THE IMPACT OF CLIMATE CHANGE RISK OF BEACH LOSS ON TOURIST BEHAVIOUR: A REVIEW

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Abstract

Climate change is expected to have important effects on the tourism industry, both on the supply and demand. This article conducts a systematic search and meta-analysis of peer-reviewed research articles published in the last twenty years (2000-2019), addressing the topic of Climate Change risk of beach reduction and its relation to tourist behaviour - destination choice, willingness to re-visit, expenditure and willingness to pay for climate-related policies. The search counts for 19 papers providing *a priori* useful data to identify transferable economic values. The conclusion of the meta-evaluation is that greater multidisciplinary methods are needed. The available data does not deal with all the potential impacts resulting from beach alterations due to CC, unsuitable for an integrated approach to risk assessment on tourist behaviour. Among the available socio-economic impacts the ones usable in a value transfer context are related to willingness to pay and tourism expenditure. Finally, findings confirm that the economic impacts of this environmental threat would imply large reductions in the number of tourists visiting tourist destinations and relevant amount of monetary damages.

Keywords: Climate change, Risk, Beach availability, Environmental services, Tourist behaviour.

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Resumen

Se espera que el cambio climático tenga efectos importantes en la industria del turismo, tanto en la oferta como en la demanda. Este artículo lleva a cabo una búsqueda sistemática y un meta-análisis de artículos de investigación publicados en los últimos veinte años (2000-2019), los cuales abordan el riesgo de pérdidas de playas debido al Cambio Climático y su relación con el comportamiento del turista – elección del destino, disposición a revisitar, gasto y disposición a pagar por políticas relacionadas con el clima. La búsqueda cuenta con 19 artículos que proporcionan *a priori* datos útiles para identificar valores económicos transferibles. La conclusión de la meta-evaluación es que se necesitan mejores métodos multidisciplinarios. Los datos disponibles no abordan todos los posibles impactos resultantes de las alteraciones de las playas debido al CC, por lo que son inadecuados para llevar a cabo un enfoque integrado de la evaluación de riesgos en el comportamiento turístico. Entre los impactos socioeconómicos disponibles, los utilizables en un contexto de transferencia de valor están relacionados con la disposición a pagar y el gasto turístico. Finalmente, los resultados confirman que los impactos económicos de esta amenaza ambiental implicarían grandes reducciones en el número de turistas que visitan los destinos turísticos y cantidades relevantes de daños monetarios.

Palabras Clave: Cambio climático, Riesgo, Disponibilidad de playas, Servicios ambientales, Comportamiento del turista.

1. INTRODUCTION

Climate is one of the elements of tourist destinations with the greatest potential impact on tourist behaviour (Rosselló & Waqas, 2016), although studies are still considered scarce (Ciucci et al., 2013; Li et al., 2016), especially with regard to the appraisal of climate impacts (Goh, 2012) and the socio-psychological reactions of tourists under different climate scenarios (Rutty & Scott, 2010).

Given the importance of the effects of climate change at global and local levels, the analysis of the relationships between climate and tourism has been presented as an important research challenge in recent years (Denstadli & Jacobsen, 2014). For example, the morphological alterations in the beaches and coastlines alert to the potential risk for the sustainability of great part of the global tourism industry (Hemer, Fan, Mori, Semedo & Wang., 2013). In some environments, the drastic variation in the quality, direction and height of waves could also mean the practical impossibility of carrying out the tourist activities. In relation to these effects, there is an expected impact on global tourism expenditure and the geographical movements of tourists (Anning, Ware, Raybould & Lazarow, 2013), among other socio-economic implications.

Regarding the study of tourist responses to climate change effects, and the policies needed to deal with them, the concept of Environmental Services is widely utilized (Gössling, Scott, Hall, Ceron & Dubois, 2012; Martín, López & Iglesias, 2017). The Environmental Services are the analytical interface between Climate Change (CC) impacts on oceans, atmosphere and coasts and the effects of those impacts on the functional activities that tourists demand (Turner & Pearce, 1990). Thus, tourists' valuation of the Environmental Services are often analysed together with their behaviour when these services experiment changes or damages due to Climate Change. This so call non-market valuation assessment is also needed in order to identify how the tourist experience value is altered.

With the increase in the non-market valuation literature, the meta-analysis became a stronger and widespread tool in the tourism climatology literature (Bateman & Jones, 2003; Bergstrom De Civita, 1999), useful to identify aggregate or disaggregated measures that are suitable to be transferred to other research contexts, to analyse the state of the art of the research on this topic, and to examine the effectiveness of the methods and approaches utilised in assessments of tourists' behavioural responses.

According to this, this paper aims to analyse the latest research advances with regard to the study of the impact of Climate Change risk of beach loss, erosion and surface availability's reduction in tourist behaviour. To do this, the present study conducts a systematic and meta-analytic review of the publications of the last twenty years (2000-2019), collecting and interpreting all the impacts and economic values found in the existing literature, together with some characteristics of the scenarios contemplated and the methodology used. Moreover, an effort has been made to determine which of the results could potentially be transferred directly.

The article is organized as follows. The following section is devoted to a concise presentation of the systematic review and meta-evaluation methodology and their importance to measure research advances within a specific topic. It is also dedicated to explain the benefit transfer methodology, a criteria followed in this study to identify and classify the more useful findings, which are shown in the following sections. The third section outlines the process of data collection and classification that was conducted. The findings section is dedicated to integrate the outcomes of the selected manuscripts and to analyse and interpret their results. Finally, the last section is dedicated to the concluding remarks and offers recommendations for further research.

2. LITERATURE REVIEW

2.1. Systematic review and meta-evaluation

Systematic review and meta-evaluation are both forms of what is increasingly becoming known as research synthesis (Weed, 2005). Systematic review as a method of synthesis is widespread in the fields of medicine and psychology, to ensure that treatment, interventions, and initiatives are based on the 'best evidence' (Davies et al., 1999). However, it can also be used to assess the nature and extent of knowledge in any area (Weed, 2005). Thus, a systematic review is a review in which there is a comprehensive search for relevant studies on a specific topic, and those identified are then appraised and synthesised according to a pre-determined explicit method (Klassen et al., 1998). The key to systematic review is that the criteria for the inclusion or exclusion of studies is explicit from the outset and thus the scope of the review, are clearly delimited (Weed, 2006).

Given that the prefix 'meta' literally means 'beyond' or 'across', the term 'meta-evaluation' usually refers to the evaluation of a number of studies. Some authors such as Woodside and Sakai (2001) note that meta-evaluations

report on the validity and usefulness of the methods that studies employ, while others delimit its scope to the 'meta-evaluation of methodologies' (Scott-Little et al., 2002). Following Finn et al. (1997), this research conducts a meta-evaluation to assess the extent to which, regardless of the internal consistency and validity of a study, the methodology and methods used result in findings that have any broader utility in the studied area as a whole.

In the meta-analysis research area, either a quantitative or a qualitative approach dominate (Hunter, Schmidt, & Jackson, 1982). The former is geared towards comparing the studies by tabulating them into selected categories and then aggregating through any single category (Pike, 2002). The latter, while following the same classification procedure, is more interpretive than aggregative (Paterson, Thorne, Canam, & Jilings, 2001). This meta-analysis lies within the second, more qualitatively oriented.

2.2. Benefit transfer: climate change impacts

The benefit transfer method (BT) is a technique developed with the aim of estimating the economic value of environmental services when an original valuation is not viable (Barbera, 2010). Therefore, it is a second-best approach. Environmental value transfer has been applied in a wide range of topics, from water quality management (Luken et al., 1992) and associated health risks (Kask and Shogren, 1994) to waste (Brisson and Pearce, 1995) and forest management (Bateman et al., 1995).

In environmental economics, several techniques have been developed with the aim of measuring the value people give to natural resources and services. The objective is to obtain a monetary measure of these environmental values. Thus, two wide extended measures are the individual willingness to pay (WTP) or the willingness to accept (WTA)[3]. Often, they can be calculated by directly asking people through a survey (that is contingent valuation) or indirectly by assuming that the valuation of these resources is implicit on the travel costs or the prices paid to live in a specific area. That is, people would only pay these amounts because these places/resources/services have a value for them.

Empirical studies often obtain an aggregate measure of welfare for a representative individual of the sample such as mean WTP (willingness to pay) for a given change in a good or ecosystem service/characteristic for a particular sample of individuals (Johnston et al, 2015). They call this marginal measure as $\overline{y_{js}}$, where the sub-script j represents the site and s is the population sample of the primary study. Parallel estimations are required for a place where the site is i≠j and population are r≠s, called $\widehat{y_{ir}}$. Thus, the transferred unit quantities could be a single unadjusted value, a value adjusted depending on the attributes of the policy context or using expert's opinion, a measure of central tendency or a range of estimates from different prior studies. The simplest but less accurate is the single non-adjusted value. That means that we assume that per person WTP at the study site is equal to per person WTP in the policy site[4] ($\widehat{y_{ir}^{BT}} = \overline{y_{js}}$), where BT means that these values have been taken using the benefit transfer approach. If the population at site is equal to W, then the aggregate value will be equal to W*$\widehat{y_{ir}^{BT}}$.

Another form of transferring values is to transfer an adjusted value, depending on the attributes of the policy context or using expert opinion. Maybe we want to account for differences in currency value, income or other factors. This methodology consists on finding a function f ($\overline{y_{js}}$) that satisfies $\widehat{y_{ir}^{BT}}$=f($\overline{y_{js}}$). The functions can be determined by using objective or subjective factors, i.e. if we want to use a price index (P) as a proxy to account for differences in real currency values, we must use P*$\overline{y_{js}}$. However, Johnston et al (2015) clarify that analysts should be aware of the strong assumptions needed by these types of scaling adjustments. To avoid these adjustments problem, we can use the administratively approved values. But an associated problem is that these values have been derived from subjective and arbitrary processes, instead of by quantitative and formal estimations.

In our study this technique is used to analyse the usefulness of previous research addressing the topic of Climate Change impacts on beaches leading to changes in tourist behaviour, for the context of islands destinations. Thus, the meta-analysis conducted aims to identify potentially transferable economic values coming from the analysis of the risk of beach loss, erosion and reduction of beach surface that can be employed in further similar research in insular contexts.

[3] The willingness to pay (WTP) refers to the maximum price at or below which a consumer would definitely buy one unit of a product. The willingness to accept (WTA) is the minimum amount of money that a person is willing to accept to abandon a good or to put up with something negative.

[4] When naming the case study (study site) we are referring to the places for which the literature has already calculated an economic value. On the other hand, when we talk about the policy case (policy site), we are mentioning the place in which those values taken from the literature are going to be applied.

3. METHOD

This paper uses the systematic review procedure to identify articles published in journals, addressing the study of climate change impacts on beach availability, erosion and surface reduction, and their subsequent effects on tourists behaviour. It examines a particular tourism segment (e.g. beach use or beach valuation) and a wide range of areas (e.g. tourist destinations all over the world with their micro destinations, protected areas, etc.), thus establishing a picture of current knowledge and issues in the area.

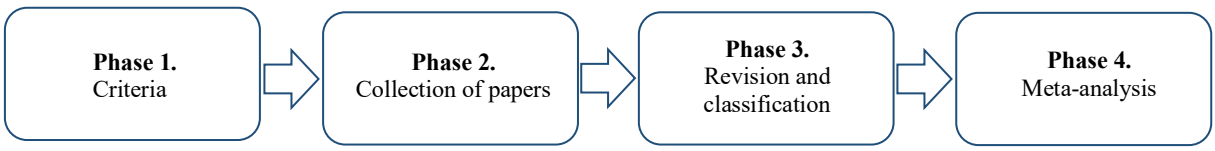
The review was conducted in four steps, and has taken place from August 2018 to February 2019, although it was reviewed and extended in August 2019 too. The first step consisted on establishing the criteria to select the relevant papers:

- Articles should be published in scientific journals with high impact, indexed in the databases Journal Citation Reports and Scopus. The main search source used was Google Scholar.
- The articles' main aim should be the study of economic impacts of Climate Change in the tourism sector due to beach erosion, beach surface reduction or beach loss. The analyses could include different scenarios of Climate Change impacts.
- The researches should include so far the risks of beach loss, beach erosion and/or beach surface reduction, together with the estimation of economic values of these risks occurrence.
- The estimation of the economic values should be related to tourists behavioral responses to the identified CC risk.

The second step of the process was the collection of papers. Once the risk was identified within the tittle or the content of the papers, the general impact studied in the article was determined, together with the distinction between demand or supply effect. An example and non-exhaustive list of keywords is the following: Climate Change, climate impacts, climate risk, tourist perception, benefit transfer, risk perception, environment management, environmental technical change, impact assessment, beach loss, beach surface availability, beach erosion, tourist behavior, willingness to pay, climate policy, tourism expenditure, destination choice, etc.

At this stage a speed reading (abstract, first paragraph, and as much text from relevant sections as needed) was necessary to classify the articles according to the following areas: research focus, theoretical foundations, conceptualization, geographical scope, methodologies employed, and management policies.

Figure 1. *Process for collection and review of existing literature regarding the economic valuation of the Climate Change risks and related policies on Tourism Behaviour*



The third step corresponded to the revision, classification and validation of the materials collected. It was checked that the risk and final analysis were in line with the criteria described in the first step. All sampled articles were tabulated along several perspectives. If an article sought to develop an in depth understanding of concepts by building on existing knowledge, the article was considered conceptual. Conversely, if an article tested original research or theory by employing human subjects or textual samples and statistical techniques, it was classified as empirical. The articles that were exclusively conceptual were discarded.

Those empirical and conceptual/empirical articles were further classified into quantitative versus qualitative streams based on predominant methodologies. Methods and models employed in quantitative studies were also identified. Other categories were created for the associated CC hazards being studied, the location of the study, and the behavioural and economic impacts analysed.

Manuscripts were classified according to three level of potential usefulness for benefit transfer (Low –L, Medium –M, High-H). To do this, the following criteria were employed:

- High usefulness is related to researches conducted in areas with similar spatial and socioeconomic characteristics of islands (i.e coastal destinations, outermost regions).
- Recent publications are more suitable to be used for benefit transfer.

- Price elasticity functions and macroeconomic indicators are the most useful measures to transfer economic values to other contexts.

The next section is dedicated to describe the materials collected and interpret the most relevant findings.

4. FINDINGS

The review procedure resulted in a sample of 19 articles: 5 articles were published in journals related to economics and policy; other 5 articles were published in journals related to coastal management or conservation; and the rest were published in journals related to environmental topics. Moreover, one paper was published in the journal of *Tourism Management*; and another one in the journal *Annals of Tourism Research.* Table 1 presents the distribution of the final sample of articles considered for meta-analysis phase.

Some papers provide additional information on biophysical impacts due to climate change hazards and the estimated socio-economic impacts, expressed in different economic variables. Other columns in the table are dedicated to show methodology employed, the location of the study, the source and the usefulness classification.

Table 1. *Journal articles measuring the impacts of climate change on tourist behaviour: beach loss, erosion and surface availability (2000-2019)*

Hazard/ Physical impact	Behavioural effect / Economic impact	Method/ Model	Location	Source	Usefulness
SLR 25 cm – 45.6% of coastline sensitive to coastal squeeze	83% of tourists use beaches at risk. Infrastructure up to 300m landward and within 5-10m along the coast is vulnerable to SLR: 11-14% of island surface and 62% of infrast. at risk.	Spatial analysis based - GIS model.	Martinique	Schleupner, (2008)	(L-to-M)
2 m inundation 24% of land loss - 7 m inundation 59% of land loss - By 2050, 50% of sandy shore lost (SLR 860mm)	Two scenarios developed: economic development first; sustainability first.	Spatial analysis based - GIS model.	Morocco	Snoussi et al (2008)	(M)
Negative impact of CC on coral reefs and beaches	Image worsened; 80% unwilling to re-visit for same price; Wealthy tourist contribute 40% GDP (Bonaire)	Survey – Principal Component Analysis	Bonaire and Barbados	Uyarra et al (2005)	(H)
Beach erosion	17-23% tourists opting for alternative destinations; Loss of tourism receipts imply losses of $20m-$56million	Survey	Australia	Raybould et al (2013)	(H)
Beach disappearance	Tourists would choose a different destination (39%). Protecting beaches from erosion and inundation is among the most preferred policies. Beach size among the most important environmental attributes determining destination choice.	Survey	Florida	Atzori et al (2018)	(L-to-M)
Beach replenishment (protection and adaptation measures)	Tourists express positive sentiment towards changed image of the beaches. Others have concerns from aesthetical points of view, but are aware of the necessity of protection measures.	Survey – Hypothetical scenarios	Playacar, Mexico	Buzinde et al (2010)	(L)
SLR, 25 cm by 2050	Redistribution of tourists flows triggers GDP loss ranging from 0.5% in Small Island States to almost no loss in Canada	CGE GTAP-EF (Global Trade Analysis Project) model.	Different countries	Bigano et al (2008)	(M)

Hazard/ Physical impact	Behavioural effect / Economic impact	Method/ Model	Location	Source	Usefulness
SLR by 2100: i) 516-1010 mm IPCC; ii) 1430 mm Rahmstorf; iii) Sardinia 1350 mm, flooding 5500 km2 of coastal plains;	Subsequent loss of land will impact the environment and local infrastructures.	Digital Terrain Models (DTM)	1) North Italy-Adriatic 2) Gulf of Taranto; 3) Sardinia	Antonioli et al (2017)	(L-to-M)
SLR 0.5 m by 2100, no protection measures	Annual Direct Costs (no protection): 1) Europe: 7 billons; 2) Asia: 36 billons; 3) Rest of the world:10,5 billons	Computable General Equilibrium (CGE) model	Global	Darwin and Tol (2001)	(L-to-M)
SLR, IPCC projections Shoreline will retreat about 13m for 2020 and 52m for 2060.	31% of tourism facilities highly physically vulnerable to SLR; Beaches will lose on average GHC 227,500 per year; ↓ 2000 visitors per beach facility per holiday .	Historical orthophotos and topographic maps	Accra, Ghana	Sagoe-Addy and Addo (2013)	(M)
SLR 1000 mm Beach erosion	50-60% coastal at risk of erosion damage, and larger number would experience loses of beach assets.	Geo-referenced database	19 Caribbean Community (CARICOM) countries	Scott et al (2012)	(L)
El Niño events ↑ 76% erosion in winter	Economic losses estimated at over US$11.5 billion (in 2016 dollars).	Aerial Light Detection and Ranging (Lidar) & Global positioning system-based (GPS)	6 regions of US West Coast in winter 2015-2016	Barnard et al (2017); NOAA (2016)	(L)
Coral reef decline generate erosion of 65%-100% after 10 years.	1) Implicit price of beach width was $1.57/m/person/night (2009US$) 2) revenue losses to the resorts of $52-$100 million over the next 10 years	Hedonic prices (properties around)	Dominican republic	Wielgus, Cooper, Torres and Burke (2010)	(M-to-H)
Coastal Erosion – Beachrock processes	Assesses beach users' willingness to pay for protecting European beaches WTP an annual tax in the range of 13.2€-16.4€/household	Contingent valuation	Greece	Kontogianni et al (2014)	(L-to-M)
Coastal Erosion & Adaptation	Visitors WTP for beach defence: 1) Mean WTPs 0.5€-1.49€/day. 2) Willing to donate on average 1.1€ every 5 years for beach defence	Contingent valuation	France Greece Italy	Koutrakis et al (2011)	(L-to-M)
SLR of 7 cm in 2030 and, depending on the hypotheses, of 35 cm, or perhaps even 1 m, by 2100	Mean WTP for beach protection is 36.4€ per household per year	Contingent valuation	France	Rulleau and Rey-Valette (2013)	(M)
Sea level rise and adaptation measures	Beach protection significant attention because beach tourism is economically significant. Additionally, beach nourishment is popular in alleviating erosion.	Case study	Barbados	Mycoo and Chadwick (2012)	(L)
SLR 50cm by 2050, Rounded up to 50% reduction in beach width	>50% visitors willing to pay to reduce beach erosion and improve beaches; Annual total WTP to avoid erosion: $997,468 (2011 US Dollars); Annual loss of revenue of tourism sector: $73m. (reduced 66.6%).	Contingent valuation	Colombia	Castaño-Isaza, Newball, Roach and Lau (2015)	(M-to-H)
Beach erosion	Mean WTP per household for a 5 years period: $78-$124. Estimates for beach protection: $62million-$257million to reduce impact of beach erosion at 75km of beach (aprox. $2.1million/km)	Contingent Valuation	Southeast Queenland, Australia	Windle and Rolfe (2014)	(H)

The meta review conducted sheds lights and shadows. By the side of lights, the review has allowed to gather values for the selected risk of Climate Change, however, these values are represented very differently: some papers look at the destination image or the choice of destination; while other focus on either beach use, beach protection or beach erosion.

Besides, the transferability of the economic values found is strongly conditioned by the extraordinary heterogeneity in the nature of the data provided and the different locations studied, and the methodology used to elicit them. It means that value transfer will be far from a simple, direct attribution of values from some places to the context of island destinations, but it will require a quite laborious data refining process. Notwithstanding, at this time it is worthwhile to remind that values mined from the literature are just one source, and not the main one, to evaluate climate change impacts on tourist behaviour when visiting island destinations.

With respect to the behavioural effect of climate change impact, some relevant information was found even if the variables in which it is expressed show dispersion in nature, and treating them jointly requires some operations to give them enough homogeneity. They differentiate each other either on the variable selected to refer to the behaviour (willingness/unwillingness to revisit, choice of alternative destination, loss of number of visitors, etc.) or on the criterion followed to delimitate the tourist destination.

It ranges from very specific economic valuation in terms of changes in willingness to pay for tourism and for a unit change in a particular environmental service, i.e., the beach width, to very general economic evaluation referred to a percentage of GDP due to a climate-related impact. Generally speaking, former-type data are more useful than latter-type ones. In some other cases, the obtained information focuses on the costs of some adaptation policies enabled to reduce tourism vulnerability to climate change. This information may be useful to make estimations of the economic value of climate change impacts based on avoided costs-type methodologies.

The methodological heterogeneity of the sources of data may also add complexity to the task of value transfer. The literature shows that some observed differences in the economic valuation are intrinsic to the methodologies used to elicit the values. In the information mined from the literature, most of the cases used contingent valuation, or its evolved version, discrete choice experiments, to estimate the average willingness to pay, or accept, of the targeted population for environmental changes that bring improved/worsened recreational experiences. The minority of collected values come from the application of travel costs and hedonic prices methodologies, while in some cases, these three methodologies are combined to elicit economic values.

Just a few study cases focus on islands scale. The economies of the European islands are mostly tourism-based, which is the chief activity in terms of GDP and employment, and highly significant in terms of land occupancy and environmental impacts. Additionally, the European islands have developed mostly coastal and marine tourism modalities, extraordinary sensitive to a wide range of climate change related hazards. They also hold highly vulnerable ecosystems, representing an important proportion of the European biodiversity. Taking all these specificities into account, the transference of economic values of climate change events from mainland located territories should be modulated for this set of islands' specificities.

4.1. Changes in tourists' destination choice

Within this group of articles, the study of Bigano et al. (2008) estimated the impacts of SLR on tourists' flows. The results suggest that 25 cm of sea level rise projected by 2050 would lead to a GDP loss ranging from 0.1% in South East Asia to almost no loss in Canada, while redistribution of tourist flows would correspond to GDP losses ranging from 0.5% in Small Island States to 0.0004% in Canada. Therefore, the study also highlights that both SLR and the redistribution of tourism flows would have different impacts in different parts of the world.

In Barbados, 77% of tourists declared unwillingness to return in case of beach surface reduction. This would translate into tourism revenues decreasing by as much as 46% (Uyarra et al., 2005). In Australia, where under different beach erosion scenarios the share of tourists opting for alternative destinations is estimated to be 17-23%, the drop of revenues would be as large as $20-$56 million p.a. (Raybould, 2013). However, many tourists claim to reconsider their choice if coastal protection measures are taken (Atzori et al., 2018). Buzinde et al. (2010) investigate the case of Playacar, Mexico, that was hit by severe beach erosion and undertook some protective measures, which were expected to have a strictly negative impact on tourists' perception.

Studies focused on extreme weather such as El Niño events (Barnard et al., 2017) revealed that the shoreline retreat among the six regions of the US West Coast in the winter of 2015-2016 was 76% above the normal winter erosion

rates. Similarly, the stormy winter of 2013-2014 along the Atlantic coast of Europe was found to have changed dramatically the equilibrium state (beach gradient, coastal alignment, and nearshore bar position) of the beaches (Masselink et al., 2016). The effects were found to vary depending on obliqueness of the waves, and lead not only to beach erosion, but also to beach rotation (Burvingt et al., 2016). The immediate economic impacts of events such as El Niño can be quite considerable, reaching US$11.5 billion globally (NOAA, 2016). Regarding the effects on the demand side, the literature consistently finds a negative impact on tourist arrivals.

4.2. Changes in tourists' activities and consumption

Due to Climate Change the Mediterranean region will become too hot in summer but a more pleasant destination in the shoulder seasons (Amelung & Viner, 2006; Amelung et al., 2007). For the case of Balearic Islands the studies predict that, while these changes may be even favourable from resource management and biodiversity point of view, the effects from an economic and social perspective are likely to be detrimental. According to the results obtained by Gómez-Martín et al. (2014), many tourists switched to indoor activities and 25% reported a substantial increase in water consumption.

The studies also highlight that perceptions as well as behaviour are heterogeneous across respondents of different age: younger generations are less susceptible to extreme weather conditions than the elderly. Nevertheless, a 25cm SLR was estimated to pose a risk on 87% of beaches used for tourism (Schleupner, 2008).

4.3. Effects of adaptation measures

The analysis carried out by Buzinde et al. (2010) revealed that tourists adapt their views and attitudes when protection measures are used at beaches: some express positive sentiment towards the changed image of the beaches while others, although expressing concerns from aesthetical points of view, are still aware of the necessity of protection measures, and are willing to accept them in the light of Climate Change. Consequently, some countries have begun to invest in a variety of adaptation initiatives such as beach protection and artificial beach nourishment (Mycoo & Chadwick, 2012). Such measures are obviously costly, but ignoring mitigation and adaptation strategies may lead to much higher losses.

Darwin & Tol (2001) estimate that if no protection measures take place, a 0.5 meters SLR in 2100 would have the annualised total cost of about US$43 billions, with severe differences across regions: US$7 billions in Europe and US$36 billions in the Asian region. However, adopting an optimal protection package would reduce total cost, thus resulting in US$10.5 billions for the whole world. Importantly, the authors find that international trade is going to smoothen disparities in losses by redistributing from regions with relatively high to regions with low damages.

Unfortunately, literature referred to the relationship between climate-induced impacts and its effect on the destination image is almost inexistent. We sought this potential relationship as changes in the destination image are good predictors of tourists' destination choice, expenditure and satisfaction. However, it is necessary to carry out a second round of searches to try to find some related evidence, at least performing as a proxy of this relationship.

5. CONCLUSIONS

The meta-analysis conducted allows to obtain an overview of what has been studied in the last two decades regarding the impact of Climate Change risk of beach loss in tourism behaviour, and which may be the potential gaps within the topic. Moreover, an effort has been made to determine which of the results could potentially be transferred directly.

However, in future research a refinement of this first search will be made, and the methodologies presented will be applied more thoroughly in order to obtain useful values and results from the benefit transfer methodology and from different estimations, in order to apply them to the European islands context.

It should be remarked the very few publications found in the specific context of an integrated approach of the impact of climate change risk of beach loss in tourism behaviour, meaning, starting the analysis from the physical impacts until the economic or behavioural impact, passing through the effect on the environmental services. The reduced amount of publications found could be a potential measure of the lack of involvement of the scientific community with this specific topic. Nevertheless, the authors suggest extending the search both to a longer time period and to a variety of research resources such as books, project reports, doctoral dissertations, etc.

The conclusion of the meta-evaluation is that greater multidisciplinary methods are needed, and that researches need to give more consideration to the development of knowledge in the area as a whole. Moreover, the available data does not deal with all the potential impacts that can result from beach alterations due to CC, unsuitable for an integrated approach to risk assessment on tourist behaviour. Among the potential available socio-economic impacts, those which can be utilized in a value transfer context are the ones related to willingness to pay and tourism expenditure. Finally, findings confirm that the economic impacts of this environmental threat would imply large reductions in the number of tourists visiting tourist destinations and relevant amount of monetary damages.

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