
276 eradication and prevention valuation exercises, respectively. Table 3 summarizes the number
277 of questionnaires included and excluded in the econometric exercise. Using a nonparametric
278 Wilcoxon test, we analyzed differences between the probability to participate in the economic
279 valuation exercise under eradication and prevention strategies, using a 2-fold cutoff . ANOVA
280 was applied to analyze results from the Heckman model to determine the influence of the
281 stakeholder type on WTP. Fisher's multiple comparisons post-test was employed to determine
282 statistical differences among WTP estimations among stakeholders under the eradication and
283 prevention regimes. Finally, we tested if the estimated cumulative distribution on WTP for
284 management strategy was the same for eradication and prevention survey formats by
285 calculating the likelihood ratio (LR).

286 **Results**

287 ***Motivations that influence support or not for different IAS management***

288 The Wilcoxon analysis showed significant differences between the probability to participate
289 under both different regimes ($p = 0.001$, Wilcoxon test for paired two samples).

290 The motivational factors influencing individuals to pay on the hypothetical market and support
291 IAS management were related to the perception of IAS impact on (1) ecosystems; (2) native
292 species, particularly those threatened by IAS; (3) how IAS effects ecosystem services and the
293 local economy; and (4) tourism (Table 4).

294 Real zero answers were related to the respondent's lack of economic resources, other
295 environmental priorities, or the respondent's preference to spend his or her money elsewhere.
296 Alternatively, the higher percentages of protesting respondents, who refused to participate in
297 the CV procedure, principally believed that the government was the responsible party and
298 should work towards a solution, opposed a monetary contribution to manage IAS, or held
299 distrust for the government. Table 4 shows how these motives were distributed under the two
300 management plans, and how despite the probability to participate differed between eradication
301 and prevention, the particular motivations influencing individuals were similar except of the
302 motivation related with dislike the way of management. It is important to note that 10% of
303 respondents under prevention believed that it was not the best IAS management strategy, or did
304 not participate because of uncertainties of the impacts generated by the new species
305 introductions. Furthermore, for some respondents, IAS have economic value and, as a
306 consequence, eradication is not a desirable option.

307 ***Social factors underlying economic support for IAS management***

308 Full sample model specification

309 The probit regression analysis detected four variables that explained the probability of
310 participation in the eradication hypothetical market. *Active interest in nature and IAS*
311 *knowledge* and *sense of place* with positive signs and *impact of IAS* and *household size* with
312 negative ones (Table 5). Respondents who were more willing to contribute on the hypothetical
313 market exhibited the following characteristics: a general and active interest in nature,

knowledge of IAS, and higher education level -captured by the variable *active interest in nature and IAS knowledge* positive loadings (Table 2)-, be awareness about IAS impacts on ecosystems -captured by *impact of IAS* negative loadings (Table 2)-,and felt emotional bonds with Doñana and impacts of IAS on their cultural identity -captured by sense of place positive loadings (Table 2)-. A larger household size was related to a lower probability to pay (Table 5). Under the prevention strategy, two variables were statistically significant. *Active interest in nature and IAS knowledge*, which had positive sign and household size, which had negative sign. In this regime, the variables related to possible impacts generated by new introductions were not significant (Table 5).

In the second stage of the Heckman model to explain WTP amounts, we found four statistically significant variables under the eradication strategy. Higher WTP amounts were related to increased *active interest in nature and IAS knowledge*, *sense of place*, and higher levels of income. Once again, larger household size contributed to lower WTP amounts (Table 5). In the case of prevention strategies, higher contributions were associated with increased *active interest in nature and IAS knowledge*, higher income levels and smaller household size. The inverse Mill´s ratio was significant under the two management strategies (Table 5), indicating some correlation between the error terms in the two stages.

Interactions between social factors and stakeholder groups on the economic support for IAS management: Stakeholder groups cross effects

Table 6 reports an additional model formulation, which includes the role of stakeholder groups creating cross effects variables of the interaction between social factors and stakeholder groups. Estimation results of the eradication strategy indicated statistically significant cross effects that explained respondents probability to participate in the hypothetical market, and were cross effects that captured the relationship between: 1) *active interest in nature and IAS*

knowledge and *nature tourists*; 2) *sense of place* and *generalist tourists*; and 3) *sense of place* and *local users* (Table 6). All estimated coefficients were positive demonstrating that all variables were complimentary. For example, the probability to participate in the hypothetical market increased with *active interest in nature and IAS knowledge*, when the respondents were *nature tourists*. In the second stage of the Heckman model under eradication, the significant cross effects were as follows: 1) *impact of IAS* with *generalist tourists*; and 2) *sense of place* and *generalist tourists.* It is noteworthy that when estimation results were calculated without cross effects (Table 5), *impact of IAS* in the second stage of the Heckman model was not a significant variable. However, when the variable was expressed in relationship to the stakeholder groups, it was significant (Table 6). Therefore, the impact of IAS on the socio-economic dimension (captured by positive loadings) was relevant in WTP amounts when respondents were *generalist tourists*.

Finally, for prevention, cross effects were not statistically significant across all social factors under analysis, with the exception of *active interest in nature and IAS knowledge* for *conservation professionals 2*. Increased *active interest in nature and IAS knowledge* contributed to the support of IAS management initiatives based on prevention, when the stakeholders were *conservation professionals 2* (Table 6).

WTP estimation results under eradication and prevention management regimes and the influence of stakeholder type on economic support

The overall mean WPT obtained under the eradication strategy was 44.55 € (standard deviation (SD): 5.72), however the prevention regime received lower support (28.81 €; SD: 5.06).

Significantly different WTP was indicated between both management plans (ANOVA; $F= 6.94$; $p < 0.001$). Furthermore, we estimated the pool model (eradication + prevention) and computed the likelihood ratio test (LR) to determine if the estimated WTP amounts were the

same between both management plans. We obtained a value of 4.86, higher than the critical value of 3.84 (Table 7). The empirical evidence rejected the hypothesis that WTP amounts for both management plans were approximately the same as the pool WTP.

The influence of stakeholder type was evident in WTP (mean value) for IAS management for both management regimes (Table 7). Three groups, through Fisher's groups, were revealed from the eradication regime lending economic support to IAS management. Both groups of *conservation professionals* were respondents with the highest contributions, followed by *nature tourists*, who did not differ significantly from *local users*. Finally *generalist tourists and local users* were respondents with the lowest WTP contributions for IAS eradication. *Conservation professionals* contributed the highest amounts towards prevention. WTP amounts given by *tourists* and *local users* did not differ (Table 7).

Discussion

We aim to make contributions to understand and enhance IAS management by assessment of non-market valuation using two different strategies: eradication and prevention. The main findings of this work are related with the different motivations that influence support or not for different IAS management strategies, the social factors underlying the economic support, and the WTP estimations obtained in the economic valuation exercise considering different stakeholders profiles and strategies.

Motivations that influence support or not for different IAS management strategies and social factors underlying economic support to IAS management

Carson and others (2000) concluded that WTP estimates obtained from CV surveys are generally sensitive to other key features of the hypothetical market. Although this has been a source of concern to CV critics, it should be more accurately viewed as strength of this

385 approach, because it examines the influence of key factors related to how the item measured is
386 evaluated. Hanley and Milne (1996) showed that the economic valuation of the environment
387 differs from the valuation of any other good or service because of the influence of moral,
388 ethical or moral survival motives. Also, Nunes and Schokkaert (2003) highlighted how
389 motivational factors including consumer direct consumption/recreation, feelings of satisfaction
390 by the act of giving, or consumer non-use motivation associated with environmental
391 conservation (independent of its human use), played a role in explaining differences in WTP.
392 In our study, we observed a positive and significant association between household income and
393 WTP, and a negative and significant association between household size and WTP. The
394 probability an individual would make a contribution on the hypothetical market and the amount
395 of money donated were also influenced by a range of social factors including: respondent
396 active interest in nature and IAS knowledge, perception of IAS impacts on the ecological and
397 socio-economic dimension, and sense of place defined as the emotional bonds respondents felt
398 for the geographic area and their concern for IAS impacting their cultural identity. Other
399 studies have found a range of factors influencing WTP for IAS management, including age
400 (Philip and MacMillan 2005), income (Jetter and Paine 2004; Philip and MacMillan 2005),
401 distance (Nunes and Van Den Bergh 2004), and active interest in nature (Jetter and Paine 2004;
402 Philip and MacMillan 2005). These findings indicate that WTP for IAS management is
403 dependent on the respondent profile. Consequently, incorporating a socio-cultural dimension is
404 critical for a solid economic valuation of biological invasions. Future research on the
405 economics of IAS should address how to engage stakeholder groups in IAS management and
406 explore the tradeoffs related to ecosystem services and disservices generated by biological
407 invasions.

408 Regarding the motivations that influence the lack of support for IAS management, we obtained
409 that a 39.6% and a 45.5% of the respondents under the eradication and prevention strategies

410 respectively, gave protest answers. This percentage is higher than the obtained in other studies
411 conducted in the same study area for biodiversity conservation (Martín-López and others
412 2007a). As Gren (2008) found, the need for management of IAS arises from its public good
413 characteristics. This means that many may suffer from damages caused by IAS.
414 Correspondingly, costly actions undertaken by one will create beneficial changes from
415 reductions in the probability of damages from IAS for several others. Due to this asymmetry in
416 cost and benefits from IAS management, public intervention is needed. In fact, our results
417 show that the principal motive to give a protest answer was related with the belief that the
418 government was the responsible of solving the problem.

419 ***WTP estimation results under eradication and prevention management regimes***

420 The Convention on Biological Diversity (2002) recommended prevention as the first strategy
421 in biological invasion management and it is considered the most cost-effective and
422 environmentally desirable approach. In economic terms, eradication programs required a one-
423 off and high cost, meanwhile prevention ones require a continual and low cost invest. Different
424 IAS studies based on bioeconomic risk analysis have demonstrated that investment in
425 prevention is more cost-efficient than control or eradication measures to circumvent biological
426 invasions (Heikkilä and Peltola 2004; Keller and others 2007; Leung and others 2002).
427 However, our findings showed a lower public financial support for IAS management under
428 prevention strategy. Similarly, IAS management in Spanish Natural Protected Areas (NPAs)
429 has had a similar approach, where prevention has been employed less often than management
430 measures (Andreu and Vilà 2007). Also, prevention has been less investigated from an
431 economic standpoint (Born and others 2005). Respondents' were more interested in actions to
432 resolve the present situation than invest in actions to maintain future biodiversity and
433 ecosystem integrity. It could be related to the perception of uncertainty related to the public's
434 notion of risk under prevention plans (Finnoff and others 2007). In contrast, a survey designed

435 to elicit donation levels to delay inevitable aquatic invasions of inland water bodies of the
436 United States found that the average household respondent was willing to make a one-time
437 payment of: 1) 34$, 2) 48$, and 3) 218$ to delay: 1) low impacts for one year, 2) high impacts
438 for one year, and 3) high impacts for ten years; respectively (McIntosh and others 2010). Then,
439 when respondents did not feel uncertainty respondents future was valued. It is also important to
440 note that in our study, respondents were provided with a list of IAS and their impact in Doñana
441 under the eradication regime, but not a list of potential invaders that could be kept out by a
442 clearly defined mechanism; as such respondents could assess the risk and response for
443 eradication but not so clear for prevention. In the environmental economic valuation,
444 uncertainty over the effectiveness of environmental programs reduces WTP (Hanley and Milne
445 1996). In fact, other studies addressing public attitudes to IAS control showed a degree of
446 doubt for some methods used to control IAS, and this ambiguity resulted in low recognition of
447 the benefits of control (Fraser 2006). Under uncertainty there is a lack of knowledge with
448 respect to identifying outcomes and risk assessments; other difficulty is that people in general
449 have difficulties in assessing low probabilities with detrimental effects. In general, there is a
450 low probability of establishment, spread and creation of damages for an introduced species;
451 however, once established and spread, the damages of an IAS can be high (Hulme 2006).
452 Then, prevention should be promoted among managers and policymakers as well as among
453 researches, interested stakeholders, and the general public.

454 Comparing our mean WTP estimations with other studies, we found that an analysis of IAS
455 management in Seychelles which used a CVM to obtain a WTP for a scenario to protect
456 biodiversity at risk from IAS indicated a tourists' annual mean WTP of 40-44 € (Mwebaze and
457 others 2009). Nunes and Markandya (2008) found that the annual mean WTP would amount to
458 50.1€ for a program focuses on the prevention of marine bio-invasions. Here, our overall
459 means WPT of 44.55 € and 28.81 € under eradication and prevention regimes seem reasonable

when compared to other studies. Assuming that Doñana has a 4092380 user's population (Martín-López and others 2007b), the annual aggregated donations in our study are 182315529 € and 93347187.8 € for IAS management under eradication and prevention regimes, respectively. By comparison, Andalusia has invested 29479527 € in the last decade for invasive plants management, and Doñana has invested around 4500000 € in the last two decades. As Zaradic and others (2009) stated, the fate of biodiversity and intact ecosystems may depend less on rates of habitat loss or IAS, than on public perception of whether conservation should be supported at all. Following this argument, our estimations indicate that the Department of Environment of Andalusian Government has enough social support for the expenditures done and even to justify an increase in this budget.

The influence or stakeholder type on the economic support for IAS management

Differences in WTP for economic support among stakeholders was revealed to support management strategies to challenge IAS. At the local scale, users recognized some benefit from the introduction of exotic species. The local community saw service and economic profit from certain IAS. Thus, local users considered that they received economic benefit from IAS. For example, crayfish fishermen that profit from *P. clarkii*, or beekeepers whose beehives depend largely on *Eucalyptus* spp. On the other hand, *generalist tourists,* who lack an awareness of the impacts of IAS, contributed decreased amounts of money than people residing a greater distance from the survey area such as *conservation professionals and nature tourist.* Spatial scales and stakeholders are often correlated because the scale at which ecosystem services are supplied determines which people benefit from them (Hein and others 2006; Martín-López and others 2009b). Due to the complexity of IAS impacts on ecosystem services essential for human well-being, individual or group interests can provide importance to some roles of IAS, but neglect others (Binimelis and others 2007) and different stakeholder groups have different attitudes towards IAS management (Ceddia and others 2009). Clearly, conflicts

485 of interest emerge from IAS management. Subsequently, it is vital to consider the tradeoffs
486 among stakeholders related to IAS effects on ecosystem services in the decision-making
487 process.

488 **Conclusions**

489 In this paper, we conducted an econometric analysis of the social factors influencing WTP for
490 IAS management. We analyzed stakeholder motivations to support IAS management regimes
491 and the social factors underlying WTP for IAS management under eradication and prevention
492 plans. Together these data should be representative of public views on the value of IAS
493 management, the conflicts of interest in IAS management among stakeholders and among
494 different management policies. Our findings support that the stated preferences method was a
495 viable tool to explore the social preferences related to IAS management and the economic
496 public support. IAS management research should confront the challenge to include stakeholder
497 engagement and the tradeoffs among different management policies. Finally, our WTP
498 estimations suggest that the Department of Environment of Andalusian Government has
499 enough social support for the expenditures done and even to justify an increase in this budget.

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513 **Appendix A. Supplementary material. Questionnaire structure and content**

514 ***Section one: Addressing the public's knowledge and perception of IAS social-ecological***
515 ***impacts and attitudes toward IAS introduction***

516 These questions included:

517 • The definition of the term invasive alien species.
518 • The willingness to introduce non-native species if the respondent obtained an economic
519 or recreational benefit from this action.
520 • The knowledge of any non-native species in Doñana, and the perception of the role of
521 IAS: 1) threatening ecosystems in the Doñana area; 2) having a positive or negative
522 effect on the local economy; 3) affecting disease transmission; and 4) affecting cultural
523 identity.

524 This first section also comprised questions regarding the respondent's active interest in nature:

525 • If the respondent hold a membership in an environmental non-governmental
526 organization (NGO).
527 • The number of natural protected areas (NPAs) that the respondent had visited during
528 the previous year.

We also included socio-demographic inquiries regarding the distance from their place of residence to the interview site, education level, gender, age, household size, and monthly family income.

Finally, the interviewer answered two follow-up questions to summarize the respondent's attitude and understanding of the interview and its intent.

Section two: The economic valuation exercise

Under the eradication regime, the question was asked as follows:

> *'With the knowledge that you have about the impacts generated by the presence of these species, if you think that the IAS of Doñana are generating ecological and socio-economic impacts, would you be willing to make an annual economic contribution to a fund created by the Environmental authorities to eradicate these species in Doñana?' Your economic contribution would comprise part of an annual donation to a trust fund that would be managed by the Environmental authorities in order to eradicate these species from Doñana and ensure the biodiversity conservation in the area.*
>
> *Original question as was asked in Spanish: Con el conocimiento que has adquirido acerca de los impactos generados por la presencia de estas especies y en el caso de que consideres que las especies exóticas invasoras presentes en Doñana estén generando impactos a nivel ecológico y socio-económico, ¿estarías dispuesto a realizar una contribución económica anual a un fondo creado por las instituciones ambientales para erradicar estas especies en Doñana? Tu contribución económica entrará a formar parte de un donativo anual en un fondo fiable que será gestionado*

por las autoridades ambientales con el objetivo de erradicar estas especies en Doñana y así asegurar la conservación de la biodiversidad en esta zona.

Finally, following an information summary of IAS impacts, and to evaluate public awareness of the importance of prevention as a tool for IAS management, each respondent was asked the following:

'With the knowledge that you have about the impacts generated by IAS, would you be willing to make an annual economic contribution to a fund created by the Environmental authorities to prevent the introduction of new IAS in Doñana?' Your economic contribution would comprise part of an annual donation to a trust fund that would be managed by the Environmental authorities in order to develop strategies to promote prevention policies to avoid new introductions and ensure biodiversity conservation in the area.

Original question as was asked in Spanish: Con el conocimiento que has adquirido acerca de los impactos generados por la presencia de estas especies, ¿estarías dispuesto a realizar una contribución económica anual a un fondo creado por las instituciones ambientales para prevenir el establecimiento de nuevas especies exóticas invasoras en Doñana? Tu contribución económica entrará a formar parte de un donativo anual en un fondo fiable que será gestionado por las autoridades ambientales con el objetivo de desarrollar estrategias que fomenten las políticas de prevención y eviten nuevos establecimientos y así asegurar la conservación de la biodiversidad en esta zona.

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831 **Fig 1. Study area and sample points.**

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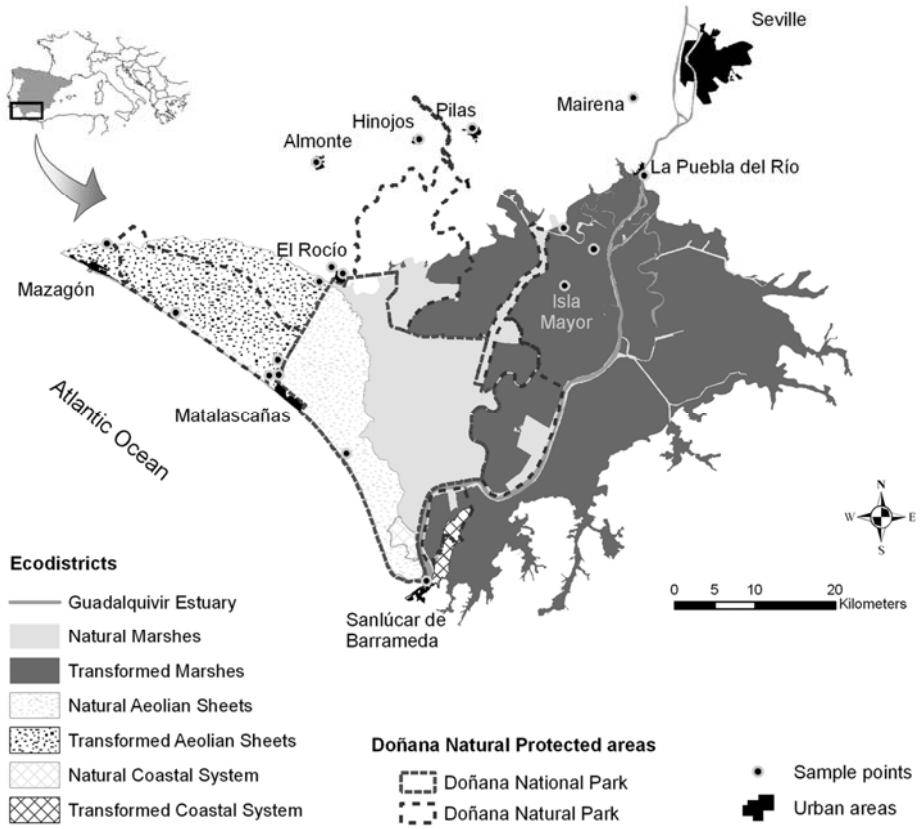

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835 **Table 1. List of IAS referred to in the questionnaire and impacts: describes the type of impacts that occur with the biological invasion.**

Species latin name´s	Species common name´s	Type of organism	Ecological impacts	Socio-economic impacts	References
Azolla filiculoides	Red waterfern	Aquatic plant	Competition with native species Impacts on ecosystem structure and function	Effects on navigation Indirect effects in fishing activities Indirect effects on agriculture Cost in management policies in Doñana:Control and research (140.200 €)	Baoia and Carrapico 1998; Gratwicke and Marshall 2001; de Macalel and Vlek 2004; Fernández-Zamudio and others 2006
Pistia stratiotes	Water lettuce	Aquatic plant	Competition with native species Impacts on ecosystem structure and function	Recreation activities Block of irrigation systems Cost in management policies in Doñana: Eradication	Meerhoff and Mazzeo 2004; García-Murillo and others 2005
Carpobrotus edulis	Ice plant	Terrestrial plant	Competition with native species (in particular with *Limonium emarginatum* and *Juniperus oxycedrus*)	Cost in management policies in Doñana: Eradication and educational programs	Blanca and others 2000; CMA 2003; Figueroa-Clemente 2003; Bañares and others 2004; GEIB, 2006
Eucalyptus spp. (*E. globulus* and *E. camaldulensis)*	Eucalyptus	Terrestrial plant	Competition with native species Impacts on ecosystem structure and function	Cost in management policies in Doñana: Eradication (more than 2.5 million €)	Dana and others 2005
Procambarus clarkii	Red swamp crayfish	Crustacean	Competition with native species Impacts on ecosystem structure and function Predation of native species	Possible damage in rice fields Cost in management policies in Doñana: Research (more than 400.000 €)	Algarín 1980; Cano and Ocete 1997; CPA 2001; Aguayo and Ayala 2002; Madroño and others 2004; Geiger and others 2005
Cyprinus carpio	Common carp	Fish	Competition with native species (in particular with *Oxyura leucocephala*) Impacts on ecosystem structure and function Predation of native species		Gómez-Caruana and Díaz-Luna 1991; Lowe and others 2004; Madroño and others 2004; Jiménez-Pérez and Delibes de Castro 2005; Miller and Crowl 2006; García-Berthou 2007
Fundulus heteroclitus	Mummichog	Fish	Competition with native species (in particular with *Aphanius baeticus*) Impacts on ecosystem structure and function		Gómez-Caruana and Díaz-Luna 1991; Doadrio and others 2001; Smith and Darwall 2006
Gambusia holbrooki	Mosquitofish	Fish	Competition with native species (in	Cost in management policies in Doñana: Eradication	García-Berthou and Moreno-Amich

			particular with *Aphanius baeticus*) Impacts on ecosystem structure and function		2000; Doadrio and others 2001; Smith and Darwall 2006
Lepomis gibbosus	Pumpkinseed	Fish	Competition with native species Impacts on ecosystem structure and function	Potential impact on mollusc, eggs and young fishes	Fernández-Delgado and others 2000 (García-Berthou and Moreno-Amich 2000a).
Micropterus salmoides	Largemouth bass	Fish	Competition with native species Impacts on ecosystem structure and function		Fernández-Delgado and others 2000; García-Berthou 2002; Lowe and others 2004
Trachemys scripta	Red-eared slider turtle	Reptile	Competition with native species (in particular with *Emys orbicularis* and *Mayremys leprosa*) Impacts on ecosystem structure and function	Disease transmission Cost in management policies: Eradication and educational programs	Pleguezuelos 2002; Lowe and others 2004; GEIB 2006
Oxyura jamaicensis	Ruddy duck	Bird	Competition with native species (in particular with *Oxyura leucocephala*) Hybridation (with *Oxyura leucocephala*)	Negative effect in bird-watching due to its damage on the endemic species.	Garrido and Sáenz de Buruaga 2002; Madroño and others 2004

836 **Table 2. Description of the explanatory variables used in the data analysis.**

Variables	Type	Attributes
Social factors related with stakeholders knowledge and perception of the impacts of IAS*		Factor derived from a principal component analysis to characterize stakeholders regarding their knowledge and perception of the impacts of IAS, attitudes toward IAS introduction, active interest in nature, and socio-demographic variables.
Active interest in nature and IAS knowledge	Continuous	Stakeholders' active interest in nature and knowledge regarding IAS. Positive factor loadings reflected general and active interest in nature, knowledge of IAS, and stakeholder education level; negative loadings reflected a willingness to introduce non-native species.
Impact of IAS	Continuous	Perception associated with IAS impacts, in which positive loadings reflected the effect of IAS on the social system, and negative loadings reflected the IAS effect on ecosystems.
Sense of place	Continuous	Characterize the emotional bonds people form with a geographic area. It is also related to cultural and historical aspects. The variables that contributed most to this factor were the distance between a stakeholders' place of residence and Doñana, and the impact of IAS on cultural identity; both of these variables exhibited positive loadings.
Socio-economic variables		
Household size	Ordinal	Household size (members)
Income	Semi-continuous	Ln (Monthly family income which reflected the mid-point of six income intervals (600€; 1200€; 1800€; 2400€; 3000 €; 3600 €) (1€=US$ 1.32, June 2006-Sep 2007)
Stakeholder groups*		Stakeholders identified in a hierarchical cluster analysis (employing Euclidean distance and Ward's method) for degree of knowledge and perception of IAS impacts, attitudes toward IAS introduction, active interest in nature, and socio-demographic variables.
Conservation professionals 1	Dummy	Managers and researchers which were awareness about the impacts generated by IAS and who were willing to considered the different ecological and social factors involved in the process of invasion.
Conservation professionals 2	Dummy	Managers and researchers which were awareness about the impacts generated by IAS and who thought that the ecological impacts caused by IAS are a reason enough strong in itself to management them.
Nature tourists	Dummy	Specialist tourists, especially birdwatchers, which had high education level, environmental attitudes and awareness about the impacts generated by IAS.
Generalist tourists	Dummy	Beach tourists, pilgrims and one-day visitors which environmental attitudes were poor.
Local users	Dummy	People with a strong relation with provisioning services of Doñana such as fishermen, beekeepers, crayfish fishermen, seafood collectors, rice farmers, and farmers in general; but also by people with a weak relation with provisioning services such as people related with building industry, shop assistants or housewives; they had poor education level and environmental attitudes.

* The variables used in the principal component analysis and in the hierarchical cluster analysis where: 1) Distance (continuous variable related with the distance from place of residence to the interview place in km), 2) definition of the term invasive alien species (1=Knowledge of the meaning; 0=otherwise), 3) willingness to introduce a non-native species (1= willing to do it; 0=otherwise), 4) number of non-native species known (ordinal variable), 5) IAS threaten ecosystems (1=threaten ecosystems; 0=otherwise), 6) IAS impact on local economy (1= positive or negative effect on economy; 0=otherwise), 7) IAS impact on cultural identity (1= effect on cultural identity; 0=otherwise), 8) IAS impact on disease transmission (1=disease transmission, 0=otherwise), 9) member of environmental non-governmental organization (1=member, 0=otherwise), 10) number of visited other Natural Protected Areas the last year (ordinal variable), 11) education level (0=none; 1=primary; 2=secondary; 3=university) (see García-Llorente and others 2008 for more details).

837 **Table 3. Description of the number of questionnaires conducted, rejected, and included in**

838 **the econometric analysis.**

	Number of questionnaires to different category of respondent identified	**Number of questionnaires rejected due to minimal understanding and unreceptive attitude**	**Number of questionnaires rejected due to protest response**		**Number of questionnaires included in the econometric analysis**	
Stakeholder groups			Eradication	Prevention	Eradication	Prevention
Conservation professionals 1	60	3	29	30	24	23
Conservation professionals 2	66	8	24	24	37	35
Nature tourists	165	25	68	83	82	66
Generalist tourists	85	23	25	29	49	37
Local users	96	30	41	49	37	31
Total	472	89	187	215	229	192

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841 **Table 4. Motives behind willingness to pay on the survey described express in number of**

842 **respondents and percentage (%) of respondents in each case.**

	Eradication		Prevention	
	Number of respondents	% of total willing to pay	Number of respondents	% of total willing to pay
Motives to be willing to pay on the survey described				
IAS impact on ecosystems	123	64	105	69
Impact on biodiversity because of the effect on rights of existence of the species threatened by IAS	40	21	29	19
IAS are economically harmful because of the effect on provisioning ecosystem services	27	14	17	11
IAS impact on tourism	2	1	2	1
Total WTP>0	192	100	152	100
Motives to not be willing to pay on the survey described				
Real zero values	Number of respondents	% of total real zero values	Number of respondents	% of total real zero values
Lack of economic resources	33	35	35	33
Other environmental priorities	60	65	70	67
Total real zero values	93	100	105	100
Protest answers	Number of respondents	% of total protest answers	Number of respondents	% of total protest answers
The Environmental Government is the responsible of solving the problem	75	40	82	38
Not agree with the payment method used	54	29	49	23
Distrust Government	13	7	15	7
Did not live in or near the Doñana area	11	6	13	6
Prefer to provide assistance through volunteer work and advice, but did not intend to pay for IAS measures	9	5	9	4
I do not agree with this type of question	6	3	6	3
I do not believe that the strategy proposed could be possible	6	3	9	4
IAS have an economic use	6	3	0	0
It must be done by whomever that introduced these species	4	2	2	1
Dislike the way of management (eradication or prevention is not the best way of management)	2	1	22	10
Existence value of all species	0	0	4	2
I do not how these species could generate impacts	0	0	2	1
There is sufficient existing budget for this purpose	2	1	2	1
Total protest answers	187	100	215	100

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Table 5. Estimated coefficients showing the determinant factors to be willing to pay for IAS management under eradication and prevention plans. Probit regression results for the first stage of the Heckman model and the sample selection for the two-stage least squares regression (OLS) results for the second stage of the Heckman model (standard errors in brackets).

	Eradication				**Prevention**			
Variables	**PROBIT**		**OLS**		**PROBIT**		**OLS**	
	Coefficient (standard error)	***p*-value**	**Coefficient (standard error)**	***p*-value**	**Coefficient (standard error)**	***p*-value**	**Coefficient (standard error)**	***p*-value**
Constant	-0.583 (1.330)	0.661	-0.406 (1.945)	0.835	-0.235 (1.345)	0.861	-1.042 (1.873)	0.578
Active interest in nature and IAS knowledge	0.110 (0.060)	0.066	0.232 (0.090)	0.001	0.160 (0.066)	0.015	0.237 (0.090)	0.008
Impact of IAS	-0.174 (0.086)	0.042	-	-	-0.071 (0.087)	0.415	-0.066 (0.124)	0.595
Sense of place	0.191 (0.098)	0.051	0.307 (0.138)	0.026	0.086 (0.099)	0.383	0.204 (0.136)	0.134
Income	0.207 (0.191)	0.280	0.510 (0.279)	0.068	0.137 (0.194)	0.479	0.522 (0.269)	0.052
Household size	-0.188 (0.094)	0.046	-0.283 (0.149)	0.057	-0.171 (0.100)	0.087	-0.237 (0.145)	0.103
λ	-	-	2.217 (0.100)	0.001	-		2.008 (0.097)	0.001
N	229		229		192		192	
Log likelihood	-125.38		-297.68		-113.10		-217.25	
AIC	1.15		-0.18		1.24		-0.50	
Chi-square	18.66 (*p*-value<0.001)				12.30 (*p*-value<0.001)			
Pseudo-R^2	0.14				0.11			
Percent correct predictions	75%				69%			
Adjusted R^2			0.78				0.81	

Dependent variable in PROBIT regression, 0 when WTP=0 and 1 when WTP>0. Dependent variable in OLS, Ln (WTP).

Table 6. Estimated coefficients with stakeholder groups cross effects. Probit regression results for first stage of the Heckman model and sample selection two-stage least squares regression (OLS) results for the second stage of the Heckman model (standard errors in brackets).

		Eradication				Prevention			
Variables		**PROBIT**		**OLS**		**PROBIT**		**OLS**	
		Coefficient (standard error)	***p*-value**	**Coefficient (standard error)**	***p*-value**	**Coefficient (standard error)**	***p*-value**	**Coefficient (standard error)**	***p*-value**
Active interest in nature and IAS knowledge	**Conservation professionals 2*	0.137 (0.143)	0.338	0.070 (0.190)	0.711	0.321 (0.156)	0.040	0.280 (0.178)	0.115
	**Nature tourist*	0.390 (0.221)	0.077	0.415 (0.288)	0.150	0.354 (0.228)	0.120	0.460 (0.294)	0.118
	**Generalist tourist*	-0.287 (0.204)	0.158	-0.307 (0.276)	0.266	-0.156 (0.289)	0.587	-0.324 (0.427)	0.448
	**Local users*	0.123 (0.181)	0.500	0.285 (0.267)	0.286	-0.114 (0.207)	0.581	-0.018 (0.291)	0.949
Impact of IAS	**Conservation professionals 2*	0.106 (0.601)	0.860	-0.041 (0.823)	0.960	-0.399 (0.596)	0.504	-0.228 (0.785)	0.754
	**Nature tourist*	-0.167 (0.237)	0.481	0.242 (0.329)	0.463	-0.103 (0.241)	0.667	0.162 (0.335)	0.625
	**Generalist tourist*	0.550 (0.343)	0.109	0.950 (0.468)	0.042	0.266 (0.423)	0.523	0.539 (0.615)	0.381
	**Local users*	-0.226 (0.256)	0.377	-0.532 (0.355)	0.134	-0.226 (0.249)	0.581	-0.361 (0.353)	0.306
Sense of place	**Conservation professionals 2*	0.663 (0.442)	0.133	0.591 (0.566)	0.296	0.106 (0.340)	0.755	0.208 (0.457)	0.648
	**Nature tourist*	-0.057 (0.239)	0.812	0.167 (0.323)	0.604	0.019 (0.257)	0.941	0.267 (0.342)	0.431
	**Generalist tourist*	0.637 (0.321)	0.047	1.042 (0.461)	0.024	0.271 (0.271)	0.497	0.558 (0.571)	0.328
	**Local users*	0.480 (0.246)	0.051	0.407 (0.323)	0.201	0.200 (0.223)	0.370	0.202 (0.315)	0.512
N		229		229		192		192	
Log likelihood		-118.84		-286.20		-110.84		-210.79	
AIC		1.16		-0.20		1.31		-0.47	
Chi-square		31.75 (*p*-value<0.001)				16.81			
Pseudo-R^2		0.22				0.15			
Percent correct predictions		76%				69%			
Adjusted R^2				0.79				0.80	

Dependent variable in PROBIT regression, 0 when WTP=0 and 1 when WTP>0. Dependent variable in OLS, Ln (WTP).

862 **Table 7. WTP estimation results under eradication and prevention regimes (in €; 1€=US$**

863 **1.32, June 2006-Sep 2007). ANOVA results for the effect of stakeholder groups, Fisher's**

864 **groups and likelihood ratio test for pooling the different regimes into one single model.**

	Eradication			**Prevention**			**Pool (eradication + prevention)**		
Stakeholders	N	Mean WTP (€)	Fisher´s groups	N	Mean WTP (€)	Fisher's groups	N	Mean WTP (€)	Fisher´s groups
Total sampling	229	44.55 (5.72)	-	192	28.81 (5.06)	-	421	36.32 (5.51)	-
Conservation professionals 2	37	70.95 (5.36)	A	35	49.82 (4.36)	A	72	60.58 (4.89)	A
Conservation professionals 1	24	65.99 (6.78)	A	23	32.54 (5.63)	A	47	40.34 (6.11)	A
Nature tourists	82	52.29 (4.83)	B	66	29.8 (4.85)	B	148	41.68 (5.08)	B
Local users	37	31.50 (5.93)	BC	31	20.66 (5.22)	B	68	24.39 (5.64)	C
Generalist tourists	49	25.69 (6.21)	C	37	20.19 (5.31)	B	86	24.17 (5,72)	C
F			11.493***			4.594***			11.896***
Ln N	-297.68			-217.25			-528.14		
LR							4.86		

865 Dependent variable, WTP (€), statistical significance at the **=5% and *=10% levels. Standard

866 deviation shown in brackets. LR: Likelihood ratio test (χ^2 critic value ($p<0.05$) = 3.84).

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