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ECONOMIC VALUE OF CARIBBEAN FLAMINGO (*PHOENICOPTERUS RUBER*) AT CELESTUN BIOSPHERE RESERVE, YUCATAN, MEXICO: A BIRDWATCHING-TOURISM APPROACH

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Abstract · Bird watching activities are increasing worldwide, allowing for a closer citizen-nature experience. These activities are considered to promote biodiversity conservation values. We assessed the economic value of the Caribbean Flamingos (*Phoenicopterus ruber*) at the Celestun Biosphere Reserve, Yucatan, Mexico. Celestun has become an important destination for birdwatching-based tourism because of the presence of flamingo flocks in its coastal lagoon. Flamingos at Celestun attract approximately 50,000 national and international visitors yearly. The human population of Celestun is approximately 6,800 inhabitants; their livelihoods mainly depend on fishing, and more recently on bird watching tourism. In order to assess the economic value of flamingo-watching at Celestun, we interviewed 427 visitor groups after they took a flamingo-watching motorboat tour. We conducted the interviews during three of the highest tourism seasons within a year period (2012–2013). The interview questions were directed towards the visitors' place of origin, their main reasons for visiting Celestun, and how much money they spent traveling, using a direct questionnaire with a total of 37 items. We applied the Travel Cost Method in order to estimate the economic value for flamingo-watching at Celestun. For approximately 80% of the interviewed visitors, flamingos were the main reason to visit Celestun. We obtained a total of US$16,542,004 as the "Flamingo value" placed by visitors.

Resumen · Valor recreativo de la observación de Flamencos del Caribe (*Phoenicopterus ruber*) en Celestún, Yucatán, México

Las actividades de observación de aves han aumentado a nivel mundial, permitiendo una experiencia más cercana entre ciudadanos y naturaleza. Se considera que estas actividades promueven los valores de la conservación de la biodiversidad. Estimamos el valor económico del Flamenco del Caribe (*Phoenicopterus ruber*) en la Reserva de la Biosfera de Celestún, Yucatán, México. Celestún se ha convertido en un importante destino para el turismo basado en la observación de aves, debido a la presencia de parvadas de flamencos en la laguna costera. Los flamencos de Celestún atraen aproximadamente 50,000 visitantes nacionales e internacionales al año. La población en Celestún es de aproximadamente 6,800 habitantes, que viven principalmente de la pesca y más recientemente del turismo de observación de aves. Para estimar el valor económico de la observación de flamencos en Celestún, entrevistamos a 427 grupos de visitantes después de que tomaron el recorrido para observación de flamencos en lanchas de motor. Cubrimos tres temporadas altas de turismo en un periodo anual (2012–2013). Preguntamos acerca del lugar de origen de los visitantes, principal razón para visitar Celestún y cuál fue la cantidad de dinero gastada en su viaje, utilizando un cuestionario directo con un total de 37 ítems. Aplicamos el Método de Costo de Viaje para estimar el valor económico para la actividad de observación de flamencos en Celestún. Para cerca del 80% de los visitantes entrevistados, los flamencos fueron la principal razón para visitar Celestún. Obtuvimos un total de US$ 16,542,004.00 como el "valor del flamenco" en función de la tasa de visitación.

Key words: Birdlife valuation · Birdwatching · Celestun Biosphere Reserve · Flagship species · *Phoenicopterus ruber* · Travel Cost Method · Yucatan

INTRODUCTION

In order for citizens to be interested in the conservation of nature, it is necessary for them to be familiarized and to feel identified with the natural landscape and wildlife (Myers 2009). If citizens identify a benefit from natural

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areas, they will strengthen their willingness to advocate for its conservation (Philips 1998). One of the most effective ways of promoting such a relationship is through tourism that involves watching wildlife. The impact of wildlife-watching tourism on the conservation of nature is considered to depend greatly on the economic benefits involved (Bergstrom et al. 1990, Lindberg 1991, West et al. 2006, Andam et al. 2010). When tourism occurs in natural protected areas, it raises the question of how much this economic activity actually contributes to the wellbeing of nature at the local level (Tisdell 2012).

One of the main attractions of nature-based tourism is represented by charismatic flagship species and their natural habitats. Nature-based tourism is thought to be more effective in terms of the conservation of natural resources and public awareness when there are charismatic species involved (Krüger 2005). The concept refers to the attraction that a particular species produces for the general public. Charismatic flagship species can be used as a conservation strategy (Ducarme et al. 2012).

This research focuses on the Caribbean Flamingo (*Phoenicopterus ruber*, Linnaeus, 1758) as a charismatic flagship species that inhabits the coastal wetlands of the Celestun Biosphere Reserve (CBR), located in the northwestern coast of the Yucatan Peninsula, Mexico. The Celestun area includes a coastal lagoon with a mangrove forest and a coastal wetland ecosystem that represents the most important feeding ground for Caribbean Flamingos in southeastern Mexico (Baldassarre et al. 1997). The human population of this coastal town was reported to consist of 6,831 inhabitants in 2010 (INEGI 2010). Fishing is the main economic activity, followed by flamingo-watching tourism. In recent years, an average of 50,000 visitors per year has been reported visiting the Reserve with the specific purpose of taking the flamingo motorboat tour.

Celestun has become an important destination for nature-based tourism chiefly because of the presence of flamingo flocks in the coastal lagoon. First declared as a Wildlife Refuge in 1979 to protect flamingo wintering grounds, Celestun was re-categorized as a Biosphere Reserve in 2000 (CONANP 2000), with an area of 81,482 ha. The Celestun coastal lagoon is considered to be the principal non-breeding site for Caribbean Flamingos in Yucatan (Allen 1956, Espino-Barrios & Baldassarre 1989). According to Arengo & Baldassarre (2002), flamingos at Celestun are likely "the most observable flock of flamingos in the world." Recent aerial surveys have reported around 40,000 flamingos feeding and resting in flocks along the coastal lagoon during the winter months (Rubio 2010), which are easily approached by motorboat. This has promoted a growing flamingo-watching activity, with visitors from all over the world taking motorboat tours along the Celestun coastal lagoon to watch these birds.

Flamingo-watching activity at Celestun is based on the preservation of the healthy lagoon ecosystem and mangrove forest, where flamingos find high quality food resources. Long-term studies of Celestun coastal wetland ecosystems report a high productivity at the benthos level (Herrera-Silveira & Morales-Ojeda 2009), which is where flamingos filter their food. In order to maintain coastal ecosystems within protected areas, and keep them safe from unsustainable coastal development plans, people's advocacy is considered to be important.

There are apparently few valuation studies focused on flamingos. We found one specific reference (Navrud & Mungatana 1994), which assessed the economic recreational use value of Lesser Flamingos (*Phoeniconaias minor*) at Lake Nakuru, Kenya, using the Travel Cost Method. The Travel Cost Method (TCM) estimates the value that visitors place upon a site they visit, using their travel expenses as a proxy of their willingness to pay (WTP) for conserving the particular species or site they are visiting (Clough & Meister 1991). This WTP allows building a demand function for visitors to the site, and it is used to estimate the value of such a site or species (Hackett 2000).

Flamingo-watching at Celestun provides a good opportunity to estimate the value that visitors place on the species. Recreation in natural areas is listed as an environmental service (Brown et al. 2007), allowing for the use of economic valuation methods in order to estimate citizen engagement for conservation. In this case, the result of a flamingo valuation estimate should serve to inform policy makers about the opportunity cost for conservation activities, and the economic incentives for conservation of an ecosystem in which a species has become the base of a tourism economic activity (Martín-López et al. 2007).

The TCM applied in this study uses the cost indulged by visitors traveling to Celestun as a surrogate for the economic value of the species of interest. The basic assumption in this case is that visitors' single purpose to travel to Celestun is flamingo-watching. The cost of traveling to Celestun from different places of origin will provide an estimate of the amount of money visitors are willing to spend in order to actually watch flamingos.

METHODS

Study area. The Celestun Biosphere Reserve is located at the northwestern seaboard of the Yucatan state, Mexico (Figure 1). This is the northern-most breeding population of Caribbean Flamingos (Arengo & Baldassarre 1995), and it is the only flamingo population in Mexico. Celestun is a coastal lagoon of 22.5 km long with the mouth at its southern tip, mostly shallow with a maximum depth of 3 meters. A healthy mangrove forest (*Rhizophora mangle*, *Laguncularia racemosa*, and *Avicennia germinans*) surrounds the whole lagoon (Tapia-González et al. 2008).

Survey data. During 2012 and 2013, we conducted a stratified survey including 427 national (Mexican)

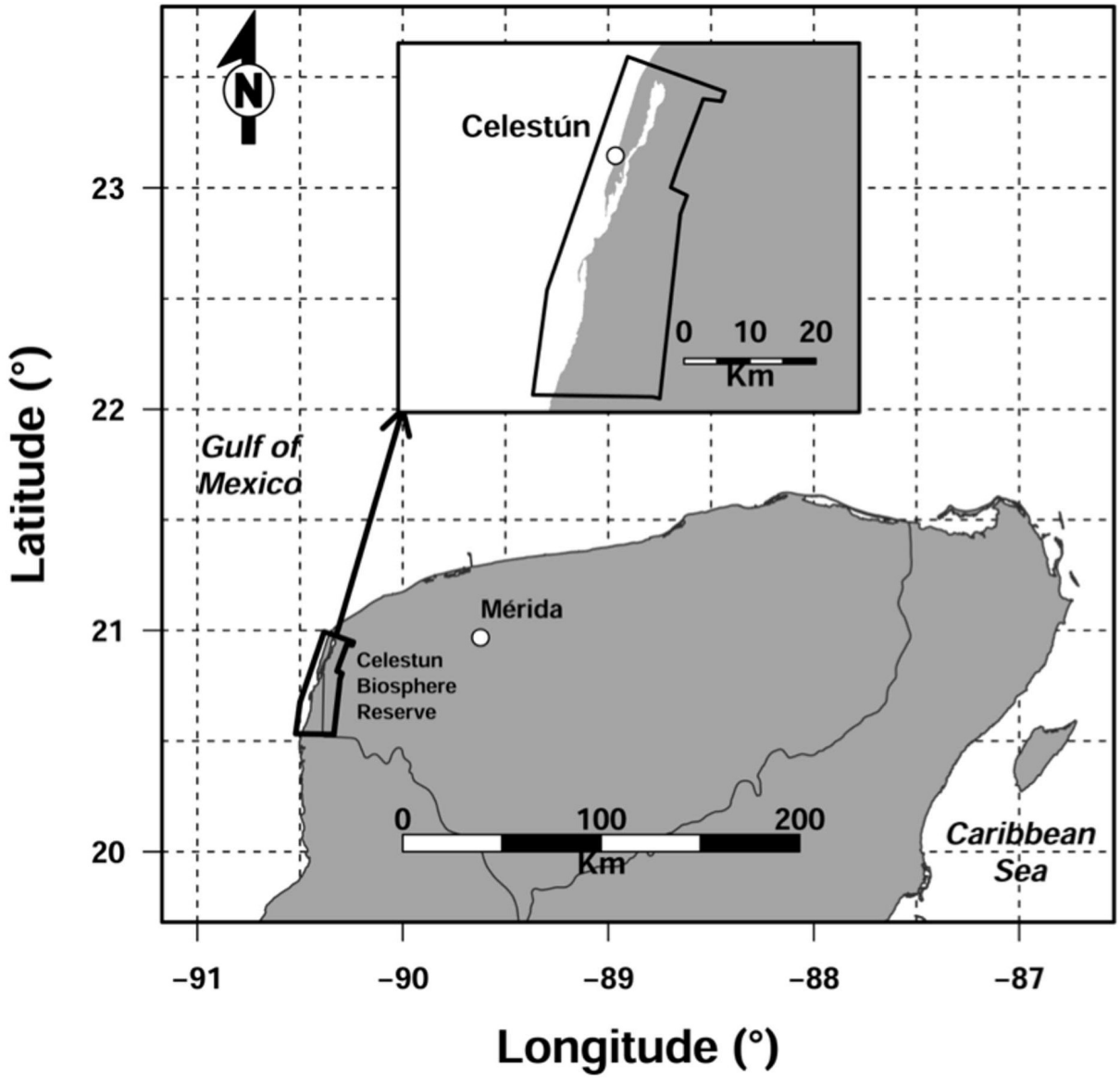

Figure 1. Celestun Biosphere Reserve and coastal lagoon in Yucatán, Mexico. Map from Comisión Nacional de Áreas Naturales Protegidas de México-CONANP 2000.

visitors to the Celestun coastal lagoon. In the region, there are three holiday seasons during a single year period, which represent three peak tourism seasons; following these, we interviewed visitors from July to August 2012, December 2012 to January 2013, and from April to May 2013. We approached visitors on-site, after they had taken the motorboat tour to watch flamingos in the coastal lagoon. The interview was performed on a single person per group, usually the head of the group or a group-designated person. For the interviews, we used a previously designed and tested questionnaire of 37 questions in closed and close-ended format, including a rating-scale and multiple-choice questions.

We divided the questionnaire into three sections. The first section referred to information about the economic profile of the interviewed visitor (one for each party), including income. Second, we collected information about the activities undertaken by these visitors during the Celestun visit, and their experience during the flamingo boat ride. The third section referred to information about travel cost incurred by interviewed visitors.

Travel Cost Method (TCM). Economic valuation methods can be classified into four categories: 1) Direct market valuation; 2) Indirect market valuation; 3) Contingent valuation; and 4) Group valuation (De Groot et al. 2002). The TCM falls into the indirect market valuation methods. These types of methods are used when there are no explicit markets for services, and they are used to establish the (revealed) willingness to pay for the availability of these services (De Groot et al. 2002).

The TCM is related to the recreational use of ecosystem services that require travel, thus the travel costs can be considered as a proxy of the service value (De Groot et al. 2002). The assumption is that

the value placed by visitors is, at least, what they are willing to pay to travel from their place of origin in order to enjoy the destination components. In situations where there is "only one species involved" at the destination, this method can be used under the assumption that visitors to the site are actually there because of the species of interest (Tisdell & Wilson 2004). The TCM has widely been used to assess wildlife value placed by visitors to natural areas and species (Navrud & Mungatana 1994, Bhat 2003, Shrestha et al. 2007, Fleeming & Cook 2008, Knoche & Lupi 2013, Czajkowski et al. 2014).

The estimation of WTP (Willingness To Pay) is used to build an individual demand curve, which is the inverse relationship between the WTP in monetary terms, vs. the quantity demanded of a good or service. In the case of the TCM, the individual demand curve relates the visit rate as the quantity demanded with the incurred travel cost by visitors as the WTP in monetary terms. The price of the good (flamingo-watching) is a function of the visit rate and the socioeconomic variables defined by the visitor's profile. Variations in travel cost in this study are generated according to different travel distances from visitors' zone of origin; thus, we are using the zonal travel cost method. It is expected that cost should be less for visitors living closer to Celestun, and higher for visitors living further away. We followed the approach of Parsons (2003), by considering Celestun as a single site, and using zonal travel cost information.

Statistical analyses. We conducted all our statistical analyses within the R environment (R Core Team, 2013). We first used descriptive statistics to describe visitors' data, and obtained information about number of visitors, age, sex, occupation, city of origin, and travel expenses. We estimated the recreational value of flamingos at Celestun by using the Travel Cost Method (Navrud & Mungatana 1994, Haab & McConnel 2003, Parsons 2003).

The demand curve using TCM has usually been determined by means of a linear regression (Clough & Meister 1991, Navrud & Mungatana 1994). However, some shortcomings arise if the response variable does not fulfill the assumptions of linear regression such as normality, independence, and homogeneity. Thus, we performed a generalized linear model (GLM) to obtain the demand curve in order to estimate the total willingness to pay. We use total travel costs per individual as the response variable, whilst the covariates considered were: visit rate as the continuous variable, and region of origin, income level, occupation, level of schooling, extra fee for conservation (i.e., if people would like to pay extra fee to be used for flamingo conservation), extra fee amount, first time visiting the site, flamingo-watching as main reason to visit Celestun, and place where the group decided to visit Celestun (i.e., home, hotel, travel agency) as factors.

Total travel costs were estimated as the cost of travel in each interviewed group, considering all the travel expenses incurred to arrive to Celestun and the cost of the flamingo-watching tour. The response variable (total travel costs) was performed assuming a Gamma error distribution. The Gamma distribution was expected to be most appropriate to describe travel costs because this variable has non-negative continuous values.

According to the zonal travel costs method, the total WTP is obtained first multiplying the individual WTP by the population in each zone considered, and second by calculating the sum of these values. However, some socioeconomic characteristics are particular for the visitors interviewed in this study, such as income level or education. Therefore, we considered these characteristics to delimit the population that could potentially visit Celestun to participate in the flamingo-watching tour. This delimitation was obtained from the National Institute of Statistics and Geography (INEGI; http://www.inegi.org.mx/). For instance, Mexico City has over 20 million inhabitants (INEGI 2014), thus we obtained the amount of Mexico City citizens with the income and education levels of our interviewers coming from this region, resulting in 1,260,263 potential visitors. We repeated this procedure for all the zones of origin of the people interviewed.

Furthermore, in order to estimate the visit rate (quantity demanded of a good) we obtained the annual number of visitants to Celestun from each zone provided by the Patronage of the Units of Cultural and Tourist Services of Yucatan (CULTUR, http://www.culturyucatan.com). We assumed that the total number of visitors to Celestun from each zone represents the demand for flamingo-watching. Therefore, we estimated the ratio between the population and the total number of visitants from each zone.

The procedure to obtain the recreational economic value of the flamingos in Celestun was: 1) We fitted a full model as follows:

$$TTC = \beta_0 + \beta_1 VR + \beta_2 In + \beta_3 Oc + \beta_4 Sc + \beta_5 Co + \beta_6 FT + \beta_7 Rn + \beta_8 De + \beta_9 Wi,$$

with TTC = Total Travel Cost per individual, β_0 = intercept, VR = visit rate, In = income level, Oc = occupation, Sc = level of schooling, Co = extra fee for conservation, FT = first time visiting the site, Rn = flamingo-watching as main reason to visit Celestun, De = place where the group decided visit Celestun, Wi = extra fee amount, and from β_1 to β_7 variables' coefficients. We selected the best model based on the Akaike Information Criterion (AIC) through a stepwise procedure. 2) With the final model we built demand curves for each combination of covariates. 3) In order to estimate the individual willingness to pay, we estimated the average demand curve (AUC) and solved its integral. 4) The sum of the product of this individual WTP by the population from all regions was interpreted as the total willingness to pay, which is a proxy of the recreational economic value of the flamingo in Celestun. Notice that the zone of origin factor was not included in the model to avoid multicollinearity with most of the other covariates,

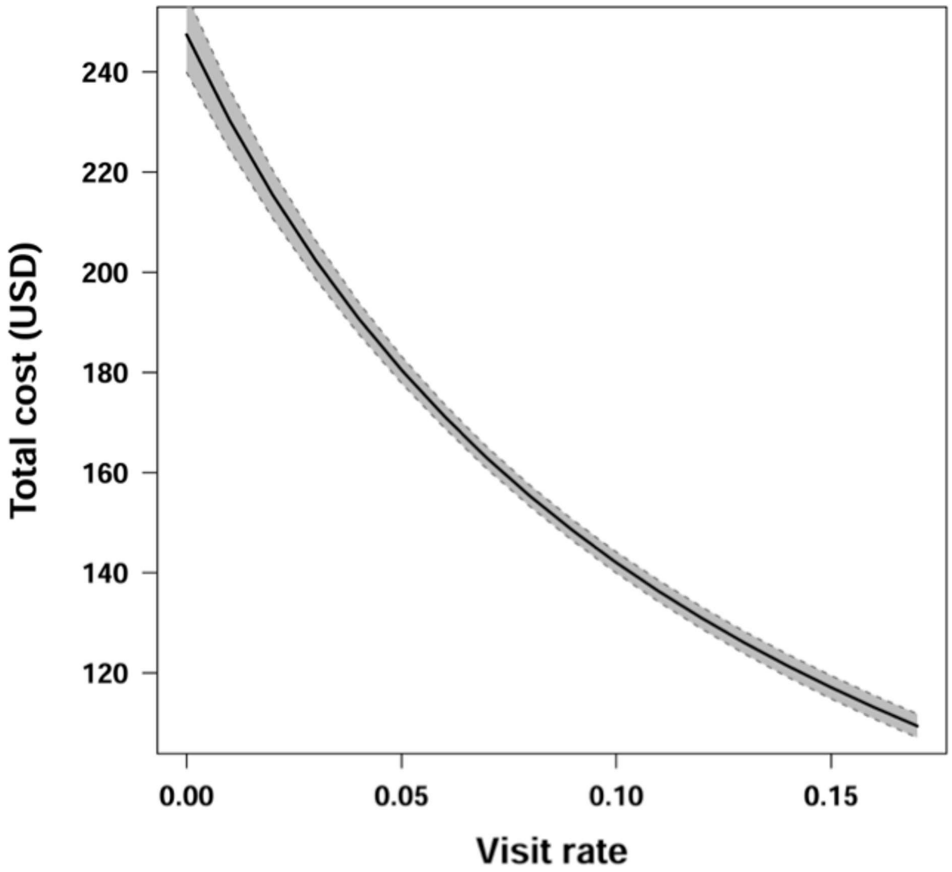

Figure 2. Average Demand Curve (in solid line, the 95% confidence interval is displayed by the dashed line) for Caribbean Flamingo (*Phoenicopterus ruber*)-watching at Celestun, Mexico. The total travel cost (y-axis) is a surrogate of the willingness to pay (WTP) by visitors, in function of the visit rate (x-axis), representing the quantity demanded of the good. In this case, the consumed good is flamingo-watching, and the visit rate is the number of times such good is consumed. The area under the curve is used to estimate the total WTP (recreational economic value) as described in Methods section.

but it is indirectly considered through the visit rate, i.e., the closer to Celestun the visitants the higher the visit rate. Furthermore, we estimated a confidence interval (95%) for the total WTP (recreational economic value). We obtained the confidence intervals for GLM coefficients, and used them in steps 3 and 4 to estimate the corresponding lower and upper total WTP confidence interval.

RESULTS

It was found from the interviews that 78% of responding visitors that took part in the flamingo-watching tours were Mexican nationals and 22% were from different countries around the world, mostly from Europe (14%) and the United States (6%). From all visitors interviewed (national and international), 79% stated that their main reason to visit Celestun was for flamingo-watching. 70% decided to visit Celestun when they were planning their trip from home. From the Mexican nationals group that we used for this valuation study, the majority came from Mexico City (the Capital City of Mexico), with 102 visitors, followed by visitors from Yucatan, where Celestun is located, which consisted of 86 visitors. The rest came from different regions of the country. Because of the low numbers of international visitor's interviews, we were not able to use this data in the calculations of the Travel Cost Method.

Of all of the visitors that were interviewed (nationals and non-nationals), 75% were visiting Celestun for the very first time, while the rest (25%) had visited before. For Mexican nationals, in terms of income, 31% of the interviewed visitors earn between US$40,000–50,000 yearly or more; 30% earn between US$20,000–40,000 yearly, and the rest less than US$20,000. 60% of visitors interviewed hold at least a College degree (University). Average income in Mexico is close to US$13,000 (OECD 2017), which indicates that visitors to Celestun are above the average. When asked about paying an extra fee for flamingo conservation, 83% responded positively.

The GLM with the lowest AIC (2773.71) included visit rate (*VR*), income level (*In*), occupation (*Oc*), and place where the group decided visit Celestun (*De*) (Table 1; see Table S1 with the other models assessed in stepwise procedure, and Table S2 with coefficients' values and their confident intervals). Considering that

visit rate represents the quantity demanded for flamingo-watching, for instance, the higher the visit rate is the lower are the travel costs (Figure 2).

From step 2 and 3, we estimated the individual WTP for each zone and then we obtained the total WTP, resulting in a total of US$16,542,004 (US$16,411,863–16,674,109; 95% CI). The area under the curve (Figure 2) was used to estimate the total WTP (recreational economic value). This quantity represents the "Flamingo value" placed by visitors in Celestun, according to the amount they spend travelling and paying for the actual motor-boat flamingo tour.

DISCUSSION

The Travel Cost Method allowed us to estimate the recreational economic value of Flamingos in Celestun, placed by visitors to the site. Because of the characteristics of Celestun and the Flamingos, where a single species is the main natural attraction, we are able to say that our result, represented by the travel expenses of visitors and potential visitors, is a close approximation of Mexican people's valuation of the flamingos and their coastal wetland environment. Considering that visit rate represents the quantity demanded for flamingo-watching, for instance, the higher the visit rate is the lower are the travel costs (Figure 2). This pattern is in accordance with economic theory, in which demand (visit rate) of a good will be high at low prices (total travel cost). It should be noted that it is necessary to establish the relationship between total travel cost with visit rate in order to build a demand curve and to incorporate other socioeconomic variables. For instance, high income level depicted high total travel cost.

As stated by Hackett (2000), when most people can visit a site only once a year, it is difficult to estimate individual visit rates to relate to the travel cost, and consequently construct the demand curve to estimate the total WTP or economic value. In this case, the zonal Travel Cost Method, used here, explains the travel costs of each region's visitors as a function of the portion of each zone's population (i.e. visit rate) visiting Celestun, allowing us to build a demand curve.

The only other article published about flamingo value (Navrud & Mungatana 1994) refers to the Lesser Flamingos in Kenya. The authors found that flamingo value accounts (7.5–15 Mio. USD) for more than one third of the annual recreational value of wildlife viewing in Lake Nakuro National Park. Navrud & Mungatana (1994) also found a significant relationship between income and visitation rate, both variables having a determinant weight in their model. The results we obtained from the visitors of Celestun are consistent with the results obtained by these authors.

The amount we reported as the flamingo value is a reflection of how much Mexican visitors appreciate nature for recreational purposes. Such an important value could justify conservation programs that promote the maintenance of the coastal lagoon and the flamingo population in Celestun, in order to keep acceptable tourism impact levels on flamingo-watching activities, preventing flamingo-watching tourism, and tourism development from over-exploiting this valuable natural resource.

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