

“The environmental impacts of tourism in Antarctica: increasing complexity and global challenges”

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Introduction

Tourism in Antarctica has increased steadily over the last two decades and established itself as a legitimate Antarctic activity. Since 1991 the Antarctic tourism industry has self-organized in the International Association of Antarctic Tour Operators (IAATO), imposing a wide range of operational and environmental procedures on its members. The Environmental Protocol, adopted, ratified and implemented domestically by the Antarctic Treaty Parties in the 1990s set out the environmental protection of Antarctica from all human activities, including tourism. Some Treaty Parties expressed concern but tourism was not considered a priority issue between 1994 and 2000. Since 2001 the question of additional measures has received closer attention at the Antarctic Treaty Consultancy Meetings. Recently, additional measures have been taken with regard to a number of tourism issues, among them site-specific guidelines for a number of frequently visited tourist landing sites (Bastmeijer & Roura 2004, Crosbie 2005).

Alongside the political debate, from 1990 until recently an impressive body of academic literature has developed about the desirability, implications and manageability of tourism in the fragile, pristine and extreme Antarctic environment. A limited number of empirical scientific studies into the impacts of tourism on Antarctic biota and ecosystems have also been carried out (Stonehouse & Crosbie 1995, Naveen 2000). Within this lively academic debate, environmental impacts and risks of tourism have played a central role.

This paper is a review of a number of academic papers that were published in the period from 1990 until recently. In this paper, I will assess the environmental risks and impacts presented in these papers and discuss some of its limitations and complications for academic research. Implications for management and regulation will be largely left out of this discussion. I would like to note that this review is based on a limited number of research papers and is by no means complete. Before moving towards the main discussion of this paper, I will provide some context by briefly sketching the historical and current state of play in Antarctic tourism.

Tourism in Antarctica: growth, temporal and spatial concentration

Tourism in Antarctica started as early as 50 years ago. Ship based tourism became a regular pattern when Lars Erik Lindblad started his tourist voyages in the mid-1960s (Stonehouse 1994, Hall & Wouters 1995). Tourism has continued to develop itself, slowly during the first two decades and more rapidly from 1990 onwards (see Figure 1). The total number of tourists partaking in Antarctic travel itineraries has exceeded 30,000 in the 2004/05 season and is projected to grow in the future.

Tourism has diversified into a number of specific industry sectors based on the mode of transport that is used (ship or aircraft), the basis from which activities are undertaken (ship based or land based), and whether or not tourists land on the Antarctic islands and continent (the non-landing itineraries are referred to as over-flights and cruise-only). These categories are recognised as such by the International Association of Antarctica Tour Operators (IAATO 2005).

As Figure 1 shows, ship based tourism with landing is the most dominant type of tourism in Antarctica. The classic Antarctic expedition cruises in the 'Lindblad-style', involving small to medium sized ships, rubber boat landings and educational programmes are now complemented with large cruise liners, fly-sail operations, as well as adventurous activities such as helicopter excursions, kayaking, scuba diving, mountain climbing, and cross-country skiing (Stonehouse & Crosbie 1995, Bastmeijer & Roura 2004).

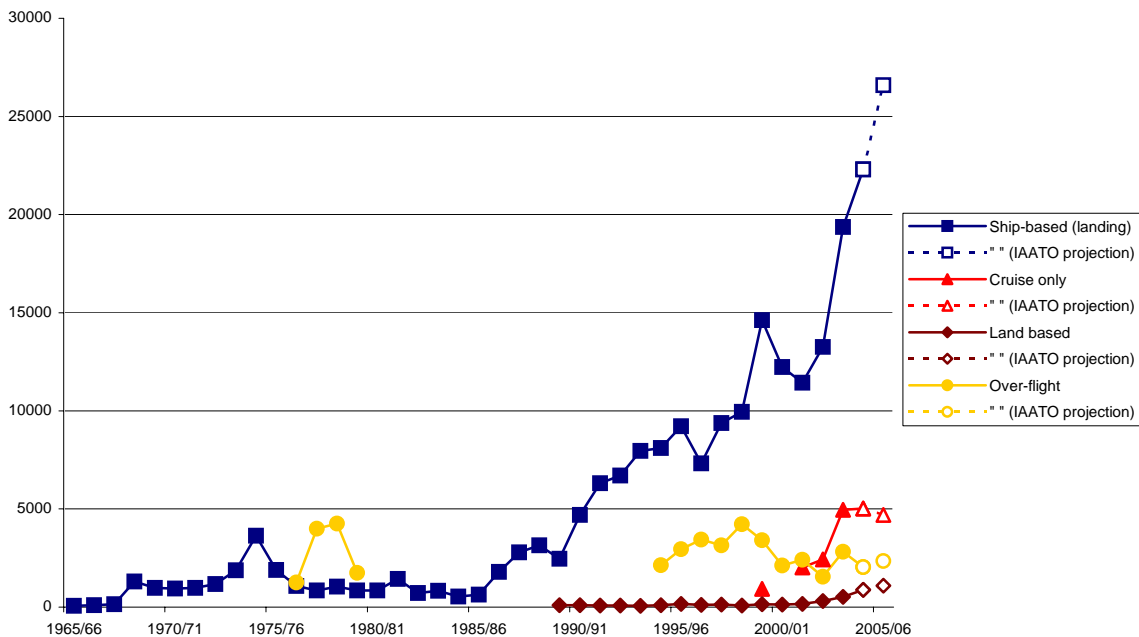


Figure 1: Tourist numbers visiting Antarctica 1965-2005 (Enzenbacher 1992, Headland 1994, Headland 2005, IAATO 2005)

Figure 1 shows that tourist numbers are still relatively small considering the size of the continent and the fact that not every tourist actually lands in Antarctica. However, Cessford notes that these growing numbers of tourists are temporally concentrated in the short Antarctic summer season of about four months (Cessford 1997). The tourist operations coincide with the science activities of the National Antarctic Programmes (NAPs) and the breeding season of most penguins, seabirds and seals.

Most tour operations concentrate in the Antarctic Peninsula area, because of geographical proximity and lack of sea ice (see Figure 2) (Stonehouse & Crosbie 1995). Some authors have estimated the availability of these sites, with landing possibilities, as low as 0.5% of the total coastline. These areas are in some cases also used by national science programmes and generally concentrate biological diversity, in terms of penguin and seabird breeding grounds, seals and floral biota (Cessford 1997). The biological diversity of these sites provides one of the main attractions in the Antarctic. Recent research has proven that although the absolute numbers of tourists to the Antarctic Peninsula are still relatively small compared to the size of the continent, tourist activities are highly concentrated in a limited number of accessible landing sites and therefore cause for concern (Naveen et al. 2001, Crosbie 2005).

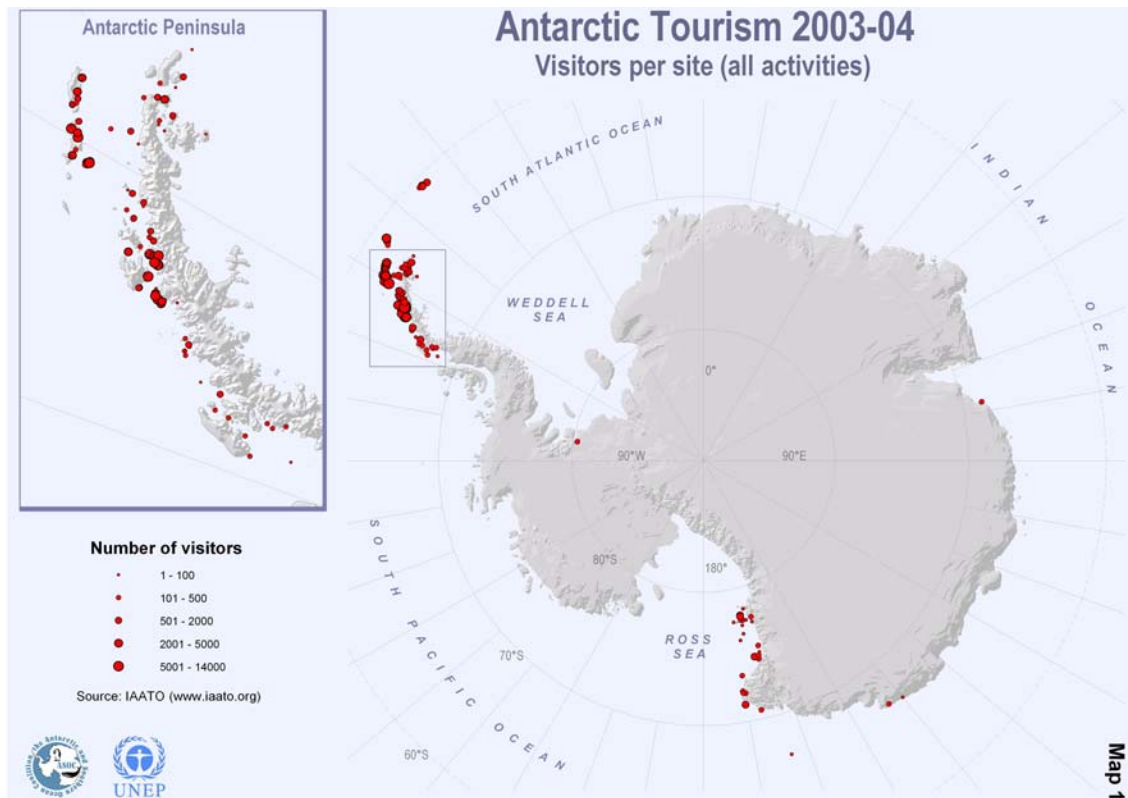


Figure 2: Spatial distribution of tourists in Antarctica 2003-04 (ASOC/UNEP 2005)

The environmental impacts of tourism in Antarctica

Environmental impacts are discussed and classified in different ways within the papers under review. For the purpose of this paper, I will define an environmental impact as “the result of an environmental component being exposed to an output from an activity” (De Poorter 2000). Environmental components can be physical (land, water, air), biological (flora, fauna), and ‘non-material’ (values). Outputs can take various forms, including: emissions, trampling, noise or the visual presence of people. The combinations of its nature, intensity, extend/spread, duration, and degree or reversibility, will lead to a human assessment and judgement on the significance of an impact. Environmental risk is defined as the probability or likelihood that a particular impact will occur and can include all of the previously mentioned issues (adapted from: De Poorter 2000).

Risk or impact?

This difference between environmental impact and risk is crucial in the academic debate on the environmental impacts caused by tourism. Generally, a distinction can be made between the literature that focuses on management issues, and therefore addresses risks, and the literature about areas of tourism impact based on actual empirical research. However, both terms are often used interchangeably. I will briefly illustrate this point.

The research efforts of the Scott Polar Research Institute (SPRI) in the 1990s, the ongoing Antarctic Site Inventory of Oceanites, and several research studies near scientific stations have not revealed major environmental impacts or changes caused by tourism (Hofman & Jatko 2000). Bernard Stonehouse, the research leader of the work done at SPRI reports that “preliminary results suggest that the number of tourists currently deployed, and under the

gentle but strict codes of practice prevailing, have very little immediate impact on ecosystems at many of the sites they visit" (Stonehouse, 1994: 209).

Although the research projects of SPRI and Oceanites do not deny that the development of Antarctic tourism may entail certain environmental risks, currently no convincing evidence is available to suggest that tourism is causing more than minor or transitory environmental impacts. Interestingly enough, both projects relate the limited impacts to the prevailing management efforts made by Antarctic tour operators (Stonehouse 1994, Hofman & Jatko 2000).

Nevertheless, other authors, eager to criticise the current regulation and management of tourism in Antarctica, do not seem to have any difficulties finding convincing evidence for tourism-induced environmental impacts. In fact, Polk states that the "potential and realised impacts on the Antarctic environment are numerous" (Polk, 1998: 1398). Polk seems to point here to both the risks and the actual impacts of tourism in Antarctica. The citations illustrate the different ways in which environmental risks and impacts are used as evidence in academic papers. Although legitimate most of the times environmental risks and impacts are sometimes used as a rhetoric trick in academic papers and can create confusion or misinterpretation.

Possible impacts on the physical environment

The following section is an assessment of possible environmental impacts caused by tourism as presented by the different academic papers under review. I will start with possible impacts on the physical and biological environment, followed by possible impacts on non-material environmental values.

Possible impacts on the physical environment are often divided into impacts on the terrestrial and the marine environment. Frequently mentioned risks include:

- The impact of rubbish disposal and littering (HRSCERA, 1989, Hall 1992, Hall & Johnston 1995, Hall & Wouters 1995, Polk, 1998, Mason & Legg 1999, Hofman & Jatko 2000, De Poorter 2000, Bastmeijer & Roura 2004, Molenaar 2005).
- The degradation of frequently visited landing sites; damage to unique geomorphologic features; souvenearing; footpath erosion; and soil erosion (HRSCERA, 1989, Hall 1992, Stonehouse 1994, Hall & Johnston 1995, Polk 1998, De Poorter 2000, Bastmeijer & Roura 2004).
- The pollution of marine and coastal regions as a result of oil or fuel spills and sewage dumped by ships (HRSCERA 1989, Hall 1992, Hall & Johnston 1995, Polk 1998, Bastmeijer & Roura 2004, Molenaar 2005).
- Contamination of the atmospheric and terrestrial environment as a result of particulates and chemicals emitted from ship engines or aircraft; fall out from aircraft (Hall 1992, Hall & Johnston 1995, Hofman & Jatko 2000, De Poorter 2000, Bastmeijer & Roura 2004, Molenaar 2005).
- More recently there is mentioning of possible damage to the marine environment done by anchoring ships in frequently visited sites (Hofman & Jatko 2000, De Poorter 2000, Molenaar 2005).

Possible physical impacts on the terrestrial environment are mentioned more frequently than on the marine environment. Impacts on the Antarctic atmosphere are largely ignored. This may be because terrestrial impacts are more obvious and observable than marine and atmospheric impacts. The same factor accounts for the popularity of the argument about littering and rubbish disposal over the more gradual cumulative impacts of frequently used landing sites. In more recent articles littering and rubbish disposal is considered to be controllable with sufficient management from tour operators and expedition leaders, whereas cumulative impacts are considered a much more important and complex problem.

Possible impacts on the biological environment

Various Antarctic biota could be affected by many of the above-mentioned physical impacts, such as chemical contamination, litter, and damage as a result of anchoring. Frequently mentioned risks include:

- Disturbance of wildlife and modification of wildlife behaviour through: noise, trampling of nesting sites, and the presence of humans (HRSCERA, 1989, Hall 1992, Stonehouse 1994, Hall & Johnston 1995, Hall & Wouters 1995, Cessford, 1997, Polk, 1998, Mason & Legg 1999, Hofman & Jatko 2000, De Poorter 2000, Bastmeijer & Roura 2004, Molenaar 2005).
- Damage on vegetation, such as mosses and lichen, through trampling or vehicles (Stonehouse 1994, Hall & Wouters 1995, Cessford, 1997, Hofman & Jatko 2000, Bastmeijer & Roura 2004, Molenaar 2005).
- Introduction of animal and plant diseases and introduction of exotic flora and fauna (Hall 1992, Hall & Johnston 1995, Chown & Gaston 2000, De Poorter 2000).

In general, the impacts of tourism on Antarctic biota especially terrestrial biota such as nesting birds, have been researched more intensive than the impacts on the physical environment. Penguins and seabirds, in turn, have been a more popular object of study than floral biota, such as mosses and lichen. Although the problem of introducing exotic species and diseases is mentioned in the literature under review as early as 1992 (Hall 1992), it has only recently received concerted attention especially in combination with the issue of climate change (Chown & Gaston 2000, De Poorter 2000).

Impacts on non-material environmental values

Every environmental impact mentioned above has an impact on wilderness, science and intrinsic values. Tourism impacts on Antarctic environmental values have never been studied thoroughly as is reflected by the fact that they were not as frequently mentioned as the physical and biological impacts (HRSCERA 1989, Cessford 1997, De Poorter 2000, Bastmeijer & Roura 2004, Molenaar 2005). Nevertheless, non-material values are very important for both the understanding of environmental risks, and decision-making about Antarctica. Non-material Antarctic values include aesthetic value, wilderness value, science value, intrinsic value, amongst others. An example of a non-material value is the satisfaction that people get from knowing that an enormous wilderness area, or place with outstanding beauty, exists and is protected from human encroachment. This value applies also to people who have never been to the Antarctic (De Poorter 2000).

Discussion: limitations and complications

Following the presentation of the different environmental risks and impacts I will discuss a number of limitations and complications.

Focus on easy observable environmental changes

As was mentioned in the previous section, discussions on environmental risks and impacts have a tendency to focus on easily observable changes. The most frequently discussed environmental impacts of tourism are those on penguins. Empirical research on the impact of tourism activities has also largely focused on penguins and other seabird species (Naveen et al. 2000, Crosbie 2005). Penguins and seabirds are easily accessible and apparent since they are the main attraction for tourists in Antarctica and operators would not want to destroy their primary attraction. According to Bastmeijer and Roura, so far, attention on the impacts of tourism has mainly focused on the terrestrial environment. The coastal and marine

environment has largely been ignored (Bastmeijer & Roura, 2004: 767). Marine living animals included.

Cumulative impacts

A complicating factor in the study of environmental impacts is the gradual transient impact, or cumulative effect of tourism in Antarctica. Addressed as early as 1992 (Hall 1992, Hall & Johnston 1995), it is only more recently that researchers are coming to grips with this concept and realizing its implications (Hofman & Jatko 2000, De Poorter 2000, Bastmeijer & Roura 2004).

Cumulative impacts can be defined as “the results of additive and aggregative actions producing impacts that accumulate incrementally or synergistically over time and space” (Bastmeijer & Roura, 2004). Instead of affecting the short term, in a particular place, like an oil spill, tourism activities are more likely to accumulate effects that cause for impact that is more serious on the longer term. In other words, cumulative impacts are the combined impacts of past, present and future tourism activities.

Determining cumulative environmental impacts relies on long-term collection of data. The earlier mentioned Antarctic Site Inventory project began monitoring ship-based tourism in the Antarctic Peninsula in 1994 (Naveen et al 2000, 2001). Although evidence for cumulative impacts has not been found, a whole range of site-specific characteristics have been identified that affect possible cumulative impacts. These site characteristics include biological diversity, location and robustness of species present, availability of open space, general topography, novelty of the site, ice and weather conditions, availability of anchoring or waiting sites, acoustic characteristics and location of alternative sites nearby (Hofman & Jatko 2000). Besides site specifics, Hofman and Jatko also present activity variables that might affect the occurrence of cumulative impacts. Several other authors have linked environmental risks with particular tourist activities (Hall 1992, Hall and Johnston 1995, Kriwoken & Rootes 2000).

As was stated in the introduction, very recently a measure was adopted at the Antarctic Treaty Consultancy Meeting to set out guidelines for a number of frequently used sites in the Antarctic Peninsula, based on the work done by Oceanites (Crosbie 2005). For example, Naveen et al. (2001) note there should be considerable concern for landing sites and activities near nesting southern giant petrels because of their lengthy breeding cycle. Recent evidence by German researchers has proven that southern giant petrels are highly responsive to human presence making their eggs and chicks more vulnerable to predators. In addition, heart rate measurements proved that the giant petrels are highly responsive to human presence, more so than under natural interactions (Pfeiffer & Peter, 2004). Based on their findings the researchers advise a minimum distance to the southern giant petrel breeding grounds of 50 meters.

In the larger picture of Antarctic tourism development, it is not clear whether this will really the pressure off some of the frequently visited sites and species. It may just mean tour operators will search for new landing sites or visit sites that are not yet covered by guidelines.

Other human activities and impacts

Besides environmental risks there maybe other risks that may influence human judgement regarding environmental impacts. It is difficult to isolate environmental impacts from issues of human safety; the activities of other stakeholder groups in the region, such as National Antarctic Programmes; and issues of cultural heritage. Different risks and impacts are linked in complex ways and often manifest themselves jointly in decision-making issues. By

combination and accumulation, they can become problematic in different places and at various points in time. For example, environmental impacts caused by tourism and scientific programmes can accumulate simultaneously and reinforce each other (Bastmeijer & Roura 2004). Crosbie notes that the Antarctic ecosystem may be still recovering from the damage caused by the whaling industry in the last two centuries (Crosbie 2005). In other words, isolating the impacts of a single human activity like tourism is very difficult, especially when the effects may be combinations and accumulations from other human induced and natural causes.

In relation to other human-induced environmental impacts in Antarctica, some of the authors stress the positive impacts of tourists, especially their role as observers. Despite the concern for tourism, some authors state that national Antarctic programs are perceived a bigger threat to the environment (Hall & Wouters 1995, Riffenburgh 1998).

Global environmental change

Perhaps the greatest limitation of the academic literature on tourism-induced environmental risk and impact is that, so far, it has remained a local story. As noted earlier, the current debate on biosecurity is intrinsically linked with issues of climate change (Chown & Gaston 2000). Tourism does not only put pressure on local sites but also connects these sites with the rest of the world. Climate change feeds into every issue on environmental risk or impact, especially in the Antarctic Peninsula where there has been an increase of average annual temperature of 3° C since the 1940s, causing the disintegration of ice-shelves, and creating opportunities for the success and distribution of exotic species (Crosbie 2005).

Remarkably enough, some authors have considered airborne tourism and overflights the most environmentally friendly types of tourism in Antarctica (HRSCERA 1989: 10, Hall & Johnston 1995: 13). Tourism and mobility are very large contributors of carbon dioxide emissions, especially with regard to global air travel but cruise ships are also known to emit large quantities of CO₂. Bastmeijer and Roura note that the impact of the transport is ignored in the current literature (Bastmeijer & Roura, 2004: 767). Tourism in Antarctica is not limited to the activities that take place in the Antarctic itself but also includes the transport towards the gateway ports in the Southern Hemisphere. As we know, by far the largest share of the Antarctic tourists origin from countries in the Northern Hemisphere. No matter how carefully or considerately an Antarctic tourist behaves, from a global perspective the “ecological footprint” could be enormous.

Conclusion

We have seen that the current state of play in Antarctic tourists puts increasing pressure on specific landing sites in the Antarctic Peninsula in terms of human presence. Despite a lively academic debate on the environmental risks associated with this development, empirical research projects have not found convincing evidence for severe environmental impacts.

The review has identified a number of limitations and complications in the literature. It has become clear that research, so far, has focused on locally available, readily apparent indicators such as penguin and seabird populations. At the same time, academics have come to realize that local environmental changes are very complex and not so easily directed towards a particular human activity, such as tourism. Complicating factors include cumulative impacts; combined impacts of other human activities in the region or in the past; global environmental changes, such as climate change and biosecurity; and other natural fluctuations. Some of the linkages between these complicating factors are currently not addressed and need further research.

Literature:

- ASOC/UNEP (2005). Antarctic Tourism Graphics. An overview of tourism activities in the Antarctic Treaty Area. Antarctica Treaty Consultancy Meeting XXVIII, Stockholm, Sweden.
- Bastmeijer, K. & Roura, R. (2004) Regulating Antarctic Tourism and the Precautionary Principle. *The American Journal of International Law* 98(4): 763-781.
- Cessford, G. (1997) Antarctic Tourism. A Frontier for Wilderness Management *International Journal of Wilderness* 3(3): 7-11
- Chown, S. & Gaston, K. (2000) Island-hopping invaders hitch a ride with tourists in South Georgia. *Nature* 408 (7 December 2000): 637.
- Crosbie, K. (2005) Towards Site Guidelines: A Preliminary Analysis of Antarctic Peninsula Site Landing Data, 1999/00-2003/04. Paper tabled by IAATO at Antarctica Treaty Consultancy Meeting XXVIII, Stockholm, Sweden.
- De Poorter, M. (2000) Tourism Risks from an Environmental perspective. In: Wrath, G. *Proceedings of the Antarctic Tourism Workshop, Antarctica New Zealand, 23 June 2000*. Christchurch: ANZ.
- Enzenbacher, D. (1993). "Tourists in Antarctica: numbers and trends." *Tourism Management* April: 142-146.
- Hall, C.M. (1992) Tourism in Antarctica: Activities, Impacts, and Management. *Journal of Travel Research* 30(4): 2-9.
- Hall, C.M. & Johnston, M. (1995) Introduction: Pole to Pole: Tourism Issues, Impacts and the Search for a Management Regime in Polar Regions. In: Hall, C.M. & Johnston, M. *Polar Tourism: Tourism in the Arctic and Antarctic Regions*. Pp: 1-26. John Wiley & Sons Ltd.
- Hall, C.M. & Wouters, M. (1995) Issues in Antarctic Tourism. In: Hall, C.M. & Johnston, M. *Polar Tourism: Tourism in the Arctic and Antarctic Regions*. Pp: 147-166. John Wiley & Sons Ltd.
- Headland, R. (1994) Historical Development of Antarctic Tourism. *Annals of Tourism Research* 21(2): 269-280.
- Headland, R. (2005). *Chronological List of Antarctic Expeditions and Related Historical Events*. Cambridge, Cambridge University Press.
- Hofman, R. & Jatko, J. (2000) Assessment of the Possible Cumulative Environmental Impacts of Commercial Ship-Based Tourism in the Antarctic Peninsula Area. *Proceedings of a workshop held in La Jolla, California, 7-9 June 2000*. Washington: National Science Foundation.
- HRSCERA (1989) *Tourism in Antarctica*. Report of the House of Representatives Standing Committee on Environments, Recreation and the Arts. Canberra: Australian Government Publishing Service.
- IAATO (2005). *IAATO Overview of Antarctic Tourism 2004-2005 Antarctic Season*. Antarctica Treaty Consultancy Meeting XXVIII, Stockholm - Sweden.
- Kriwoken, L. & Rootes, D. (2000) Tourism on ice: environmental impact assessment of Antarctic tourism. *Impact Assessment and Project Appraisal* 18(2): 138-150.
- Mason, P. & Legg, S. (1999) Antarctic Tourism: activities, impacts, management issues, and a proposed research agenda. *Pacific Tourism Review* 3: 71-84.
- Molenaar, E.J. (2005) Sea-borne Tourism in Antarctica: Avenues for Further Intergovernmental Regulation. *International Journal for Marine and Coastal Law* 20(2).
- Naveen, R., Forrest, S., Dagit, R., Blight, L., Trivelpiece, W., Trivelpiece, S. (2000) Censuses of penguin, blue-eyed shag, and southern giant petrel populations in the Antarctic Peninsula region, 1994-2000. *Polar Record* 36(199): 323-334.
- Naveen, R., Forrest, S., Dagit, R., Blight, L., Trivelpiece, W., Trivelpiece, S. (2001) Zodiac landings by tourist ships in the Antarctic Peninsula region, 1989-99. *Polar Record* 37(201): 121-132.

- Pfeiffer, S. & Peter, H-U. (2004) Ecological studies towards the management of an Antarctic tourist landing site (Penguin Island, South Shetland Islands). *Polar Record* 40(215): 345-353.
- Polk, W. (1998) Welcome the Hotel Antarctica: The EPA's Interim rule on Environmental Impact Assessment of tourism in Antarctica. *Emory International Law Review* 12: 1395-1442.
- Riffenburgh, B. (1998) Impacts of the Antarctic environment: tourism vs government programs. *Polar Record*: 34(190): 193-196.
- Stonehouse, B. (1994) Ecotourism in Antarctica. In: Cater, E. & Lowman, G. (eds.) *Ecotourism: A Sustainable Option?* Pp: 195-212. John Wiley & Sons Ltd.
- Stonehouse, B. & Crosbie, K. (1995) Tourist Impacts and Management in the Antarctic Peninsula Area. In: Hall, C.M. & Johnston, M. *Polar Tourism: Tourism in the Arctic and Antarctic Regions*. Pp: 217-233. John Wiley & Sons Ltd.