

# Climate Change and Coastal & Marine Tourism: Review and Analysis

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## ABSTRACT

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Coastal and marine tourism is a growing sector, in terms of both participation and economic relevance. For its enjoyment and safety, coastal and marine recreation requires suitable weather conditions, and attractive environments. Climate change will impact both. At the same time, tourism is an important source of the greenhouse gases (GHG) that are causing climate change. To date, and with the exception of beach recreation, most studies on climate change and tourism have concentrated either on impacts on whole countries and world regions or on certain ecosystems like coasts, focusing their attention in only one activity and overlooking the great diversity and very different weather requirements of the rest of activities these environments support. This paper reviews the importance of coastal and marine environments for recreation, presents current knowledge on the impacts of climate change on activities in these environments and identifies the main scientific gaps. This study provides an updated knowledge base for understanding climate change relationship with coastal and marine tourism and proposes a number of future research lines.

**ADDITIONAL INDEX WORDS:** *Climate change, tourism and recreation, coastal and marine environments*

## INTRODUCTION

Tourism is one of the most important economic sectors worldwide and few environments are more important for tourism and recreation than coastal zones. For many centuries the coast has been a major resource for recreation and the intensity and diversity of activities seem to be continuously growing (HALL, 2001; MILLER, 1993; ORAMS, 1999; ORAMS, 2007). Many countries are now aware of the potential of coastal and marine environments and are developing policies to stimulate these activities. For example, Denmark's national tourism policy strategy 2006-2009 has coastal tourism as one of the three main strategic areas and Mexico's Ministry of Tourism is applying fast track mechanisms to approve licenses for foreign investments in coastal zones (OECD, 2008).

All outdoor recreation and tourism activities are to a certain extent conditioned by weather conditions. Scholarly interest in the relationship between weather and climate on the one hand and recreation and tourism on the other started around the 1950s (SCOTT *et al.*, 2006). Over the last few years, this field of research acquired a new dimension with the inclusion of climate change as a potent factor shaping tourism activities (MATZARAKIS *et al.*, 2004). Reflecting this increasing interest, the United Nations World Tourism Organization (UNWTO), jointly with the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) convened in 2007 the Second International Conference on Climate Change and Tourism, in Davos (Switzerland). More than 450 participants from over 80 countries participated. The conference declaration states that "climate is a key resource for tourism and the sector is highly

sensitive to the impacts of climate change and global warming, many elements of which are already being felt. It is estimated to contribute some 5% of global CO<sub>2</sub> emissions." (UNWTO, 2007).

Coastal and marine environments have been identified as being highly vulnerable and "likely to be especially affected" by climate change (IPCC, 2007a), with important implications for the tourism activities that take place in them. Despite this high vulnerability and the great importance for tourism and recreation, researchers that have traditionally explored issues of coastal and marine tourism have commonly omitted the problem of climate change, whereas scholars exploring issues of climate change impacts on tourism, have typically focused on few activities, mainly related to sun & beach recreation (e.g. tourists preferences for weather factors; impacts on tourists' comfort; or physical impacts on destinations). Other activities related to the coastal or marine realm such as sailing or marine wildlife watching have received little if any attention. The aim of this paper is to present the key impacts climate change will have on coastal and marine tourism based on current knowledge and scientific literature. Tourism's role as a source of greenhouse gases (GHG) is very important though not included in this paper. The paper is organized as follows. The importance of tourism and recreation activities in coastal and marine environments is explored in section 2. Section 3 describes the main observed and projected impacts of climate change on these environments. Section 4 elaborates on the complex relationship between climate change, marine environments and tourism, introducing the state-of-the-art knowledge in terms of impacts. The main knowledge gaps that should guide future research are identified in section 5. Section 6 concludes.

## VARIETY AND IMPORTANCE OF COASTAL & MARINE TOURISM

According to HALL (2001, p. 602), “coastal tourism embraces the full range of tourism, leisure, and recreationally oriented activities that take place in the coastal zone and the offshore coastal waters. These include coastal tourism development (accommodation, restaurants, food industry, and second homes) and the infrastructure supporting coastal development (e.g. retail businesses, marinas, and activity suppliers) (...) Marine tourism (...) includes ocean-based tourism such as deep-sea fishing and yacht cruising”. This definition of coastal and marine tourism is important as it acknowledges the multiple elements involved in the tourism sector, from demand to offer, using the coastal and marine environment as the contextual background for the tourism activities.

The diversity of coastal and marine recreation goes well beyond the typical beach (sun, sand & sea) tourism. Shore-based leisure includes activities as varied as sunbathing, collecting objects (e.g. dead shells, fragments of corals), nature appreciation or land-based wildlife watching. Diving and underwater photography, recreational fishing and cruising are only a few examples of off-shore recreation; some other forms are less common, such as solo around the world yacht trips. For many communities, countries and regions around the world, marine tourism constitutes the main economic sector and source of employment. For example in Calvià, a coastal town in the island of Majorca (Spain), 95% of the jobs in 2002 were related to tourism (UNEP and UNWTO, 2005).

The great diversity of activities and the expansion the sector is experiencing are related to socioeconomic factors and coastal population growth. Most importantly, development of, and easier and cheaper access to advanced technology have dispersed coastal and marine recreation to virtually every corner of the world, from the poles to the tropics (HALL, 2001; ORAMS, 1999).

For most of coastal and marine activities there is no data about participation and revenues at the global level. However, some studies about specific sectors and regions can give an idea about the relevance of the sector. According to LEEWORTHY and WILEY (2001) 89 million Americans (43% of the population) participated in at least one marine outdoor activity in 1999-2000. One sector that has experienced rapid development in the last years is the cruise industry; the worldwide average growth rate is 7.4% per annum; the segment of 2 to 5-day cruises in the North American market has even grown by 1011% between 1980 and 2007 (CLIA, 2008), which corresponds to 9% per annum. Finally, whale-watching is another activity which has seen a spectacular increase, taking place in 12 countries in 1983 but expanding to 65 countries by 1995 (ORAMS, 2000; cited from HOYT, 1996). Before looking into the relationship between the coastal and marine tourism industry and climate change, it is necessary to understand what kind of impacts the latter will pose on these environments.

## CLIMATE CHANGE IMPACTS ON COASTAL AND MARINE ENVIRONMENTS

Scientific evidence indicates that the climate is changing, and that it is all but certain that human activities play a crucial role in these changes, affecting the rate and speed at which this process is happening. Research in the field of climate change has identified coastal zones as highly vulnerable to its effects. The Intergovernmental Panel on Climate Change (IPCC) is the main body in the field of climate change science, impacts, adaptation and mitigation. In 2007 the IPCC published the 4th Assessment

Report (AR4) which states there is a very high confidence that coasts will be increasingly exposed to climate change risks, including coastal erosion and sea-level rise (IPCC, 2007b). The report comprehensively compiles the available evidence, including observed climate related changes and projections of future impacts in all kinds of natural and human environments. The AR4 contains a wealth of relevant material for tourism, although the implications for this sector are not always explicitly addressed (AMELUNG *et al.*, 2008). Impacts contained on the IPCC report (IPCC, 2007b) which are relevant for tourism include losses of coastal wetlands and mangroves and increasing damage from flooding (very high confidence), erosion of beaches reducing the value of these destinations for tourism (high confidence) and damage to infrastructure, settlements and facilities that support livelihood in small communities (very high confidence), all related to sea level rise. Changes in the water cycle will very likely increase the extent and frequency of drought and flood-affected areas (high confidence) whereas increasing average temperatures will cause major changes in ecosystems and species and more frequent coral bleaching events (high confidence).

Among the most vulnerable industries the report identifies those located in coastal plains and whose economies are closely linked with climate sensitive resources (IPCC, 2007b), which is clearly the case for the coastal and marine tourism industry.

## CLIMATE CHANGE AND COASTAL & MARINE TOURISM

Climate change and tourism are related in a circular manner (PATTERSON *et al.*, 2006). Climate has a direct impact on (i) the physical, environmental and social resources available for tourism and (ii) the comfort, perceptions and safety of participants. At the same time, tourism contributes significantly to anthropogenic global climate change through the emission of greenhouse gases (GHG) related to accommodation, activities and most importantly, transport. This section is focused on the impact side of this relationship.

## Implications of Climate Change on Coastal & Marine Tourism

The extent to which the variety of coastal and marine activities is related to and dependent on weather conditions and climate changes differs. While for some of the activities the relationship is direct and easy to observe (for example sunbathing requires a minimum temperature, bright skies, and no precipitation), in other cases this connection is less obvious (e.g. the weather requirements of wildlife viewing, or climate change impacts on animal populations). This is one of the reasons why researchers are only starting to understand the possible threats and opportunities that climate change might pose to certain tourism activities. As a consequence, existing research on climate change and tourism is highly unbalanced, with most of the attention so far focused on those activities more directly dependent to weather conditions.

## Activities for which Research is Commonly Available

Of all the activities that take place in coastal environments, beach tourism has received most research attention. As they have sunbathing and swimming as their main activities, beach tourists are very sensitive to weather variables such as precipitation, temperature and wind. Climate-related studies of beach tourism have typically focused on (i) establishing preferences for certain

weather conditions, and establishing the climate suitability (i.e. tourism comfort) of coastal destinations, based on tourist preferences, and (ii) assessing the impacts of climate change on climate suitabilities.

Research on weather requirements for outdoor and more specifically beach recreation started in the 1970s and 1980s (e.g. BESANCENOT *et al.*, 1978; MIECZKOWSKI, 1985), and it has intensified significantly since the 1990s (e.g. BECKER, 1998; DE FREITAS, 1990; DE FREITAS *et al.*, 2008; MORENO *et al.*, 2008; MORGAN *et al.*, 2000). Building on biometeorological information, observation and questionnaires, this research attempts to better understand tourist comfort, behaviour, and preferences for weather conditions, usually reducing these into the individual weather components, such as temperature, wind, and precipitation. From raw data for the relevant weather variables, composite indices are constructed that reflect the climate suitability of destinations for beach recreation. These studies form the basis of research exploring the impacts of climate change on beach tourism and in most cases, destinations.

The increasing availability of information about potential impacts of climate change on coastal zones has opened up new research avenues. One of these focuses on tourists' appreciation of the physical characteristics of beach destinations, and explores how climate change could affect this appreciation. BRAUN *et al.* (1999) proposed a series of scenarios for future tourism at the German North Sea and Baltic Sea coasts, to facilitate the assessment of their potential desirability and acceptability. UYARRA *et al.* (2005) examined the importance of environmental attributes for the selection of holiday destinations, and for tourists' enjoyment of two Caribbean islands. One of these islands had a strong focus on marine biodiversity and diving activities, while the other one featured beach (i.e. sunbathing) activities. The study suggested that climate change would have a significant negative effect on visitation to both islands: in the first case through coral bleaching and reduced marine biodiversity as a result of higher sea temperatures; in the second case through reduced beach area as a result of sea level rise.

Finally, coastal destinations and small island states have been at the centre of attention of climate change research, due to their high vulnerability to sea level rise, extreme events and coastal erosion. Added to this in many cases, is their high dependency on tourism as an economic activity (e.g. BECKEN, 2004).

### Emerging Research

Climate change impact studies for most tourism activities are in short supply, although their number is currently on the increase. In many cases, the impact on tourism is a second-order effect, the first-order effect being the impact on the resource or ecosystem that form the basis of the tourism activity. Meaningful impact assessments for tourism therefore need sufficient prior knowledge about the physical impacts of climate change. Two examples represent well this. The first one relates to diving tourism, mainly in connection with reefs. An initial phase of studies focused on issues such as coral monitoring and bleaching (DONNER *et al.*, 2005; IPCC, 2007a; WALTHER *et al.*, 2002), while a second phase analyzed the socioeconomic impacts for tourism destinations that rely on this type of tourism and the effects of these physical impacts on tourists (ANDERSSON, 2007; CESAR, 2000).

The second example relates to certain types of wildlife watching, for which habitat deterioration, and impacts on the phenology of species are relevant. Phenology studies the times when recurring natural phenomena occur, including flowering of plants and first flights of butterflies. There is increasing evidence that climate change is having an impact not only on species' habitats, but also on their migratory patterns, breeding timings,

and overall distribution (PEÑUELAS and FILELLA, 2001). As some of these phenomena are important tourist attractions, climate change will indirectly also affect the tourists that travel to certain areas to observe them. Probably the most significant and representative example is that of climate change impacts on polar bears. Many authors have reported on the deterioration in the habitat and population of the species due to climate change (e.g. DEROCHER *et al.*, 2004; STIRLING and PARKINSON, 2006; TYNNAN and DEMASTER, 1997). Only recently, however, has a first assessment been made of the consequences for tourist perceptions, and for the economies of destinations that depend on polar bear viewing (DAWSON *et al.*, 2007). For other types of wildlife watching, such as whale-watching, the impact of climate change is largely unknown, despite the growth of the activity, and the economic importance it has for many communities (CURTIN, 2003).

For certain tourism activities, there is a body of literature on the first-order effects on the ecosystem, but the second phase of research linking these effects to tourism has not occurred yet. An example are the impacts of climate change on deltas and coastal wetlands many of which are important for tourism (commonly connected to wildlife and bird-watching). Physical impact assessments have been performed for wetlands, but not in direct relation to the implications of those impacts to tourism activities (NICHOLLS *et al.*, 1999; EL-RAEY, 1998). Other examples include climate change impacts on coastal glaciers such as the Ilulissat Icefjord, in Denmark, and impacts on historical monuments and coastal cities like Venice (UNESCO, 2007).

### Non-researched Activities

For the coastal and marine recreation activities that have not been addressed above (e.g. windsurf, kitesurf, sailing and cruising, recreational fishing, marine archaeology), climate change impacts are largely unknown and research on the topic virtually non-existent. Despite this, certain media reports of supposedly climate change related events suggest that the impacts may be substantial. Examples of this are the sinking of a tourist cruise ship in Antarctica after hitting an iceberg, and the injuries to tourists due to a glacier rupture in the Arctic, both in 2007 (CORMIER, 2007; WILLIAMS, 2007).

## RESEARCH AGENDA AND MAIN KNOWLEDGE GAPS

Climate change and tourism are both complex systems which interact in multiple ways. With the exception of few activities (e.g. beach recreation), studies on climate change impacts on tourism have focused mainly on destinations (e.g. Mediterranean) or on specific ecosystems (e.g. mountains, coasts), with little attention paid to the diversity of recreation activities that take place in these environments and their distinct weather requirements. Despite the increasing attention many coastal and marine tourism activities have received in the last years many information gaps still exist. Future research needs should be oriented towards:

- *Baseline research on weather and tourism/recreation including tourist preferences.* Recreation requirements for weather are still poorly understood, and climate change adds another layer of complexity. For this reason more research should be carried out to understand the key mechanisms of weather affecting the different types of activities. Research should focus not only on impacts on the resource or tourist attraction but also on tourists' weather preferences; satisfaction and expectations should be analyzed in order to project potential shifts in tourism demand more accurately (SCOTT *et al.*, 2008).

- *Development of vulnerability assessments.* In order to analyze the extent of the impacts of climate change on tourism in a detailed and structured manner, vulnerability assessments should be carried out at destinations. This type of analyses would facilitate the identification of key hazards and activities susceptible of being damaged by climate change, while identifying adaptation strategies to minimize negative impacts. Methodologies that facilitate this type of analyses are now available and should be implemented (MORENO and BECKEN, 2009).
- *Development of indicators and monitoring programs.* Indicators have proven to be important tools to describe and measure changes in the state of tourism systems (UNWTO, 2004; MILLER and TWINING-WARD, 2005).
- *Improvement of tourism data.* There is an important gap for activity-specific tourism figures. Numerous regions and countries are doing substantial efforts to compile this kind of data but global figures are still missing. Calculations of greenhouse gas emissions are also very limited by the lack of activity specific tourism data and energy consumption values.
- *Improvement of interdisciplinary communication.* The field of climate change and tourism could greatly benefit from the input of different disciplines such as climate change impacts on wildlife, deltas and estuaries, ecology, phenology, etc.
- *Use of analogues.* Despite the potential use of analogues (observed weather events that are similar to future climate projections) for projecting impacts, they are still uncommon in the tourism and climate change field (SCOTT et al., 2008).
- *Include feedbacks.* Certain tourism activities and destinations might benefit from climate change, resulting for example in higher visitation. Tourism management plans must incorporate this type of industry response to make sure that ecological and carrying capacity limits are not surpassed. For example warmer temperatures would mean a longer ice-free period around Hudson Bay and therefore an extended season for bears watching tours. This could imply increasing tourist numbers and pressure added to the stress exerted by changing climate conditions with uncertain consequences for the species (DYCK and BAYDACK, 2004).
- *Promote adaptation and proactive crisis management.* Natural hazards and extreme events are an important cause of crisis in many destinations (MEHEUX and PARKER, 2006). More research should be oriented toward the reduction of the impacts of such events facilitated by the use of indicators and promoting proactive adaptation management plans (DE SAUSMAREZ, 2007).
- *Raise awareness.* An important and usually underestimated mission of research should be directed towards public communication to tourism stakeholders, including tourists, companies and governments. This would facilitate collaboration between different parties, as well as impact reduction, as some stakeholders might overestimate their capacity to adapt (SCOTT et al., 2008).
- *Incorporate climate change in tourism related policies.* As in the case of Denmark and Mexico presented in the introduction, many countries around the world are developing tourism policies that include the coast as a key strategic area (OECD, 2008). Any policy or tourism plan should assess the negative impacts and opportunities brought about by climate change, and consider the potential for adaptation and mitigation.

## CONCLUSIONS

Coastal and marine environments are among the most important areas for tourism and recreation. Increasing knowledge about and interest in the coasts and oceans, as well as new and cheaper access to technologies, have caused an enormous growth in the

activities that take place in these environments. In many aspects, the involvement, enjoyment and safety of participants is shaped by weather conditions (e.g. wind and waves are needed for windsurfing, and absence of fog is required for wildlife watching). Climate change will affect these weather conditions, as well as many of the other resources on which tourism activities are based, such as beaches and coral reefs. The physical impacts include sea-level rise, beach erosion, increased frequency and intensity of extreme events, droughts, floods and changes in ecosystems' structures and biodiversity.

Climate change will have both positive and negative consequences for recreation depending on the activity and the destination. Despite the increasing interest from scientists, policy makers and tourism managers on the issue, many impacts and activities remain virtually unexplored. This article presents an overview of the existing knowledge on the impacts of climate change on coastal and marine tourism activities. A number of knowledge gaps have been identified, providing the base for future research in the topic. More research into specific activities, interdisciplinary communication, stakeholder dialogue and policies that incorporate climate into tourism planning and management are necessary steps to minimize the potential impacts of climate change, while taking advantage of the possible benefits it might bring about.

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