Analyzing Beach Recreationist's Preferences for the Reduction of Jellyfish Outbreaks: economic results from a stated-choice experiment in Catalonia, Spain

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Abstract:

Catalonia is characterized by 580 km of coastline, and this area constitutes a world-leading coastal tourist destination. In 2012 it was registered 263.7 million beach recreational visits. In this same year we applied with the supervision of qualified interviewers, an *in situ* socio-economic questionnaire to shed light on tourists' preferences for beach recreation. We use a state-choice questionnaire, exploring the use of a *Random Utility Model*, so as to estimate how much respondents are willing to pay, in terms of reported extra travel time, for the reduction of jellyfish outbreaks. According to the estimation results, respondents are willing to spend an additional 23.8% of their travel time so as to enjoy beach recreation is areas with a lower risk of jellyfish outbreak. Economists interpret this result as reiterating the importance of the reduction the risk of jellyfish outbreaks in the consumption of beach recreation activities. Combining these estimates with the respondent available income, we can calculate that the welfare gains associated with a reduction of jellyfish outbreaks in this area ranges between €312-€322 million/year. This amount corresponds approximately to 9% of the tourism expenditures of the Catalan population in 2012. Moreover, from the policy perspective this study confirms the urgency for the provision of daily information exploring the use of the wide set of social media applications, including *Iphone* and *Twitter*. According to the natural-scientists, the current lack of knowledge on jellyfish suggests that providing information to the beach recreationists is the only effective policy instrument to minimize the risk of the impact of jellyfish outbreaks.

Keywords: socio-economic questionnaire, stated choice survey, economic valuation, jellyfish outbreaks, risk perception, travel time, econometrics, welfare.

1. Introduction

While jellyfish are a natural feature of the Mediterranean Sea, "jelly blooms" are recursive events. Such events represent an inconvenience for swimmers, and certain species may even become a significant health hazard – see Condon et al (2012) and Purcell (2011) for more information. Media have been increasing their awareness and thus intensifying the echo on this phenomenon on the Catalan coast, for the period 1980-2012 – see Canepa et al (2012) for a recent review. Jellyfishes are considered a problem by fishermen, as they clog nets, keep away fish and consume fish larvae – see Sabatés et al. (2010). The resulting socio-economic impacts – both direct (tourism) and indirect (coastal development, fisheries) – are becoming quite tangible and significant. Although overfishing, coastal habitat degradation and climate warming are amongst the most probable drivers, the economic impact and consequences of such outbreaks remains unknown.

Very few studies so far have studied the impact of jellyfish outbreaks in the economic sectors. An exception is Kim et al. (2012) who assess the impact of jellyfish outbreaks in Korea´s fishing, ranging their estimated impact between 2.1% and 25% of the total value. However, jellyfish outbreaks have many more consequences than those suffered by the fishing fleet, including potentially severe losses in recreational values. Economic valuation of tourism and recreational losses due to jellyfish outbreaks is, however, very limited if not inexistent. The present paper addresses this gap and constitutes the first worldwide econometric valuation study on this area, including both market and non-market losses.

The objective of this paper is to assess the impact of jellyfish outbreaks in recreationists' preferences in Catalonia (Spain), contributing to this narrowed literature. Catalonia is a region in the North-East part of Spain with 580km of coastline and constitutes a world-leading coastal tourist destination. In 2012, it was registered 263.7 million beach recreational visits – see Catalunya Turística en Xifres (2012). In this context, the aim of this paper is to explore the impact of the risk of jellyfish outbreaks on beach recreationists, computing the implicit value of the additional time that visitors are willing to travel to the beach in order to reduce the probability of encountering a jellyfish outbreak. We find that jellyfish outbreaks are an important nuisance for recreational visitors, who are willing to pay an equivalent amount to 16-19% of Catalan tourist expenditures in Catalonia in order to avoid jellyfish outbreaks.

The structure of this paper is as follows. Section 2 presents the survey design and implementation as well as the structure of the final survey instrument. Section 3 presents the empirical work, including the selected econometric model specification and respective parameters' estimates. Section 4 explores use of the estimation results as behavioral, science based underpinnings of response polices for beach and coastal management. Section 5 concludes.

2. Survey design and implementation

2.1 Preliminary survey design

The 221 beaches present in the coast of Catalonia were classified according to a set of parameters including *inter alia* the municipality/location, the beach surface, the water

quality/visibility, the level of occupancy/congestion and the type of the surrounding environment, ranging from urban to natural. The combination of this set of elements will allow us not only to profile the beaches in the Catalonia but also help us in selecting a sample of beaches for our study that are representative for the entire coastline under study. The selected sample of is constituted by the beaches of Barceloneta, Bogatell, Sabanell, Blanes, Gran de Palamós, Fosca, Castell and Golfet– see Table 1.

** Table 1 about here **

As we can see, the beaches selected have different profiles and therefore may be attracting different users, or consumers of beach recreation activities, as well as different uses of the beach. For example, the Barceloneta is a semi-closed urban beach located in a highly touristic neighbourhood in Barcelona and with a high occupation level. Bogatell is a closed urban beach located in the urban area of Barcelona and highly occupied. Sabanell is a semi-closed beach located in a semi-urbanized area in Blanes. Blanes is a closed urban beach located in the city of Blanes. Gran de Palamós is a semi-closed beach located in the urban centre of Palamós with a high frequentation but a low occupation due to its large extension. Fosca is a closed beach located in La Fosca neighbourhood in Palamós with a high occupancy level. Castell is a closed natural beach located between the municipalities of Palamós and Palafrurgell, inside the Castell-Cap Roig, a natural protected area by the Plan for Spaces of Natural Interest. Golfet is a closed natural beach also located in the Castell-Cap Roig area, next to a low

urbanized area in the South of Calella de Palafrurgell, highly occupied due to its small area, only 1,277m^2.

In addition to the sampling of the beaches, we have also drafted and tested the survey protocol by means of several focus groups and a pilot experience hold in the beach. This set of activities allowed us to optimize the wording, the use of visual-aids and the overall understanding of the final questionnaire by the respondent. In addition, a training session to the enumerators was carried out in the CMI headquarters since the survey is proposed to be executed as a face-to-face survey. Each enumerator was debriefed about the nature and the objective of the questionnaire and given a toolbox for this operation, including a set of *verbatim* explanations whenever requested. At this stage, the final questionnaire is ready for execution. Before, however, we present and describe the structure of the final questionnaire.

2.2 Structure of the final questionnaire

The final questionnaire consisted of six sections[1].The first questions are focused on profiling the respondent with respect to *inter alia* the set of recreational activities that (s)he takes on the beach, the size and composition of persons in her/his group, number of the days on the beach during the 2011 summer season, expected number of days during the 2012 summer season, length of trip, whether nautical sports are practiced as well as the importance attached to recreational activities and other attributes in choosing the beach. The second section elicits information regarding the travel cost and expenditures incurred to visit the beach (e.g. travel cost and travel time, accommodation

[1] Please see Annex for the complete questionnaire.

cost per that day, meal cost per that day). Respondents are also asked to report the means of transportation used to get into the beach, including walking. Among the non-residents, information was also collected on respondents' type of accommodation, including holiday home, hotel or staying at friends/relatives. The third section focuses on eliciting the socio-economic impacts of jellyfish outbreaks, including the profiling of the respondent's experience with respect to jellyfish stings and the potential economic cost of treatment.

In the fourth section respondents face the stated choice exercise or a choice experiment (CE). During this task ten multiple choice cards comprised by three different options are presented to every respondent. The first two options, showed two beaches with different recreational opportunities. The third, as recommended by Adamowicz, Louviere and Swait (1998), was a non-choice option offering an alternative that contained the opportunity to stay at home or do any other creational opportunity apart from going to the beach. It was presented to participants as this is an obvious element of choice behavior. Recreational opportunities were characterized in terms of four main attributes. We refer to (1) the risk of jellyfish outbreak of the beach, (2) the water quality of the beach, (3) the infrastructure and services available on the beach, as well (4) the proposed additional travel time (with respect to the reported travel time to reach the beach) that the respondent would be incurring to reach the beach under consideration – see Table 2.

** Table 2 about here **

Respondents are presented with a given stated choice question – see Figure 1 for an example of a stated question.

** Figure 1 about here **

Respondents were placed in a hypothetical day of leisure situation where three recreational options were available on that particular day. The first two options would be to visit either Beach A or Beach B, both beaches being different from each other in terms of attributes; and a third option given (status quo) that would provide the opportunity to do something else or stay at home. In order to reduce the dimensionality of the choice design (i.e. the multiple possible combinations), the discrete choice experiment was limited to four attributes, the first two taking two levels and the other with three levels: (1) the risk of jellyfish outbreak of the beach, (2) the water quality of the beach, (3) the infrastructure and services available on the beach, (4) the proposed additional travel time (with respect to the reported travel time to reach the beach) that the respondent would be incurring to reach the beach under consideration – see Table 2. Attributes and their levels were selected from discussions with marine experts in Catalonia, focus groups and pilot studies. The number of hypothetical beach profiles that can be generated is $2^2*3^2 = 36$. To reduce the cognitive burden for respondents, fractional factorial designs were used, which resulted in 18 profiles (i.e. 9 choice sets). These choice sets were blocked into Survey A and Survey B containing 4 and 5 choice sets, respectively. Following state of the art-methodological protocol (see Carson et al. 2009), each respondent was randomly appointed with one survey type. Nunes et al.

(2009) present the first worldwide application of random design in the executing socio-economic valuation surveys on the beach. The final section of the questionnaire is characterized by a set of socio-economic and demographic variables, including age, nationality and their household income. At the end of the questionnaire, the respondent is given a cold soft drink as a sign of appreciation for their participation.

2.3 Survey execution

The questionnaire was administered in Catalan, Spanish and English through a face to face interview by a team of trained enumerators. The interviews were conducted in two distinct time frames, 10:00-14:00 and 15:00-19:00. The questionnaires were executed during both weekdays and weekends from June 14 to September 15, 2012. Only beach visitors aged 18 years or over were interviewed. Enumerators took the shoreline as a reference line and walked ten meters straight ahead between each respondent, randomly inquired. The ten meters were walked along the shoreline or from the shoreline to the inland. Interviews were carried out only to beachgoers placed in the fringe between the shoreline and, when possible, the first 30 meters, being the useful beach surface (Sardá, 2009). Beachgoers were mainly approached while they were laying and sunbathing on the towel, while they were coming out of the sea, and while they were walking along the shoreline. Enumerators were identified with a badge and were in charge of setting respondents in a specific context explaining the aim of the study as well as the estimated duration of the survey. Two teams of enumerators were established covering the 4 southern and the 4 northern studied beaches, respectively. The questionnaire took about 15 min for each respondent to fill in.

3. Empirical analysis

3.1 Survey data

We received 644 completed questionnaires and the average respondents 42 years old. First, the tourists in Catalonia constituted about 57% of our sample and report planning to stay about 16 days on holidays at the coast. In addition, international tourists represent about 24% of the respondents – see Table 3.

** Table 3 about here **

Second, three quarters of respondents stated that they planned to stay at the beach less than half a day. The others planned to stay at the beach half a day or the whole day, respectively, 21 and 6%. All together this means that the consumption of beach recreation opportunities is concentrated to a couple of hours, and the median respondent spends less than half a day at the beach. Third, about half of the respondents came to the beach on foot or the bicycle. The rest used the car, 39%, or public transportation, 13%. Forth, the average time taken to reach the beach is around 22 minutes. We also observed a wide distribution of traveling time, going from about 5 minutes (first quartile) up to three hours (fourth quartile).In addition, most of the respondents, about 61%, reported that were never stung by a jellyfish nor does not know anyone who has been stung. On the contrary, about 22% reported being stung by a jellyfish and 17% reported knowing someone who has been stung by a jellyfish. Finally, the respondents were asked for some socio-economic information. The median respondent reports having an education

higher that high school and a household income that ranges between 2,000€ and 4,000€ per month. The majority report to have a job.

3.2 Economic model

In order to elicit individuals' preferences for the various beaches represented in the choice cards, we use a CE framework, which allows individuals to select between different beach alternatives, as illustrated in the previous section. From the economic modeling view point, this attribute-based choice method has its theoretical grounding in Lancastrian consumer theory (Lancaster, 1996), which proposes that individual welfare is based on the consumption of goods and services, which is expressed in terms of their characteristics and respective contribution to welfare or utility. The underlying fundamental assumption is that individuals act rationally, selecting the consumption bundle, and respective characteristics, that yields the highest utility (McFadden, 1973; Hanemann and Kanninen, 1999). In our study, we apply this economic model to analyze the behavior of the beach recreationist and, in particular, the demand for beach recreation opportunities. This in turn is presented in terms of the selection of the beach to visit. The model is described in accordance to a set of characteristics and the respondent will be selecting the beach destination in accordance to the characteristics that this location has. In formal terms, we can represent a beach recreationist as an individual *i*'s whose utility associated with the choice of a beach-alternative *j* is described as:

$$U_{ij} = V(Z_j, S_i) \tag{1}$$

where for any respondent i, a given level of utility will be associated with any of the alternatives proposed j. The derived utility depends on the attributes of the proposed beach-scenarios (Z_j) and respondent's socio-economic characteristics (S_i).

From the individuals' point of view, the selection of a beach-scenario, as described in the survey, is the result of process of maximization of utility and the respondent's stated choice, as reported in the survey by the selection of the beach-scenario, is the one that yields the highest utility. In this context, the probability of any particular alternative *j* being chosen can be expressed as

$$P_{ij} = \frac{exp[V(Z_{ij},S_i)]}{\sum_{h\in C} exp[V(Z_{ih},S_i)]} \qquad with\ j = 1, 2, \ldots J \qquad (2)$$

Bearing in mind the present beach attributes, we can proceed with the estimation of the following empirical specification

$$U_{ij} = \beta_1 additionaltime_{ij} + \beta_2 additionaltime_{ij}^2 + \beta_3 waterquality_{ij} + \beta_4 services_{ij} + \beta_5 riskofjellyfishoutbreak_{ij} + \varepsilon_{ij} \qquad (3)$$

in other words, the utility that the respondent i has from selecting beach j depends on the four attributes under consideration, including additional time, beach water quality, the services available on the beach as well as the risk of a jellyfish outbreaks. The indirect utility function has been constructed so as to include all attributes that define the choice elections; which contain a trade-off between traveling time and different

beach characteristics. Furthermore, non-linear effects have been explored. In particular, we test for the possibility that additional time affects the choice behavior in a non-linear way. In other words, we assume – and will be testing empirically – that the marginal impact of this characteristic is not constant.

Bearing in mind the respondents´ answer to the stated choice survey, we will estimate the parameters β_s. These parameters are random and unknown to the economist. Therefore we proposed to estimate these exploring the use of a conditional logit model (McFadden, 1973). Estimation results and discussion are presented in the next section.

3.3 Estimation results

We proceed with the estimation of the main effects model, as reported in Equation 3. We refer to model I. This refers to the *main effects* model. This is because we only consider the direct effects of the characteristics in the choice of the beach scenario. We interpreted this as our baseline model specification. As we can see from Table 4, all coefficients carry the expected sign and are statistically significant.

** Table 4 about here **

In particular we can observe that estimated coefficient with respect to jellyfish outbreaks is negative. This means that a beach scenario that is described in the questionnaire with a higher risk of jellyfish outbreak is associated to a negative impact on the utility of the respondent and therefore less probable to be chosen, *ceteris paribus*. According to the estimation results, the increase in the risk of jellyfish outbreak reduces

by 34,5% the probability of the choice of the beach, as described in the survey instrument. On the contrary an increase in the water quality and the range of services provided on the beach increases the probability of the choice, respectively of 73% and 40.9%. When comparing with each other, we can infer that the most relevant characteristic in explaining the reported respondent's choice is water quality, followed by surrounding services/infrastructure and then the reduction of jelly fish outbreaks. These estimates are rather robust since the respective parameter estimates do not change with respect to the model specification under consideration, including from Model II to IV. Finally, as far as the additional time is concerned, we can observe that empirical evidence in this study does not also reject the null and having a non-linear effect of time traveling to the beach on utility. According to the estimation results, for the first additional minutes an increase in the minutes of travel time may be associated to a utility gain, and therefore increase the probability of choice. We can interpret this result as signaling that the travel time employed to reach the beach, which we have seen is mainly in trips by bicycle and on foot, is associated with a positive impact in the utility of the respondent. In other words, the respondent enjoys the time spend in reaching the beach. One of the first illustrations of this type of situation was presented by Walsh et al. (1990) who developed and applied a statistical procedure to estimate a demand function for the recreation activity of pleasure driving or sightseeing by car on scenic river highways in the Rocky Mountains. In our present study, the consumptive value of travel time is positive until a point. Mathematically, this point is computed when

$$\frac{dU}{dt} = \frac{d(0.079t - 0.001t^2)}{dt} = 0.079 - 0.002t = 0 \qquad (4)$$

which occurs when t = 39.5 minutes. This means that after 39.5 minutes any additional traveling time produces a negative impact on utility. After this point, respondents consider that reaching the beach may require the use of traditional means of transport, such as car or subway, and this way hampering the pleasure in walking or biking to the beach.

As stated earlier, travel time's estimates are rather robust since the respective parameter estimates do not change with respect to the model specification under consideration, including Model II to IV.

In addition, we also estimate the impact of beach and respondent characteristics on the stated choices. After many empirical checks, we assessed the impact of being at the beach *De Blanes* as this is characterized by the lowest jellyfish risks, as recorded from 2006 to 2010. This effect is captured by the variable *Jellyfish risk * De Blanes* – see Model II. In addition, we assess the impact of being stung. This effect is captured by the variable *Jellyfish risk * Stung* – see Model III. Finally, we also evaluated the impact in the stated choices of being a resident. This effect is captured by the variable *Jellyfish risk * Resident* – see Model IV. From the estimation results we can see that the respondents that have chosen to consume beach recreation opportunities in the beach *De Blanes* reveal a structure of preferences where the risk of jellyfish is not that important in explaining their stated choices, when compared to the average respondent. According to the estimation results from Model II and III, the increase in the risk of jellyfish outbreak reduces, on average, in 37.4 to 40.0 percent the probability of the choice of the beach. This marginal impact is reduced to 6.4 (=37.4-31.0) to 8.8 (=40.0-31.2) percent range, respectively. We can interpret these results by signaling that these respondents have already *adapted* to the risk of jellyfish outbreaks by selecting the beach with the

lowest risk profile. Second, estimation results from Model III also show that among the respondents who reported being stung, the increase in the risk of jellyfish outbreak reduces by 28.9 percent the probability of the choice of the beach. However, this marginal impact is not statistically significant at 90% confidence interval. In other words, the empirical evidence does support a statistically difference of risk profiles, i.e. with respect to the impact of reduction of jellyfish outbreaks on beach behavior, among the two respondents segments: stung vs. non stung. Finally, model IV reports that residents show a slight lower risk aversion to jellyfish outbreaks, but again this difference is not statistically significant.

From these estimation results we can infer that respondents are willing to travel on average 3.8 minutes more to move away from a beach described as having 5 or more days per week of jellyfish outbreaks to another beach where this risk is of 2 days, or less, days per week. Given that the mean traveling time for the entire sample is 21 minutes, this implies that on average, recreationists are willing to travel 23.8% more minutes as to move away from a beach that is described in the survey by 5, or more, days per week of risk of jellyfish outbreak to another beach that is characterized by 2, or less, days of risk. Furthermore, recreationists are willing to travel about 8 minutes more (or in relative terms, 38% more of the average time) in order to find a beach with a high amount of services (which include an additional children reading area, toilets, parking and lifeguards) with respect to just toilettes and parking areas which have been presented as basic services available to all. Water transparency has been also significantly valued by beach recreationists, showing that participants are willing to travel an average of 4.5 minutes (21.28%) more to find a beach with a transparency level above today.

** Table 5 about here **

In addition, we consider also two segments of respondents. In this context, it is distinguished between a more frequent segment of beach visitors, a segment below the median respondent in terms of reported travel time to the beach, and a second segment around the median. In particular, and respectively, $t_1 = 5, t_2 = 21, t_3 = 37.$ Table 5 presents the econometric valuations results of the set of attributes under consideration across three time segments. All coefficients carry the expected signs and are statistically significant. In addition, Table 6 presents the valuation of the attributes (mean willingness to pay estimates) valued for the entire sample, without splitting into the various time segments. As observable, the most valuable attribute for the entire sample is water quality, finding that on average, beachgoers are willing to travel about 8 additional minutes to find a beach with higher water transparency. It follows the importance of beach services available to beachgoers; including the presence of a play area for children and a first aid center, for which, beachgoers are willing to travel about 4.5 extra minutes. The importance of jellyfish is also significant in terms of beach selection, and it implies that recreationists are willing to travel 3.8 minutes more to reduce the probability of encouring a jellyfish outbreak.

Figure 2 represents the values of the welfare estimates obtained substituting in the utility function the time variable at specific values of the distribution of the variable traveled time. This allows us to observe the relative changes on the respective valuations of attributes with respect to the time traveled to the beach.

** Figure 2 about here **

As we can see, at the margin, respondents are willing to incur in different additional travel times so as to have alternative beach consumption patterns, as described by their characteristics. In fact, Figure 2 shows the marginal (or implicit) prices of the attributes, which depend on both the profile of the respondent, here described in terms of reported travel time, as well as in terms of the beach characteristic under consideration. First, improvement in the beach water quality is, by far, the most valuable attribute and this ranking is valid across all types of respondents. Second, the improvement in the beach infrastructure is ranked second and reduction in the risk of jellyfish outbreaks is ranked third. Finally, the from the econometric view point, the difference in ranking between these two attributes are not statistically significant. In other words, the reduction in the risk of jellyfish outbreaks is seen equally important by the respondents of this study as the improvement of support beach infrastructure.

4. Policy Analysis

As we can see from the estimation results, the risk of jellyfish outbreaks plays an important role in explaining individual behavior with respect to the consumption of beach recreation opportunities. It is also true that this characteristic, or driving force of beach recreation consumption, is not ranked as the most important one. According to the estimation results, the improvement of the water quality ranks as first and therefore it is interpreted as the most important factor when choosing the beach. However, estimation results also inform us that the reduction of risk of jellyfish outbreaks ranks as important as the improvement of beach infrastructure, including the provision of

parking lots, restrooms and libraries for the children. Furthermore, we can also monetize the survey described reduction of jellyfish outbreaks by exploring the use of the concept of value of time. According to our sample results the average income per hour of our sample is €19.23. Using this value we can also monetize the additional travel time that an average consumer is willing to incur from moving from a beach with more than 5 days a week of outbreaks to another beach with the same characteristics but with risk of jellyfish outbreak reduced to one day or two per week. This value is €1.22. This means that the consumer is willing to pay on average additional €1.22 to move from a beach with more than 5 days a week of outbreaks to another beach with risk of jellyfish outbreak reduced to one day or two per week, *ceteris paribus*.

Bearing in mind that the sample design of this study is such that it guarantees the regional representativeness of the recreationists of this area, we are able scale up this monetary value to the regional level. Based on the 2012 tourist statistics released by the Catalan government, from where we can assess a total of €263.7 millions of trips to the beach per year for all recreationists in Catalonia, local, domestic and international recreationists. We calculate that the welfare gains associated with a reduction of jellyfish outbreaks in this area ranges between €312-€322 million/year, corresponding approximately to 19% of the tourism expenditures of the Catalan population in 2012. In this case, such significant value shows that preventive policy measures pass a cost benefit analysis as long as their corresponding implementation costs are below €312 million/year.

Similar experiences regarding recreational ecosystem services assessment based on questionnaires have been carried out worldwide. For instance Hearne and Salinas (2002), evaluated several management options in the context of protected areas in Costa

Rica. Nunes and Van den Bergh (2004) and Nunes and Markandya (2008) illustrate the use of alternative, non-market valuation methods to estimate the economic value of the social damage caused by marine bio-invasions on beach recreationists. Underlying economic value assessments reveled to be relevant in the undertaking cost-benefit analyses and support the selection of a policy management practice, including the introduction of a ballast water treatment plant in the harbor of Rotterdam. In addition, Beaumont et al (2008) assessed the goods and services resulting from marine biodiversity in the UK. The present exercise also constitutes a valid tool for informing the general public – see also Remoundou et al. (2009) for a more comprehensive review on non-market valuation to estimate marine ecosystem services.

All in all, one can argue that from a policy perspective there is significant social relevance to bring forward the investment of public resources in mechanisms that deal with the management of the jellyfish outbreaks, including daily reports informing the users with respect to be presence or not of a jellyfish outbreak in each beach. An example of this type of public policy mechanism refers to the *MedJelly* (Marambio et al. 2013) that provides daily observation on the status of the Catalonian beaches, including information with respect to the presence of the jellyfish outbreaks.[2] Such informational and public awareness campaigns can be rather useful if providing public jellyfish reports, and exploring the use of new technologies, such as phone, internet and other social media applications, which are able to provide immediate and on time information. Such campaigns may help to prevent stigmatization of certain beaches and jellyfish species rising awareness and knowledge on such species among beach users and

[2] Free download at Iphone APP store and Google PlayStore as 'iMedJelly'.

citizens. According to the scientific community this may be the most effective policy instrument to adapt to jellyfish outbreaks.

5. Conclusions

In this study we conducted a survey to coastal recreationists in Catalonia in order to understand their preferences when selecting among various beaches that provided different recreational opportunities, with different chances to find jellyfish outbreaks. From this exercise, we compute the number of minutes that respondents are willing to travel in order to find (or avoid) some specific beach characteristics. After knowing the number of minutes that each beach characteristic is valuable to respondents, then we express this monetary terms. On average, each recreationist is willing to pay €1.22 per trip to the beach in order to change from a beach with more than 5 days a week of outbreaks with one of 2 or less days per week. Given that the sample used in representative of the recreationists of this area, the scaling up of these implicit personal valuations can be done at the regional level. Then, multiplying this estimate by the total number of trips to the beach, of local, domestic and international recreationist will allow us to infer the total cost of jellyfish outbreaks on recreationists in Catalonia. Based on the 2012 tourist statistics (from which we compute a total of 263.7 million of trips to the beach per year for all recreationists in Catalonia), we infer that this estimate goes up to €312-€322 million/year. This amount corresponds to 19% of the tourism expenditures of the Catalan population in 2012, and expresses the significant welfare gains associated with a reduction of jellyfish outbreaks in this area. Such significant value also shows that preventive and adaptive jellyfish measures pass a cost benefit analysis as long as their corresponding implementation costs are below €312 million/year. Needless is to

say that this pioneering study calls for further socio-economic investigation, including the mapping and distribution of the welfare impacts, the discussion and evaluation of other alternative policy measures, including jellyfish fishing and fishnets – which are currently under a phase of engineering development and experimentation.

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Annex: Survey Instrument

English version (also available in Catalan and Spanish)

Good-morning/good-afternoon. My name is ***[say your name]*** *and I am working on Marine Sciences at the CSIC/LEITAT, Barcelona, I would like to make you some questions regarding your attitudes and opinions on marine environmental quality and recreational behavior at the Catalonian beaches. This is an anonymous interview and will take less than 10 minutes of your time.*
We appreciate very much your participation, so we would like to thank you for it. However, we cannot offer you any monetary reward; instead we would like to offer you a soft drink to refresh yourself after the survey.

1. Recreational data [do not read this]

Please think carefully about each question and give your best answer. There are no right or wrong answers, only personal answers. **1.1** How many persons are in your group (including yourself?)
1.2 During the **last summer season** (from June to September of 2011), how many times did you come to **this** beach?
1.3.1 During **this summer season** (from June to September of 2012), how many times have you come to **this** beach?
1.3.2 How many more times have you planned to go to **this** beach?
1.4 How important are these activities/factors to you to chose to **this** beach?
1.5 Which of the following nautical sports have you ever practiced in **this** beach?
1.6 How long do you plan to stay at **this** beach **today**?

2. Travel Cost Expenditures Data [do not read this]

2.1 Where are you staying?
In case he/she is staying in his first residence/home, skip to section C3.
In case he/she stays in another kind of accommodation, ask for its' typology and in case it's a hotel/camping…etc, ask for its' name and location.
2.2 ¿How many nights are you going to stay?
2.3 How much did it cost for you to stay in the Catalan coast **per person** with regard to:

Now we are going to talk about your stay at **this** beach only during the day of **today**:

2.4 How did you travel from the hotel/home to the beach **today**?
In case he/she answers by car or motorbike: how much have you spend on tolls and parking to and from your origin place?
In case he/she answers by public transport: how much did the ticket cost you?
2.5 How much time have you spent to arrive to **this** beach **today**?
2.6 Did you rent any equipment at the beach (sun-umbrella, sun bed, windbreak, boat, fishing material, etc.), paid any permits (anchoring, etc) or spend any money (e.g. meals) at **this** beach?
In case he/she answers yes: how much have you spend on it?

3. Socio-economic impact of a jellyfish outbreak [do not read this]

3.1 Have you or someone you know ever been stung by a jellyfish?
In case he/she answers NO, skip to section E.
In case he/she answers YES but in another beach, ask for the name of the beach.
In case he/she or the person who knows, has been stung several times, ask to answer the questions regarding to the last time he/she/the other person was stung.
3.2 How many times have you have been stung by a jellyfish?
3.3 How did you treat the pain?

In case you went to the first aid station/physician/family doctor: how many hours/day did you spend?
In case you went to the pharmacy: how much time and money did you spend?

3.4 Did you lose work time as a result of the sting?
In case he/she answers YES, ask for many hours.
3.5 Were you able to identify the species of jellyfish that stung you? **[Please show CSIC identification of the different jellyfish species]**

4. Contingent Behavior: impact of building of an offshore wind farm [do not read this]

I would like to ask you how your use of this beach may change with the building of an offshore wind farm for next year. The proposed changes are described in CARD 1. ***[Please show CARD 1]***

4.1 Suppose that next year the change described in this card takes place in this beach. Would you like it?
4.2 Would you change the number of trips you would do to this beach over the next years´ summer season?
In case that he/she would reduce the number of trips, ask how many fewer trips he/she would do.
In case he/she would not come to that beach again and that he/she would do something else, ask what she/he would do.

5. Choice experiment

Now, imagine you are planning to go to the beach. I'm going to show you some cards in which you will see two profiles of beaches according to different attributes and characteristics. Could you choose among the two possibilities shown? Please, take into consideration that if none of the two possibilities shown fits with your preferences and wishes, you can also decide not to go to the beach. ***[Please show CARD A]***

6. Socio-economic demographic questions [do not read this]

We are finishing the questionnaire. Before, I would need to ask you some additional questions about you.

6.1 Year of birth
6.2 Place of birth
6.3 Where do you live? Ask for postal code if he/she knows it.
6.4 What kind of form of education have you got?
6.5 ¿What is your job? **In case the person is unemployed, ask for his/her last job.**
6.6 ¿How many people live in your household?
6.7 In which interval is the **after tax income** of your household **monthly**? (In case that you don't share your income with the people you are living with, could you please tell me an approximated interval of your own income? **[Wait for a spontaneous answer]** Take into consideration if the respondent is a student without job or he/she is unemployed without receiving unemployment benefits.

7. FEEDBACK

Thank you very much for your time [**handle him/her the soft drink**]**,** We hope the survey was of your interest. Would you like to receive information and the results of this survey? If yes, could you please provide us with your email address?

TABLES:

Table 1.Beaches analyzed in the study (from SW to NE)

Name of the beach	Type of Environment	Width (m)	Lenght (m)	Surface (m²)	Risk of Jellyfish* (%)	Blue Flag
Barceloneta	Urban	40	600	24,000	7.07	Yes
De Bogatell	Urban	32	625	18,676	12.96	Yes
De Sabanell	Mixed	32	2,380	75,921	0.75	Yes
De Blanes	Urban	44	610	26,170	0.37	Yes
Gran de Palamòs	Urban	55	990	48,650	9.52	No
De la Fosca	Mixed	37	514	16,461	3.96	Yes
El Castell	Natural	63	339	22,715	7.14	No
El Golfet	Natural	17	75	1,277	5.58	No

Nota:* This variable was delivered by the Catalan Water Agency and is constructed bearing in mind the observations of jellyfish outbreaks with respect to the number of inspections carried out between 2006 and 2010. [Risk = (No. of observations of jellyfish / No. of Inspections)*100]

Table 2: Stated choice architecture

Attributes	Levels		
Jellyfish risk outbreak	Low risk (=<2days/week)	High risk (more than 5 days/week)	
Water transparency	Average (as regulated by the law)	Above average	
Services	Parking and toilettes	Parking, toilettes and children play area	Parking, toilettes, children play area and first aid center
Additional travel time	+5%	+10%	+15%

Table3: Variables and its description (%)

Description	Mean	Std. Dev.
Male	0.218	0.413
Respondent has planned to stay at this beach less than half a day	0.726	0.446
Respondent has planned to stay at this beach half a day	0.210	0.408
Respondent has planned to stay at this beach whole a day	0.064	0.244
Respondent has come to the beach on foot or bicycle	0.474	0.499
Respondent has come to the beach by car or by motorbike	0.390	0.488
Respondent has come to the beach by public transport	0.136	0.343
Respondent has been stung by a jellyfish	0.217	0.412
Respondent knows someone who has been stung by a jellyfish	0.172	0.377
Respondent has not been stung nor does not know anyone who has been stung	0.611	0.488
Respondent has his/her first residence in this place	0.437	0.496
Respondent is international	0.236	0.424
Respondent lives in Spain	0.178	0.383
Respondent lives in Catalonia	0.149	0.123
Respondent has above high school; 0 otherwise	0.496	0.500
Length stay (days)	15.906	24.629
Age of respondent (years)	42.709	13.500
Respondent has a job; 0 otherwise	0.722	0.448
Respondent’s household income is below 2000€	0.367	0.482
Respondent’s household income is between 2000€-4000€	0.444	0.497
Respondent’s household income is above 4000€	0.189	0.392
Time taken to reach the beach (minutes)	21.255	24.363

Table 4: Estimation results (please see another word file)

Table 5: Willingness to pay estimates per quartile (measured in extra minutes)

Quantiles	Minutes
1	5 minutes
2	10 minutes
3	37 minutes

		Implicit value	Std. Err.	P|z|>Z*	95% Confidence Interval	
Jellyfish risk	**Quartil 1**	5.374	0.753	0.000	-6.851	-3.898
	Quartil 2	6.866	0.962	0.000	-8.752	-4.980
	Quartil 3	-13.764	1.929	0.000	0.590	1.037
Water quality	**Quartil 1**	11.251	0.559	0.000	10.155	12.347
	Quartil 2	14.374	0.715	0.000	12.973	15.774
	Quartil 3	-28.816	1.432	0.000	-1.870	-1.538
Services	**Quartil 1**	6.309	0.579	0.000	5.175	7.444
	Quartil 2	8.060	0.740	0.000	6.611	9.510
	Quartil 3	-16.158	1.483	0.000	-1.127	-0.784

Table 6: Economic valuation of the selected beach attributes (expressed as additional time to travel in minutes)

	WTP				
Variable	**Estimate***	**Std. Err.**	**P |z|>Z***	**95% Confidence Interval**	
Jellyfish risk	3.810	0.890	0.000	-5.553	-2.066
Water quality	7.975	1.773	0.000	4.500	11.450
Services	4.472	1.104	0.000	2.309	6.635

*estimates are presented in absolute values

FIGURES

Figure 1: Choice set card example

Figure 2: Relative WTP Estimates per User Intensity