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A study of environmental conflict: the economic value of Grey Seals in southwest England

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Abstract. This paper reports an analysis of a typical case of negative bilateral externality – a situation in which two legitimate activities, fishing and wildlife conservation, each give rise to damages to the other party. The Cornish fishing industry believes that its annual profits are reduced by an estimated £100 000 because of the damage by seal populations to caught fish. About 80 individuals belonging to the Cornish Grey Seal population (of about 400 specimens) are killed as a by-catch of trawling. Thus, the status quo is clearly inefficient: seals are perceived to damage fish and fishermen definitely damage seals. The biological dynamics of the seal population is not absolutely clear, so that a precautionary approach requires that care should be taken to avoid the risk of damaging the population in an irreversible way. Moreover, public opinion considers seals to be a high value 'flagship' species. One of the goals of any conflict resolution should be to capture the economic value of seal conservation – i.e. to convert conservation benefits into resource flows – and use at least part of it in order to create incentives for a more efficient allocation of resources. The authorities should invest in seal conservation (i.e. compensating fishermen) if the benefits deriving from conservation exceed the opportunity costs of conservation. Such a solution clearly requires that the conservation benefits be estimated. To investigate the economic value of seal conservation a contingent valuation study is carried out. A contingent valuation study utilises a questionnaire approach and part of the questionnaire seeks to elicit individuals' willingness to pay (WTP) for a change in the state of some good or asset, in this case seal conservation. Due to resource limitations, the sample size of those interviewed in the study reported is small, so that we cannot be extremely confident about the results. However, they are consistent with those derived from similar studies on 'flagship' species. Results show a mean WTP for recreational use of seals of about £8 per person for the option of seeing seals in a specialised sanctuary for seals recovered from accidents, and closer to £9 for seeing seals in the wild. The annual non-use value of seals – i.e. value unassociated with actual viewing – was found to be £526 000 in the most conservative estimation, aggregated over the Seal Sanctuary visitors. This economic potential could be realised in several ways and used to compensate fishermen for changing fishing techniques, targets and fishing areas. Finally, we investigate the role the Seal Sanctuary is playing in this context and some policy suggestions are discussed.

Introduction

The present study investigates a 'classic' conflict scenario in wildlife conservation: wild seals competing with local fishermen for the same resource, namely fish. Seals are killed or injured mainly as a by-catch of trawling. Current fishing activity could ultimately reduce seal populations below a biological threshold critical for survival.

So far seals have been considered as a nuisance to fishermen, with no economic value. However, seal watching is becoming important for the local tourism industry and this could transform the traditional perception of these animals. Seal management has to take in consideration the trade-off between perceived costs to the fishing industry, and benefits to the tourism industry. This paper investigates the economic importance of seals in a particular location: southwest England.

We analyse the different economic impacts that the seal population produces. The aim is to suggest policy mechanisms for sustainable seal management. Indeed, if the economic value of seals in their conserved state is significant, then different mechanisms can be used to capture this value and use it to compensate fishermen for the catch losses, whilst conserving the seals. To estimate the conservation value of seals, a contingent valuation survey was carried out. Contingent valuation has been used mainly because use value is not the only possible value that tourists can attach to the presence of seals in Cornwall. Indeed, they may also have a 'non-use' value (i.e., existence and bequest values), that we have tried to capture through the application of the contingent valuation method (hereafter, CVM). For similar studies, see Langford et al. (1998a, 1998b).

Three parties play important and different roles in the environmental conflict between seals and fishermen. The first is the fishing community that claims to suffer continual losses caused by the seal population (mainly as damage to caught fish). Fishermen threaten to react to what they see as government indifference to their plight by solving the conflict autonomously. Cornwall and Devon are more than average dependent on fishing activity. Moreover, while the local unemployment rate has increased in the last decade, the new European Union limits on fishing effort are further aggravating the economic fortunes of the industry.

The second player is the Grey Seal population that inhabits the coasts of southwest England. It represents the southernmost reproduction site of the whole European macro-population (together with the Britannic one). Since only recent data on changes in population size are available, we still lack the scientific basis to assert that the population is critically endangered. However, the limited data seem to support the possibility that seals populations are endangered.

Thirdly, there is the tourism industry, which represents an important economic activity in the area. Tourists have the opportunity to make non-consumptive use of seals in their natural environment (wild seal viewing) as well as in the man-made context of a Seal Sanctuary, in Gweek. Moreover, others who do not visit the area derive some non-use value from the knowledge that seals are conserved. In economic terms, both use and non-use values generate human wellbeing, and hence their sum defines the total economic value of the wildlife resource. Therefore, all sources of economic value have to be taken in consideration.

An estimate of the total economic value of seals (i.e. use plus non-use values) would include the general public's willingness to pay (WTP) for seal conservation, not just the tourist component. However, due to the resource limitations of the study the non-use values of the wider non-visiting population have not been estimated. The most feasible way to capture the seals' conservation value in terms of cash flows would be to charge tourists going to the Seal Sanctuary or on a seal-watching

trip. Therefore, the study focuses on the use and non-use values of visitors to the Seal Sanctuary of Gweek.

There are two main categories of objectives in this study: the first being more policy-oriented and the second more methodological. Policywise we deal with the issue of assessing the conservation value of seals and the total costs that they impose on the fishing industry. This enables us to highlight strategies to capture this value and show how it might be used to compensate the fishing industry. By estimating the total costs imposed on the fishing industry by the seal population, we also secure an idea of the distribution of the damage among different fisheries. To this end, several representatives of the fishing community were interviewed. Additionally, the Cornish Fish Producers Organisation (CFPO) mailed a questionnaire to each of its members in order to investigate the losses due to seal damage to fish. We also evaluate the benefits linked with the seals' presence in Cornwall. For this purpose a contingent valuation study was carried out in order to:

- Elicit tourists' WTP for conservation of the seal population in Cornwall. The procedure involved interviewing a sample of tourists and generalising the results of the study to the wider visitor population.
- Estimate the non-use value of the seals population among tourists.

These values are then used to clarify the general picture of the seals–fishermen conflict and, hence, to propose some policy solutions.

The second set of goals involved the investigation of some economic and econometric questions, namely:

- procedures for estimating parameters,
- influence of the level of uncertainty in respondents' answers to different format questions,
- issues arising from the truncation of WTP responses,
- influence exerted by information related to alternative recreational uses on the resulting WTP,
- different forms of value and different techniques to elicit them.

The research involved in-person and telephone interviews of 'key informants', in-person analysis of the different facilities for the 'non-consumptive' use of seals, and an in-person contingent valuation pre-test and main questionnaire survey of tourists.

The questionnaire was carried out in three different locations: the Seal Sanctuary (Gweek), and the harbours of St. Ives and Dartmouth. One goal of the research was to investigate whether users of the two different 'goods' (seals in the sanctuary and seals in the wild) differed significantly in their answers. The questionnaire was designed to incorporate three different scenarios and, therefore, to investigate different economic aspects of the problem. The scenarios are described in detail in the Section 'The status quo'. The questionnaire was carried out asking a self-selected sample of people rather than a genuine random sample of the southern England population.

We first present the background picture and describe the different 'players'. Then

Table 1. Seal population data for Cornwall.

	Number of individuals per year
Pup production (Wescott 1996)	125
Weaned Pups (Wescott 1996)	112
Seals caught as a by-catch (Glen 1998)	79–90
Natural mortality (Glen 1998)	60

we describe the contingent valuation study and present the econometric analysis. The last section is devoted to an overall discussion and conclusions.

The status quo

Even though it is a common species for the UK, the grey seal is quite rare worldwide and the world population is estimated to be around 200 000 individuals. The grey seal is listed in Annex 2 of the European Union Habitats Directive (English Nature 1996). This implies a responsibility towards conservation of seals. The Cornwall site is of particular importance because, together with Brittany, it represents the southernmost reproductive site of grey seals. Further, its location seems to be of key significance in European migration patterns. Even though a serious census has not been carried out yet, the Cornish grey seals population is estimated to be between 350 and 400 individuals (Wescott 1996).

Data related to population trends for the last 10 years (which would be extremely relevant for any conservation programme) are not available, because figures started to be collected only in 1997. The only available data are based on casual observations and, for this reason, they cannot be considered scientifically accurate. The available data are reported in Table 1. According to these data, the Cornish population is decreasing by 8–9% per year. At the time of writing, it is not possible to confirm and validate such a conclusion, but according to the veterinary staff of the Seal Sanctuary and most of the skippers working on seal-watching boats, the seal population seems to be fairly constant.

Information on the seals–fishermen conflict is based on key interviews as well as on the report by Glen (1998). The interaction is mainly in the form of direct predation from the nets. Seals eat fish from the nets. They bite the tail, aiming for the liver which is very rich in oil, required for them to store the fat that is essential to survival in the cold waters. As a result, fish are damaged and rendered non-marketable. Seals damage mainly monkfish and hake, which happen to be very high value fish (monkfish is sold at £7/kg, hake at £4.5/kg). Fishermen using fixed nets, mainly tangle nets, are the most affected. The seals' targets are generally medium sized boats (from 5 to 12 m) fishing between 6 and 20 miles off the coast. The interactions take place mostly in the summer and are localised in 'hot spots', around the Lizard Peninsula and in the area between Pendeen and St. Agnes. This information is confirmed by the CFPO, who sent a questionnaire to each member of the organisation in order to collect updated data on the locations, forms and nature

of the seals–fishermen conflicts. At the time of this study they had received 21 replies, which represents about 10% of the CFPO Membership. Obviously, fishermen have an incentive to exaggerate fish loss and it is possible that the damages are accordingly overstated. Nonetheless, the existence of a conflict over economic losses is an undeniable fact.

The reported damage is unevenly spread. Seals appear seriously to affect just that part of the Cornish fleet that is less flexible in fishing techniques and choice of fishing area, i.e. the more vulnerable group. Moreover, the ''structural changes within the local fishing industry, towards fewer, larger boats mean that small, daily boats are disproportionately threatened'' (Berry 1996). This probably means that seals, in addition to the real damage they cause, are playing the role of a scapegoat and the 'seal question' is partially over-dramatised from the fishermen's perspective.

Nonetheless, any sensible conservation policy should seriously account for the effects of the seals on the fishing community. The lack of participation by the local community is an enormous barrier for any conservation project to be successful. Also, active fishing ports are a picturesque attraction of Cornwall. Therefore, the fishing community contributes, indirectly as well as directly, to the economy of the area. Given the localised form of the interaction between seals and fishermen, it becomes easier to identify the fishermen mostly affected. One possible solution could be to compensate them alone. It is quite straightforward to quantify the losses (considering the number of fish heads in the nets). Moreover, the damage is highly localised among the fishing areas. A second possibility might be the elimination of isolated rogue seals. This has proved to be a successful solution in some cases and is permitted by the Conservation of Seals Act. In fact, any order or prohibition on killing seals does not apply '' . . . to seals killed to prevent them causing damage to a fishing net or fishing tackle, provided the seals were in the vicinity of the gear at that time'' (Bonner 1989). However, as many interviews with the local fishing community and other interested parties highlighted, seals are not killed exclusively in the proximity of fishing areas. Another proposed solution is to use contraception in order to contain the population within optimal levels. The main drawback of such a solution is that it would be quite expensive and would require a lot of work in the field.

A solution that appears infeasible is a cull. Firstly, it would be strongly opposed by public opinion. Secondly, it probably would not solve the problem because of the other competitive species populations that might take the place of seals in the food chain (e.g., seabirds or cetaceans). Finally, it would be just a temporary solution because new individuals might move into the area and replace the previous population.

The National Seal Sanctuary is located in Gweek (Cornwall) and is owned by the same company that owns the Newquay Life Centre (Cornwall). It was instituted 40 years ago and early on mainly had just rescue and veterinary functions. Nowadays it works also as a recreational and information centre. The Sanctuary receives about 200 000 visitors per annum and generates a minimum turnover of around £1 million. The entry fees are £5.95 for adults and £3.75 for children. The whole staff comprises

15 people. Concerning the rescue activity, the Sanctuary annually saves from 24 to 54 seal pups (half of all the pups that are born in Cornwall). Most of them come from the Cornish coast, but a small number come from other regions such as Devon, Dorset or the Isles of Scilly. The seals are released after about 6–10 months, even though, in many cases, they could be released after 2–3 months. The delayed release is due to the fact that, even though the Sanctuary is open all year around, the business season is during the summer. Up to 6 years ago, the majority of the releases took place in the area around the Lizard Peninsula. Now releases take place, when possible, in the same area where the pup was found. This is because fishermen showed a strong opposition to localised releases.

Seal watching is a significant attraction of this part of England. It can be done just using a pair of binoculars and standing on the coastal path. The best way, however, is to take a boat trip. Among other places, they are organised both in Dartmouth (Devon) and St. Ives (Cornwall). Boat trips departing from the Dartmouth harbour are very well organised. There is one big boat that can carry around 60 people and is fully equipped in order to provide facilities for the entire family. The trip lasts around two hours and costs £5 for adults and £4.5 for children. The boat runs from two to seven times per week. Boat trips departing from St. Ives are less organised. There are six boats that make up to six trips per day, each lasting around an hour and a half. Boats are much smaller than the one in Dartmouth (from 27 to 35 feet) and do not provide facilities in order to accommodate young children. The maximum capacity of the entire fleet is 310 people per day. The fares are £7 for adults and £6 for children. Earnings per year are around £60 000 for the entire fleet, while the cost per year per boat is around £4000. The industry is only marginally profitable and poorly organised. Consumer demand has fallen in the last decades and, indeed, around 60% of the people interviewed complained about the experience. The skippers working for the enterprise, when interviewed, outlined three main reasons for the decreased demand: the change in preferences of the younger generation, economic recession, and the presence of the Seal Sanctuary. However, the results of the contingent valuation survey suggested a very high WTP for seals in their natural environment, suggesting that the seal-viewing industry bears some responsibility. It should be underlined that the more frequent consumers are families with very young children and, while they can easily take part in boat trips organised in Dartmouth, this is not the case for the small boats departing from St. Ives.

The contingent valuation study

The survey population of the study comprises the tourists visiting the Seal Sanctuary in Gweek, and the tourists on a seal-watching boat trip, either departing from the harbours of St. Ives or from Dartmouth. Particular care was taken to collect a random sample and to interview mainly householders. However, this sample is not representative of all tourists visiting southwest England, given that it is a self-selected sample (respondents have been or are already experiencing the use of the

good). Nevertheless, this allows us to gain some important insights from this self-selected sample's stated preferences.

There are different features of the total economic value of a natural resource. The study tries to capture these by constructing, within the survey, different scenarios, each aiming to collect a different component of the information needed. For a complete version of the questionnaire, see Appendix 1. The first and second scenarios asked about the maximum WTP to 'use' the resource. In particular, given the presence of two alternative ways of 'using' seals, the second valuation question aimed to estimate the WTP for the alternative that the respondent is not actually experiencing. Thus, the maximum WTP for a seal-watching boat trip was elicited by interviewing people at the Seal Sanctuary, and *vice versa*. In the last scenario, the question asked refers to the maximum amount the respondent is willing to donate to a conservation programme, without involving any direct or indirect use of the resource. The conservation programme that was presented did not imply a growth in the seal population, but simply the creation of funds to mitigate the conflict among fishermen and seals. Seals would be able to survive and reproduce in their natural environment rather than being killed or injured. Although this third valuation question may capture a 'use' value component, if respondents belong to the seal-watching sample (deriving from the potential effect of the conservation programme on the probability of seeing a seal during a seal-watching trip), this possibility has been minimised through a careful formulation of the question. Two surveys were designed for the two samples, at the Seal Sanctuary and on the seal-watching trip. Each survey was divided into four main sections:

1. Social and environmental attitude section.
2. Descriptive section, regarding the experience (visiting the Seal Sanctuary or going for a seal-watching boat trip) and the cost of it.
3. Evaluation section.
4. Socio-economic description section.

The attitudinal and socio-economic information on respondents was collected to help respondents to out their responses to seal conservation in the context of other environmental concerns and to test the significance of explanatory variables. The descriptive section aimed to both capture important suggestions of possible management solutions and to gather information about the costs that respondents had to bare in order to experience the service. The valuation section is divided into three scenarios. Each of them follows the same structure and is composed of an explanatory introduction to the scenario in order to permit a standardization of information across respondents. The introductory part is followed by the valuation question.

The introductory part of Scenario I is followed by two different forms of questions to elicit the maximum WTP. The respondent is firstly reminded how expensive the management of the Seal Sanctuary is, and similarly for the seal-watching questionnaire. The questions then emphasised how the price of the good is not going to change, and that the aim of the survey is to collect the maximum WTP of the respondent. The respondent is asked to cast back his/her mind to the moment

he/she decided to come and assess his/her maximum WTP for the actual experience. The first valuation question is in the dichotomous choice (DC) format – i.e. in response to a suggested 'price' the respondent answers yes or no. A set of three bids was proposed on the basis of the results of a pre-test. This is followed by a question about the level of certainty of the previous yes/no answer. The second valuation question is an open-ended (OE) question, i.e. takes the form of a 'what is your maximum WTP?', followed by a question designed to elicit the level of certainty the respondents would associate to their preceding answer. For both valuation questions the payment vehicle is an increase in the entrance fee.

Scenario II is designed to capture the experience of seal watching both in the seals' natural environment and in a man-made context. Initially, each respondent is informed of the two alternatives and their characteristics. Two hypothetical prices for each of the possibilities are stated. The respondent is asked which option he/she would have chosen, given these prices. Following the first question, a second one is asked which is identical but for the price of the alternative option. The price might be higher or lower, according to the previous answer. This amounts to a combination of a choice experiment approach with a double bounded dichotomous type question. Again the payment vehicle is the entrance fee.

Scenario III aims to elicit the maximum WTP for tourists' non-use value of seals. The respondent is informed of the conflict situation concerning the seal population and the fishermen, and of the resulting problem. This is followed by the description of a hypothetical conservation plan aimed to mitigate the conflict in the most sensible economic way. Finally, the respondent is asked whether he/she would consider giving a donation to a conservation organisation, in addition to the entrance fee she/he has paid. Negative answers to the referendum question are followed by a debriefing question about different reasons for declaring a WTP equal to zero. The role of such a debriefing exercise is to identify respondents who expressed zero WTP as a form of protest, rather than as true WTP. As discussed in the Section 'The contingent valuation study', this tool makes it possible to eliminate protest zeros from the sample, given that they do not represent an effective value. Respondents willing to donate are shown a range of different amounts of money, from £0p to over £100. They are asked to:

- tick the amounts they are almost certain they would pay as a seal conservation levy;
- put a cross by the amounts they are almost certain they would not pay as a levy;
- leave blank the amounts they are unsure whether they would pay or not.

The payment vehicle is a donation.

Finally, the socio-economic characteristics of respondents were collected to examine the composition of the sample, as well as to analyse how the WTP varies with these characteristics. The survey collected data on: age, gender, number of people in the household, number of children, level of education, occupation, and household income per year.

The fieldwork for the survey was divided into two main steps: a set of 'key informants' interviews and a pre-test, and the main survey. The first step involved

interviewing fishermen's representatives – the Chief Fishery Officers of the CFPO – and some fishermen working in Newlyn harbour. This harbour plays a fundamental role in the whole problem, for two reasons. Firstly, in terms of value of fish landed, Newlyn is consistently the highest in England (PESCA 1996). Moreover, fishermen working from Newlyn are by far the most concerned about the damage due to grey seals (Glen 1998). A set of interviews with both the veterinary and management staff of the Seal Sanctuary in Gweek followed. Finally, useful information was collected from several interviews with skippers working on seal-watching boat trips in St. Ives. While this information was extremely useful in understanding the problem and what the structure of the questionnaire should be, a preliminary pre-test conducted on a small sample (12 individuals) was used to optimise the phrasing of the questions and to choose a meaningful range for the values of bids in the DC questions.

Once the survey was designed, it was carried out during 10 days of fieldwork. Five days were spent in the Seal Sanctuary, completing 112 questionnaires; 2 days in Dartmouth for a total of 50 questionnaires completed on board of the seal-watching trip; and, finally, 3 days in St. Ives for a total of 44 questionnaires. Each questionnaire was face-to-face. The interviewer presented cards to help the respondent understand the questions. An introduction preceded each interview to explain the aim of the research project as well as to capture the respondent's full attention. Table 2 reports the sample descriptive statistics.

Econometric analysis

The survey was designed to collect information by using different elicitation formats and by holding a constant payment vehicle (in the first two scenarios) to test the convergent validity of results. Internal consistency, i.e., consistency with economic rationality, could not really be tested because of the size of the sample. To have a consistent analysis of the data, in particular when collected via DC techniques, the size of the sample is fundamental. Each of the two sub-samples is of about 100 individuals – too small to be totally confident in the results. Nevertheless, for the last scenario, when regressing on the entire sample, the results are more reliable. In almost all the cases, the explanatory variables have the expected sign, even though the level of significance is often not reliable.

Scenario I

The WTP for this scenario was elicited by both DC and OE questions. Each respondent was asked a DC question (the set of three bids had been calibrated through the analysis of the pre-test results) and then to state his/her maximum WTP. The aim is to elicit the maximum WTP, for each individual, for non-consumptive use of seals. The reason both elicitation formats were used arises from the different advantages and shortcomings each format presents. DC or referendum questions present an important advantage in that they mimic everyday market transactions: the

Table 2. Characteristics of the sample (total number of respondents = 206).

	Location	
	Seal Sanctuary	Seal watching
Number of respondents	112	94
Males	51.5%	
Age (mean)	40.7	42.8
Number of people in the household (mean)	2.45	3.01
Number of children (mean)	0.74	0.59
Education (%)		
Primary	1.9	
O Levels	39.3	
A Levels or equivalent	12.1	
First degree level	18.4	
Professional qualification	10.2	
Higher degree	5.8	
Annual total household income after tax (mean, £)	23 840	24 750
Annual per capita income, after tax (mean, £)	12 020	9580
Income non-response	5.33%	
Employment (%)		
Self-employed	3.39	
Employed full-time	64.07	
Employed part-time	14.07	
Student	1.45	
Looking after the home full-time/housewife	5.82	
Retired	7.28	
Unable to work due to sickness or disability	1.45	
Unemployed	1.94	
Number of people in the party (mean)	3.54	2.44

The mean income per capita and respondents' party size are higher in the sub-sample of the Seal Sanctuary. Similarly, the number of children is higher and this is mainly related to the difficulties of going on a small boat with very young children.

individual faces a price and simply has to decide whether to take the good for that price or not. For this reason it is less likely that respondents misunderstand the question. The referendum format has been increasingly applied to take advantage of this characteristic, and was recommended in the NOAA (National Oceanic and Atmospheric Administration) Panel Guidelines (NOAA Panels 1992). It is as well to note, however, that some authors have questioned the extent to which answers to multiple bounded DC questions may be used to retrieve fully rational economic preferences – see Scarpa and Bateman (2000) and Bateman et al. (2001).

Data collected, pertinent to each individual in the sample, were (a) a bid value related to the entrance to the Seal Sanctuary (or seal watching), and (b) the yes/no response. We assume that the unobserved continuous dependent variable y^* is the respondent's true WTP for the entrance to the Seal Sanctuary (or seal watching). Moreover, we assume that the underlying distribution of y^* is a normal distribution and that y^* is conditional on a vector of explanatory variables x_j (where j is the number of explanatory variables). DC CVM data are often analysed using utility-based models with errors distributed Extreme Value Type I which can be analysed

Table 3. Single bounded model, all values certain.

	Single bounded normal model	
	Seal Sanctuary (n = 112)	Seal watching (n = 94)
Sample mean of predicted WTP (£)	8.48	9.75

with logit probabilities. However, at our sample sizes these are operationally indistinguishable from censored regression models with normally distributed errors, so we use the latter approach, originally proposed by Cameron and James (1987). The unobserved variable can be described, then, as $y^* = x_j b + e$, while the observed variable is an indicator that can take just the two values yes/no, which will be called I_Y and I_N, respectively. Therefore, the probability of observing a YES response at a given bid amount is given by

$$\Pr(\text{Yes}|\text{bid}) = \Pr(y^* \geq \text{bid}) = \Pr(x_j b + \varepsilon \geq \text{bid}) = \Pr(\varepsilon \geq \text{bid} - x_j b) \tag{1}$$

where *bid* is the bid stated in the dichotomous question. Assuming that $\varepsilon \sim N(0, \sigma)$, we have:

$$\Pr\left(\frac{e}{\sigma} > \frac{\text{bid} - x_j b}{\sigma}\right) = 1 - \Pr\left(\frac{e}{\sigma} < \frac{\text{bid} - x_j b}{\sigma}\right) = 1 - \Phi\left(\frac{\text{bid} - x_j b}{\sigma}\right) \tag{2}$$

Analogously, we can consider the probability of saying no as

$$\Pr(\text{No}|\text{bid}) = 1 - \Pr(y^* \geq \text{bid}) = 1 - \Pr(x_j b + \varepsilon \geq \text{bid}) = 1 - \Pr(\varepsilon \geq \text{bid} - x_j b) \tag{3}$$

The contribution to the log-likelihood function for each observation i, is given by

$$\ln L = \ln(I_Y * (1 - \Phi(\text{bid} - x_j b)/\sigma) + I_N * \Phi((\text{bid} - x_j b)/\sigma)) \tag{4}$$

A function programme was designed to introduce this log-likelihood function. A command programme recalls such a routine, so that STATA is able to read and maximise the function. This procedure was repeated for each of the models.

The outputs of the maximisation algorithm are the values for the parameters that maximise the log-likelihood function of the sample, see Appendix 2. In previous approaches the bid of the referendum was included only as one of the regressors of the conventional probit/logit analysis. The advantages of using this procedure, as stated by Cameron (Cameron 1988; Cameron and James 1987), are that: '' . . . estimated coefficients (other than σ) can be interpreted roughly as one would interpret the results from an OLS regression'' (Cameron 1988), whereas, ''in the past, empirical work using binary choice probit/logit models with referendum data overlooked the opportunity for this simple reinterpretation of the probit/logit parameters and therefore faced the awkward limitation of working only with probability estimates''.

The mean WTP was calculated for both sites using sample averages of the covariate variables. Results are presented in Table 3.

Information about the respondents' level of certainty was collected by introducing a follow-up question to complete the closed-ended part of Scenario I (Ready et al.

Table 4. Sample mean of predicted WTPs (£) for alternative options.

	OE	DC, all levels of certainty	DC, only more than 95% level of certainty
Seal Sanctuary (n = 112)	7.93	8.48	8.13
Seal watching (n = 94)	8.89	9.75	8.84

Table 5. Model summary and coefficients for OE Model, Seal Sanctuary sample.

```
sw reg imaxwtp ibid age educ income party11 sex envconce if location==1 ,p > r(.2)
                      begin with full model
p = 0.6051 >= 0.2000  removing envconce
p = 0.5285 >= 0.2000  removing age
p = 0.4701 >= 0.2000  removing educ
p = 0.2302 >= 0.2000  removing sex

  Source |       SS       df       MS                  Number of obs =     112
---------+------------------------------               F(  3,   108) =    3.37
   Model |  71.2708414     3  23.7569471               Prob > F      =  0.0212
Residual |  761.005944   108  7.04635134               R-squared     =  0.0856
---------+------------------------------               Adj R-squared =  0.0602
   Total |  832.276786   111  7.49798906               Root MSE      =  2.6545

------------------------------------------------------------------------------
 imaxwtp |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
    ibid |    .096902   .0508403      1.906   0.059      -.0038723    .1976762
  income |  -.0399059   .0212898     -1.874   0.064      -.0821059     .002294
 party11 |  -.2667972    .143973     -1.853   0.067      -.5521767    .0185823
   _cons |   8.896873   1.025963      8.672   0.000       6.863236    10.93051
------------------------------------------------------------------------------
```

1998). The respondent could choose among five possibilities. The analysis was carried out using the same maximum-likelihood function described above, excluding from the sample all individuals whose level of certainty was inferior to the 95% level. The resulting average WTPs are listed in Table 4 together with the results obtained from the OE data.

As can be observed in Table 4, the average WTP resulting from the analysis of a sub-sample of the DC respondents tends to get closer to the average WTP resulting from the OE data. It is interesting to note that the maximum WTP estimates for a seal-watching boat trip, deriving from Scenario II (derived from the model estimated on the Seal Sanctuary sample), are much higher. This lower value is consistent with the general dissatisfaction about the boat trips in St. Ives.

Data from the OE question were analysed using a linear OLS regression; resulting values of coefficients and models summary are shown in Tables 5 and 6.

In both samples the statistically significant coefficient, IBID – which represents the bid stated in the preceding DC question – shows a positive correlation with the maximum WTP. The anchoring to the bid level from the DC question makes the comparison of the two elicitation methods less meaningful.

As mentioned, data were collected from a self-selected sample who had already paid to get the good and whose base WTP was greater than zero. For this reason it was not possible to register WTPs smaller than £4 (i.e., the minimum entry fee, for both sites, plus zero consumer surplus). The density of a truncated variable involves '' . . . scaling the density so that it integrates to one over the range above a'' (Greene 1997), where a is the truncation point. Analytically:

Table 6. Model summary and coefficients for OE Model, seal-watching sample.

```
sw reg imaxwtp ibid age educ income party11 sex envconce if location==2 ,p > r(.2)
                      begin with full model
p = 0.8695 >= 0.2000  removing educ
p = 0.7297 >= 0.2000  removing age
p = 0.3379 >= 0.2000  removing sex
p = 0.2325 >= 0.2000  removing party11

  Source |       SS       df       MS                  Number of obs =      94
---------+------------------------------                F(  3,    90) =    3.56
   Model |  111.972645     3   37.324215                Prob > F      =  0.0174
Residual |  944.506078    90   10.494512                R-squared     =  0.1060
---------+------------------------------                Adj R-squared =  0.0762
   Total |  1056.47872    93  11.3599863                Root MSE      =  3.2395

------------------------------------------------------------------------------
 imaxwtp |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
    ibid |   .1303068   .0697975      1.867   0.065      -.0083582    .2689717
  income |   .0453515   .0280185      1.619   0.109      -.0103121    .1010152
envconce |  -1.578764   .6916581     -2.283   0.025      -2.952864   -.2046648
   _cons |   6.923978   1.186972      5.833   0.000       4.565852    9.282105
------------------------------------------------------------------------------
```

$$f(x|x>a)=\frac{f(x)}{\Pr(x>a)} \tag{5}$$

If x is a normally distributed variable such that $x\sim N(\mu, \sigma)$, then

$$f(x|x>a)=\frac{f(x)}{1-\Phi\left(\frac{a-\mu}{\sigma}\right)} \tag{6}$$

The graph in Figure 1 shows the density of a normal distribution, with mean and variance determined using the previous model results, and the truncated normal distribution.

The variable is truncated below; therefore the mean of the truncated variable will be higher than the original mean, as expressed analytically by

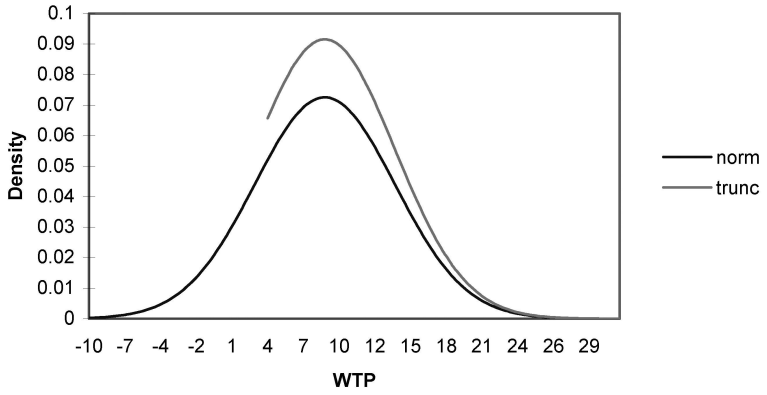

Figure 1. Normal distribution and truncated distribution ($a = 4$).

Table 7. Results from Scenario I, seal watching.

	Sample mean of predicted WTP (£); location: seal watching	
	OE	DC, more than 95% certainty
Mean truncated model	7.36	5.08
Truncated Mean	7.74	5.76

$$E[\mathrm{WTP}|\mathrm{WTP}>a]=x_j b+\sigma\frac{\phi\left(\frac{a-\mu}{\sigma}\right)}{1-\phi\left(\frac{a-\mu}{\sigma}\right)} \tag{7}$$

In the case of the OE data, considering a truncated normal model, when the truncation point is 4, the contribution to the log-likelihood function for each observation i is given by:

$$\ln L=\ln\left\{\frac{1/\sigma\phi\left(\frac{\max WTP-x_j b}{\sigma}\right)}{1-\Phi\left(\frac{4-x_j b}{\sigma}\right)}\right\} \tag{8}$$

where maxWTP is the value stated by the respondent.

In the case of the DC data, the contribution of one observation to the sample log-likelihood function is

$$\ln L=\ln\left\{I_Y\left[\frac{1-\Phi\left(\frac{bid-x_j b}{\sigma}\right)}{1-\Phi\left(\frac{4-x_j b}{\sigma}\right)}\right]+I_N\left[\frac{\Phi\left(\frac{bid-x_j b}{\sigma}\right)-\Phi\left(\frac{4-x_j b}{\sigma}\right)}{1-\Phi\left(\frac{4-x_j b}{\sigma}\right)}\right]\right\} \tag{9}$$

We can also consider the marginal effect of each explanatory variable (i.e., how the value of the truncated mean varies when varying the value of the regressors). As noted in Greene (1997), ''whether the marginal effects or the coefficient b itself is of interest depends on the intended inferences of the study. If the analysis is to be confined to the sub-population . . . the marginal effect is of interest. However, if the study is intended to extend to the entire population, it is the coefficients b that are actually of interest''. Table 7 shows the mean resulting from the truncated model (extended to the entire population) and the truncated mean, concerning the sub-population (parameter values are listed in Appendix 2).

Thus, the average maximum WTP to get on a seal-watching boat trip is, for the sub-population, £7.74 according to the OE results and £5.76 according to the DC results. The maximum WTP estimates for a seal-watching boat trip deriving from Scenario II (when respondents in the Seal Sanctuary are asked) are much higher. Again this probably reflects the high level of dissatisfaction with the quality of the actual boat trip.

Scenario II

Scenario II was designed to consider a different economic issue. How do respondents value the alternative non-consumptive use of seals? Does the bid function depend on the hypothetical price of the option they are actually choosing? Additionally, the information elicited from this set of questions is used to construct an inverse demand function for both the Seal Sanctuary and the seal-watching boat trip. This might help managers of these economic activities to understand which portion of the surplus they might be able to capture by raising the entry fees. Figures 2 and 3 show a visual representation of the data collected for Scenario II. Survivor functions represent the percentage of respondents who are willing to pay at least that amount.

The elicitation format in this scenario is a hybrid form between the choice experimental approach and closed-ended double-bounded DC method. We have analysed the data by using a double-bounded normal model. The rationale of the model follows from the previous single-bounded normal model. The difference is that, now, each respondent is answering two questions and this will give more information about the probability distribution characteristics.

In the valuation question, respondents of the Seal Sanctuary sample were asked

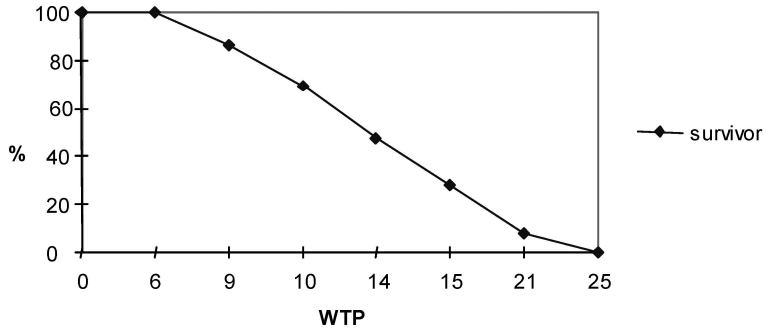

Figure 2. Survivor function for seal watching.

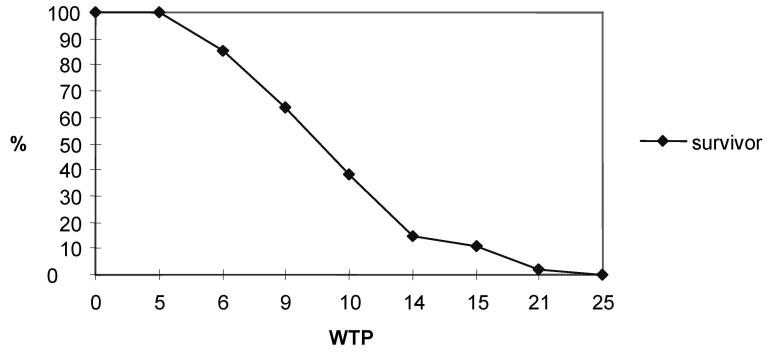

Figure 3. Survivor function for Seal Sanctuary.

Table 8. Results from Scenario II.

	Location: seal-watching WTP relative to Seal Sanctuary	Location: Seal Sanctuary WTP relative to seal watching
Mean WTP (£)	6.75	12.49

whether they would have paid BIDX to enter the Seal Sanctuary (respondents within the seal-watching sample were asked the same question relatively to seal watching) and BIDY to have the seal-watching trip (the question concerns the Seal Sanctuary, for respondents in the seal-watching sample). In the follow-up question the bid for the alternative option is increased (upBIDY, when the answer to the previous question is YES) or decreased (downBIDY, when the answer to the previous question is NO), see Appendix 1.

The explanatory variables in the bid function are the same as in previous cases, except for the variable BIDX. The coefficient of the latter variable is positive and statistically significant at the 1% level, but just in the regression related to the first site. This is probably due to the fact that introducing a high price for one of the two alternatives shifts the entire perspective of the respondent. The resulting marginal effect is positive.

The contribution of one observation to the sample log-likelihood function is now:

$$\begin{aligned}\ln L = \ln\Bigg\{ & I_{\mathrm{YY}}\left[1-\Phi\left(\frac{\mathrm{upBIDY}-x_j b}{\sigma}\right)\right] \\ & + I_{\mathrm{YN}}\left[\Phi\left(\frac{\mathrm{upBIDY}-x_j b}{\sigma}\right)-\Phi\left(\frac{\mathrm{BIDY}-x_j b}{\sigma}\right)\right] \\ & + I_{\mathrm{NY}}\left[\Phi\left(\frac{\mathrm{BIDY}-x_j b}{\sigma}\right)-\Phi\left(\frac{\mathrm{downBIDY}-x_j b}{\sigma}\right)\right] \\ & + I_{\mathrm{NN}}\left[\Phi\left(\frac{\mathrm{downBIDY}-x_j b}{\sigma}\right)\right]\Bigg\} \end{aligned} \tag{10}$$

where $I_{\mathrm{YY}}/I_{\mathrm{YN}}/I_{NY}/I_{\mathrm{NN}}$ are dummy variables that take value 1 if respondents answer yes to the first and the second (higher) bid/yes to the first and no to the second bid/ no to the first and yes to the second (lower) bid/ no to both bids; BIDY is the first question bid value; upBIDY is the upper bid value; downBIDY is the lower bid value; the unobserved variable is supposed to be normally distributed BIDY~ $N(xb,\sigma)$.

Resulting mean WTP values (calculated using a similar procedure as in the previous models) are shown in Table 8; see Appendix 2 for regression results details. Individuals interviewed in the Seal Sanctuary, when reminded of the possibility of watching seals in their natural environment, show a higher WTP than for the Seal Sanctuary itself.

The probability distribution of the WTP for the seal-watching boat trip, obtained using the results from the regression, is shown in Figure 4. It is now possible to obtain the direct demand curve. In order to design the best pricing scheme, it will be

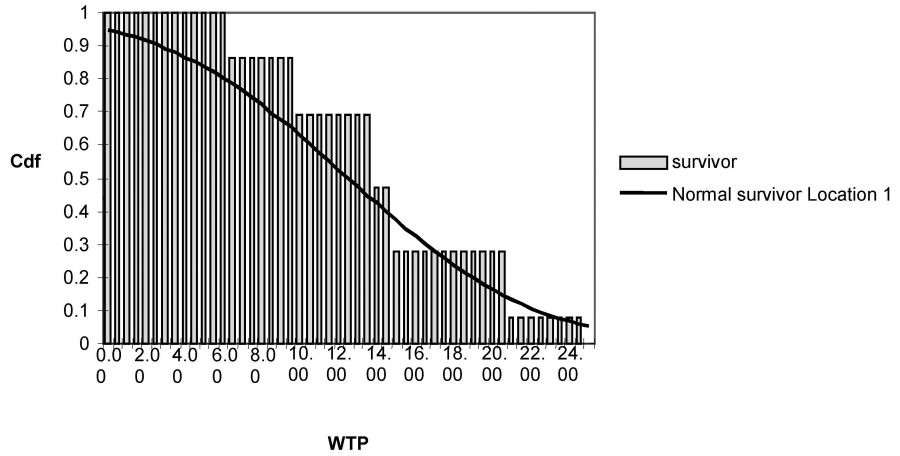

Figure 4. The demand curve for seal watching (Seal Sanctuary).

necessary to incorporate information about the cost of the activity, as well as the carrying capacity.

Scenario III

In Scenario III the question is exactly the same for both sites, and the object evaluated is the non-use value of seals. The form of payment is an optional, per person, conservation fee, that would be paid on top of the entrance fee. Respondents were shown a payment ladder and therefore the data collected are an upper and a lower bound within which the unobservable WTP lies. The first approach to the data is a simple visual analysis. It is useful to consider the survivor functions either for crosses or for ticks (see Figure 5). Data from the two samples were pooled together once the statistical significance of the variable defining the locus of the interviews had been tested and rejected.

Table 9 reports the values for the mean, the standard deviation, the minimum and the maximum WTP for ticks and crosses. It could be argued that using the average tick value is a sensible conservative solution. However, a model can be designed to estimate the average unobservable WTP and to see whether there is a relationship with any covariate information. For example, it might be of interest to consider whether the non-use value of seals is related to the location of the interview or not and, therefore, whether to pool together data from the two questionnaires in a unique sample. The problem is that there is a possibility of correlation between the income variable and the location. As before, we consider a linear normal specification for the model. Hence, the contribution of one observation to the log-likelihood function is:

$$\ln L = \ln\left\{\Phi\left(\frac{\text{cross}-x_j b}{\sigma}\right)-\Phi\left(\frac{\text{tick}-x_j b}{\sigma}\right)\right\} \tag{11}$$

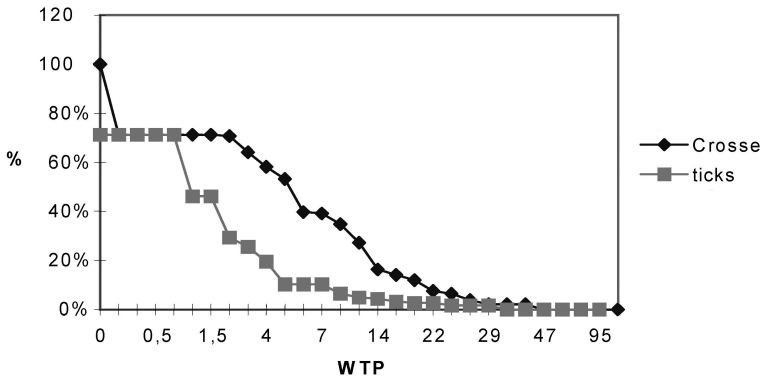

Figure 5. Survivor functions for crosses and ticks in Scenario III.

Table 9. WTP conservation fund.

	N	Mean (£)	Std. dev.	Min (£)	Max (£)
Seal Sanctuary					
Ticks	112	2.71	5.236	0	33
Crosses	112	5.24	7.426	0	37
Seal watching					
Ticks	94	2.53	4.918	0	33
Crosses	94	6.56	12.379	0	100

Table 10. 'Zero-responses' reasons, card shown to respondents.

'No Response' reasons	Tick
1. Seal conservation is important but there are far more worthy causes to which I would prefer to donate money	
2. I cannot afford to pay anything but would do so otherwise	
3. I don't think that the problems caused by seals are severe enough to warrant paying money to conserve them	
4. I don't believe that such a programme would be effective in helping conserve seals	
5. I don't believe that a programme of seal conservation should be funded through public donations	
6. Other (Please specify)	

where $\Phi(x)$ is the cumulative of the normal distribution, x_j are the jth explanatory variables, and σ is the standard deviation of the distribution that will be estimated by the optimising routine together with the b parameters.

Initially, respondents are asked a referendum question. They might answer 'no' for different reasons, which can be usefully divided into two main subgroups. The first is the group of effective zeros. The respondent might be unable to donate because of his/her budget constraint or because there are more worthy causes. The second group is defined as protest zeros: respondents are rejecting the entire question and the underlying policy implications. In case of a zero answer the card in Table 10 was shown to respondents.

Respondents refusing to participate in the contingent market (answers 4 and 5) were excluded from the sample. The protest zeros were 29% of the whole zeros (31.4%) in the sample. A second issue relates to the remaining zero values which produce a mathematical problem when working with logarithms. Several authors have dealt with this issue by applying the Spike Model (Kristrom 1997; Reiser and Shechter 1998a; Scarpa et al. 2001). The idea is to deal separately with the probability of saying yes/no, on one side, and the probability of stating a value in the positive case, on the other. The sample is divided into two sub-samples. One is not willing to pay anything, while the second is willing to pay something and the WTP is normally distributed.

The contribution of one observation to the log-likelihood function is

$$\ln L=\delta\ln p+(1-\delta)\ln(1-p)+(1-\delta)\ln\left[\Phi\left(\frac{\text{cross}-x_j b}{\sigma}\right)-\Phi\left(\frac{\text{tick}-x_j b}{\sigma}\right)\right] \tag{12}$$

where $\delta = 0(1)$ if respondents answer yes (no). We assume that the probability of saying no is the number of valid zeros over the total number of valid responses:

$$p=\frac{\sum\delta_i}{n}=0.2880435\approx 28.8\% \tag{13}$$

The value for the mean becomes:

$$E(\text{WTP})=(1-p)xb \tag{14}$$

The graph in Figure 6 shows the survivor function (i.e., $1 - \Phi(z)$), estimated using the described model, together with survivor functions for crosses and ticks. We have tested for the statistical significance of a dummy variable defining the location of the interview; however, as can be seen in detail in Appendix 2, the small size of the sample makes the results from the regression scarcely reliable. Indeed, the regression results are not statistically significant for all the coefficients except for PARTY, which has a negative value and is significant at the 2% level of confidence.

As before, results have been used to calculate the average WTP deriving from the estimated model, see Table 11. However, the more reliable and conservative data that should be used to draw some conclusions is the average value of ticks.

Of interest is the value that could actually be captured in order to compensate the fishing industry. One feasible way to obtain it is to estimate the number of paying visitors per year, which is around 200 000. Hence, to get an extremely conservative estimate of the actual monetary amount that might be collected we use the average value of ticks (£2.63) and consider a number of paying visitors equal to half of the actual annual visitors, obtaining an annual amount of £526 000.

Several results can be discussed. First, the hypothesis of weighting data coming from referendum surveys, to take into account the level of respondents' certainty, has proved to be of limited value when both formats are used in the same questionnaire, because of the anchoring effect. However, better results may be

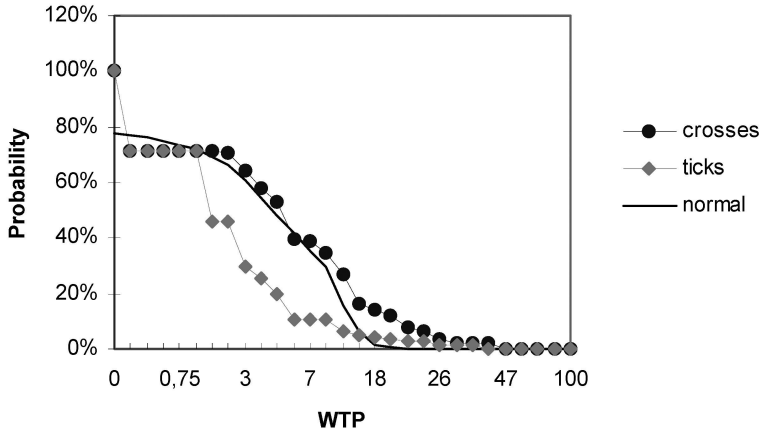

Figure 6. Different survivor functions relative to cross and tick values and to the estimated normal model.

Table 11. Possible values to be used in order to evaluate 'non-use' value of seals.

	Mean (£)
Ticks	2.63
Crosses	5.85
Average WTP calculated on the entire sample	4.65

obtained by conducting two distinct questionnaires, each using one of the two formats. This would require a large sample. Second, given the truncated nature of the sample investigated, a truncated distribution model has been used to extend the study to the entire population. The calculated average WTP is significantly lower. However, the sample is probably too small to extend results to the entire population. Third, results from the second scenario have shown that people in the Seal Sanctuary are willing to pay more to see seals in their natural environment rather than in the Sanctuary itself. Moreover, the average WTP calculated is higher than the one obtained from the seal-watching sub-population. This could partially be a reflection of the high level of disappointment recorded among respondents arriving from boat trips in St. Ives. Finally, we have followed the more conservative estimation technique and we have aggregated over the annual Seal Sanctuary visitors the mean value of ticks to obtain a gross WTP for 'non-use' value of seals of around £526 000 per year. This value can be compared, for policy purposes, to the fishermen's annual losses due to seals (roughly £100 000). Seals are a high value 'flagship' species, as the results of the study confirm. Thus, only a fraction of the total economic value is needed to compensate fishermen for the losses they suffer. Put another way, the benefits of a compensation scheme outweigh the costs. This result can be contrasted with the various 'technological' options, including seal-culling, considered so far as potential policies, and with the risk that fishermen will 'go it alone' by destroying seals, regardless of the law.

Conclusions

The conflict between fishermen and seals is, at the present, producing an inefficient outcome. This study shows that there is room for a more efficient reallocation of resources. The importance of developing definitive strategies is aggravated by the economic vulnerability of the Cornish fishing industry. Moreover, even if we are extremely unsure of the dynamics of this seals settlement, it is clearly of key importance in the migration patterns of the European population. Decision-makers should consider different policies.

The first goal is to find a way to capture part of the economic value of seals and subsequently invest in conservation. As was shown in the present study, this value is significantly higher than the losses suffered by the fishing industry, even when considering just the non-use portion of the total economic value. One way of capturing this could be an optional conservation fee on top of the fees for recreational use of seals. Fishing techniques, which are affected by and affect seals, could be restricted in areas where seals tend to gather to mate or reproduce. Fishermen would then be compensated for the losses. In order to implement this strategy, the biological dynamics of the population and the seals' territorial distribution should be studied in-depth. In specific cases, when the compensation costs are extremely high and the damage is related to isolated rogue seals, then direct elimination might be a more rational solution.

A second issue of importance is the role of the Seal Sanctuary. Even if effects on the seal population are still not quite clear, it would be advisable to introduce norms in order to regulate: the length of the captivity period for each seal pup, the maximum number of rescued pups per year, and the location of releases.

Finally, the study has revealed a demand for seal watching that is not consistent with the perceptions of people organising this activity. The tourists' WTP elicited in the present study is higher than expected. Indeed, it would be very important to invest in improved facilities, thus capturing the proportion of consumers that have very young children.

Acknowledgements

We are very much indebted to Brett Day and Wolf Krug of CSERGE, University College London for advice on the original study; and to Ian Bateman of the University of East Anglia and Ken Willis of the University of Newcastle for comments on a penultimate draft. Special thanks go to Stephen Wescott for invaluable help with the survey and advice on the ecology of seal populations. We wish to thank English Nature for financing the field study costs of V.B. Finally, this study would not have been possible without the co-operation of the Seal Sanctuary of Gweek, the CFPO (Cornish Fish Producers Organisation) and the seal-watching boat trip organisations in Dartmouth and St. Ives. All errors of fact and interpretation are solely our own.

Appendix 1

UNIVERSITY COLLEGE OF LONDON

SEAL CONSERVATION STUDY
A TOURIST SURVEY

Dear visitor

English Nature, in association with the Economics Department of the University College of London, is investigating different options for the conservation and management of seals in Cornwall.

The purpose of this survey is to gather information related to tourists' opinions about this issue. It will only take you about 15 minutes to fill in this questionnaire.

Thank you for your patience.

INTRODUCTION

1. Of the problems listed below which do you personally consider to be the most important? And which problem do you consider to be the second most important?

Show respondent list of problems

Circle ONE answer code for most important and ONE answer code for second most important:

Problem	Most important	Second most important
Inflation	1	1
Environmental problems	2	2
The Health Service	3	3
Education	4	4
Transport	5	5
Law and Order	6	6
Unemployment	7	7
Poverty	8	8

2. Consider the following list of environmental problems. Which problem do you consider to be the most important? And which problem do you consider to be the second most important?

Show respondent list of environmental problems

Circle ONE answer code for most important and ONE answer code for second most important:

Environmental Problem	Most important	Second most important
Rubbish and Waste	1	1
Air pollution	2	2
Sanitation	3	3
Species extinction	4	4
Destruction of forests	5	5
Pollution of lakes, rivers and seas	6	6

3. Which of the following best describes why you are in Cornwall at the moment;

- I live here
- I'm on holiday
- I 'm here primarily to work
- I'm visiting friends and/or relatives
- Other _____

4. Where are you staying in Cornwall? _____

5. Have you ever visited the Seal Sanctuary before? YES NO

6. [*If yes*] How often? _____

7. Have you ever seen Seals in the wild? YES NO

8. [*If yes*] Was this part of an organized excursion? YES NO

WILLINGNESS TO PAY

Scenario I

9. Are you visiting the Seal Sanctuary on your own? YES NO

If NO

10. How many people are there in your party? No. in Party ____

As you are probably aware the Seal Sanctuary has been established for over 40 years and is Europe's leading marine animal rescue centre caring for dozens of sick, injured and orphaned seals. Naturally, providing these facilities is an expensive undertaking. For the most part, the sanctuary raises funds through charging an entrance fee to visitors. Could you tell me ....

11. How many people in your party did you pay for? No. Paid for ___

12. How many of those are below the age of 14? No. < 14 ____

13. So, in total, how much did it cost you to enter the Seal Sanctuary?
Total Cost _____

14. Though, there are no plans to increase entrance fees, we are extremely interested in discovering how much people might be willing to pay to visit the sanctuary. If you could cast your mind back to the moment when you decided to visit the seal sanctuary, would you still have decided to come if the entrance fee had been £X per person?

YES NO

15. Obviously, we understand that this is a difficult question? If you could take a minute to consider your previous answer which of the following statements best describes how certain you are that you would have been willing to pay a £X entrance fee per person?

1. I am **almost certain** that I **would** pay a £X entrance fee. By "almost certain", I mean that you are **95% sure** that you would pay £X.	1
2. It is more likely that I **would** pay than that I would not pay that amount.	2
3. It is **equally likely** that I would pay as that I would not pay that amount.	3
4. It is more likely that I would **not** pay than that I would pay that amount.	4
5. I am **almost certain** that I would **not** pay a £X entrance fee. By "almost certain", I mean that you are **95% sure** that you would **not** pay £X.	5
6. Refuse to answer/Dont know	6

16. So, what is the very maximum amount that you would be **certainly** willing to pay as an entrance fee per person to visit the seal sanctuary?

Max Amount _____

Scenario II

At the moment, no organized facilities exist In Cornwall to view seals in their natural environment. However, I'd like you to imagine that there existed a boat trip that would take visitors out to the beaches and islands where wild seals can be viewed in their natural habitat. The excursion would last around 2 hours and would offer the possibility of seeing other marine animals.

17. Again, I'd like you to think back to the point of time when you made your decision to visit the seal sanctuary. Now, imagine that the entrance fee for the Seal Sanctuary was £X, if the cost of a boat trip to view seals in the wild were £Y, would you have chosen to:

- Only visited the seal sanctuary
- Only take the boat trip to view seals in the wild
- Visited both the seal sanctuary and taken the boat trip
- Visited Neither

[*If respondent answers that they would have taken the boat trip*]

18. OK, now imagine that the boat trip would cost £Y+ which option would you have chosen:

- Only visited the seal sanctuary
- Only take the boat trip to view seals in the wild
- Visited both the seal sanctuary and taken the boat trip
- Visited Neither

[*If respondent answers that they would NOT have taken the boat trip*]

19. OK, now imagine that the boat trip would cost £Y- which option would you have chosen:

- Only visited the seal sanctuary
- Only take the boat trip to view seals in the wild
- Visited both the seal sanctuary and taken the boat trip
- Visited Neither

Scenario III

OK, I have one last set of questions for you.

As you are probably aware, seals and local fishermen find themselves in competition for the same resource, namely fish. Understandably, this means that local fishermen care little for seals and indeed, would rather see their numbers reduced.

Put simply, the conflict between seals and fishermen comes down to the following:
- seals are a problem for the fishing industry because they damage fishing nets and equipment and, by eating fish, reduce fishermen's catches;
- fishermen's nets and fishing equipment cause the death of many young seals.

Imagine that a well respected conservation organization were to set up a conservation programme that aimed to:

- promote seal-friendly fishing techniques
- subsidize seal-friendly fishing equipment
- improve environmental awareness among fishermen

Imagine further that this organization could only finance such a programme through public donations.

20. Would you be willing to donate money for such a program?

YES NO

[*If Respondent Replies NO*]

21. Which of the following statements best explains your reasons for not wishing to contribute to such a fund

Reason	Tick
1. Seal conservation is important but there are far more worthy causes to which I would prefer to donate money	
2. I cannot afford to pay anything but would do so otherwise	
3. I don't think that the problems caused by seals are severe enough to warrant paying money to conserve them	
4. I don't believe that such a programme would be effective in helping conserve seals	
5. I don't believe that a programme of seal conservation should be funded through public donations	
6. Other (Please Specify) _____	

[*If Respondent Answers YES*]

22. Imagine that the seal sanctuary would raise funds for this conservation programme by giving visitors the option to pay a seal conservation levy on top of the entry fee. All the money raised through the conservation levy would go directly to the conservation programme.

Could you tell me the maximum amount you would be willing to donate as a seal conservation levy?

[*Give Payment Ladder to Respondent*]

On this worksheet is a range of different amounts of money, from £ .0p to over £100. I am going to ask you which amounts on the list:

-You are almost certain you would pay as a seal conservation levy

- You are almost certain you would not pay as a levy

- You are unsure whether you would pay or not

By almost certain - I mean you are 95% sure.

- starting from the top of the ladder could you **TICK** every value that you are **almost certain** you would be willing to donate as a seal conservation levy; stop at the first amount you are not **almost certain** you would pay.

- OK, now let's go to the highest amount on the ladder. Could you **CROSS** every value that you are **almost certain** you would NOT donate as a seal conservation levy; please stop

crossing when you reach an amount at which you think there may be a possibility that you would pay this as a levy.

- You may have left some values blank … this is no problem, I assume these are the values that you think you might possibly pay but you cannot say for certain.

£	✓, ✗
0p	
10p	
30p	
50p	
75p	
£1	
£1.50	
£2	
£3	
£5	
£8	
£11	
£14	
£18	
£23	
£29	
£37	
£47	
£60	
£76	
£95	
£100+	

SOCIO-ECONOMIC DETAILS

23. Age: Male Female

24. Age (exact) .....

18-24 years	(A)	1
25-34 years	(B)	2
35-44 years	(C)	3
45-54 years	(D)	4
55-64 years	(E)	5
65-74 years	(F)	6

Now I have a few questions about your background. These will only be used for statistical purposes. Remember, all of these answers are completely confidential.

25. How many people are there in your household, including yourself?

26. Of these, how many are 15 years of age or younger?

27. At what level did you complete your education ? (IF STILL STUDYING)
Which best describes the highest level you have attained up until now ?
Just tell me the appropriate number on this card

[Please Circle one answer code]

Primary	1
O Levels/GCSE/CSE/School Cert Scottish: Standard Grade	2
A Levels or equivalent Scottish: Higher Grade	3
Technical/vocational training (HNC/HND)	4
College/University/First degree level	5
Professional qualification of degree level	6
Higher degree (MA,MSc, PhD etc)	7
Other (Write in) ----------	

28. What would you describe as your main occupation?

[Circle one code]

Self-employed	*1*
Employed full-time (30 hrs plus per week)	*2*
Employed part-time (Under 30 hrs per week)	*3*
Student	*4*
Unemployed	*5*
Looking after the home full-time / Housewife	*6*
Retired	*7*
Unable to work due to sickness or disability	*8*
Other (please specify)	

29. Could you estimate for us your <u>total household's</u> annual income before tax? Choose from one of the categories on this card. Remember to include all of the household's sources of income, for instance, pensions, benefits, savings etc. Your answer will be completely confidential. It will be used only for statistical analysis. *Again please just read out the letter on the card.*

PER YEAR	PER MONTH	
Up to £6,000 per year	Up to £500 per month ->	1
£6,001 to £9,000 per year	£501 - £750 per month ->	2
£9,001 - £12,000 per year	£751 - £1,000 per month ->	3

£12,001 - £18,000 per year	£1,001 - £1,500 per month ->	4
£18,001 - £24,000 per year	£1,501 - £2,000 per month->	5
£24,001 - £30,000 per year	£2,001 - £2,500 per month ->	6
£30,001 - £36,000 per year	£2,501 - £3,000 per month->	7
Over £36,001	More than £3,001 per month	8
Don't know		9

Appendix 2

Scenario I Dichotomous choice

Location 1

SINGLE BOUNDED ANALYSIS: Normal Model — Number of obs = 112; Model chi2(3) = .; Prob > chi2 = .

Log Likelihood = -51.8909010

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtp						
party11	-.648621	.4895208	-1.325	0.185	-1.608064	.3108221
dinc	6.25839	3.850577	1.625	0.104	-1.288602	13.80538
inccap	-.018389	.1083907	-0.170	0.865	-.2308308	.1940528
_cons	10.77237	2.474081	4.354	0.000	5.923261	15.62148
sigma						
_cons	5.499739	1.148707	4.788	0.000	3.248314	7.751163

Location2

SINGLE BOUNDED ANALYSIS: Normal Model — Number of obs = 94; Model chi2(3) = .; Prob > chi2 = .

Log Likelihood = -46.3467695

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtp						
party11	-1.426038	.9119219	-1.564	0.118	-3.213372	.3612956
dinc	-4.97472	4.505264	-1.104	0.270	-13.80487	3.855435
inccap	.0866136	.1485436	0.583	0.560	-.2045265	.3777537
_cons	12.76553	2.60955	4.892	0.000	7.650911	17.88016
sigma						
_cons	6.0838	1.406045	4.327	0.000	3.328003	8.839597

Scenario I Truncated Model

Location 1

TRUNCATED SINGLE BOUNDED : Normal Model — Number of obs = 83; Model chi2(3) = .; Prob > chi2 = .

Log Likelihood = -31.8295854

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtp						
party11	-6.936904	5.081646	-1.365	0.172	-16.89675	3.022939
income	-.6059386	.7172419	-0.845	0.398	-2.011707	.7998298
dinc	22.08352	25.25907	0.874	0.382	-27.42335	71.59038

Location 2

TRUNCATED SINGLE BOUNDED : Normal Model

Number of obs = 62
Model chi2(3) = .
Prob > chi2 = .

Log Likelihood = -25.2747141

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtp						
party11	-1.286051	1.876109	-0.685	0.493	-4.963156	2.391055
dinc	-34.70244	30.04584	-1.155	0.248	-93.5912	24.18631
inccap	.1314945	.2096909	0.627	0.531	-.2794921	.5424812
_cons	9.540404	4.660913	2.047	0.041	.4051826	18.67562
sigma						
_cons	5.647721	2.052809	2.751	0.006	1.624289	9.671153

Scenario II Double bounded

Location 1

DOUBLE BOUNDED: Normal Model

Number of obs = 112
Model chi2(4) = .
Prob > chi2 = .

Log Likelihood = -133.5164890

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtp						
party11	-.5659017	.5045206	-1.122	0.262	-1.554744	.4229406
inccap	.0406077	.10793	0.376	0.707	-.1709311	.2521465
dinc	-5.320357	4.603316	-1.156	0.248	-14.34269	3.701977
iibidx	.6662329	.2640516	2.523	0.012	.1487012	1.183765
_cons	7.706754	3.428059	2.248	0.025	.9878818	14.42563
sigma						
_cons	7.654414	.9517602	8.042	0.000	5.788998	9.519829

Location2

DOUBLE BOUNDED: Normal Model

Number of obs = 94
Model chi2(4) = .
Prob > chi2 = .

Log Likelihood = -105.8288800

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtp						
party11	-1.796545	1.054383	-1.704	0.088	-3.863098	.2700068
inccap	-.389527	.2055788	-1.895	0.058	-.7924542	.0134001
dinc	.9637508	4.301009	0.224	0.823	-7.466072	9.393573
iibidx	.4056793	.2272978	1.785	0.074	-.0398162	.8511749
_cons	10.54495	3.7776	2.791	0.005	3.14099	17.94891
sigma						
_cons	8.798988	1.365628	6.443	0.000	6.122407	11.47557

Scenario III
Payment ladder

All sample

Normal Model

Number of obs = 206
Model chi2(4) = .
Prob > chi2 = .

Log Likelihood = -252.0865771

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtp						
party11	-1.25801	.4008149	-3.139	0.002	-2.043593	-.4724274
loci	.7279	1.265264	0.575	0.565	-1.751971	3.207771
inccap	-.0003142	.077769	-0.004	0.997	-.1527386	.1521102
dinc	-1.998704	2.529227	-0.790	0.429	-6.955898	2.958491
_cons	10.05117	1.697517	5.921	0.000	6.724101	13.37825
sigma						
_cons	6.174081	.4053461	15.232	0.000	5.379617	6.968545

Value of p= 0.288

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