Does Tourism Growth on the Galapagos Islands Contribute to Sustainable Economic Development?

An Ecosystem Valuation from a Tourist Perspective and a Cost-Benefit Analysis of Tourism Growth Scenarios

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List of abbreviations

AVL	Acceptable Visitor Load
CAAP	Annual Receiving Capacity Protected Area
CBA	Cost-Benefit Analysis
CARSEA	Caribbean Sea Ecosystem Assessment
CE	Choice Experiment
CS	Consumer Surplus
CV	Contingent Valuation
DPNG	Dirección Parque Nacional Galápagos
GMR	Galapagos Marine Reserve
GNP	Galapagos National Park
IVM	Institute for Environmental Studies Amsterdam
MEA	Millennium Ecosystem Assessment
NPV	Net Present Value
PS	Producer Surplus
TCT	Tarjeta de Control de Tránsito
TEEB	Economics of Ecosystem and Biodiversity
US	United States
WTA	Willingness to Accept
WTP	Willingness to Pay
WWF	World Wildlife Fund

Summary

The ecosystems of the Galapagos support a range of touristic activities that depend on the quality of the natural environment. Tourism is one of the most important sources of income for the local economy and due to the archipelago's international fame, the number of visitors grows continuously. Without proper management of this growth, the expansion of the industry may increasingly become a threat to the natural environment, the same environment that attracts the high number of tourists in the first place. Despite the large dependence on nature, the economic contribution of the unique ecosystems to the tourism industry on the Galapagos has never been socioeconomically quantified. This study contributes to existing research, by providing insights on the economic dependence of the tourism industry on the ecosystems of the Galapagos. This information can help raising awareness and assisting policy-makers in long-term decision-making concerning nature and tourism management at the Galapagos Islands.

To acquire these insights, an economic valuation study is carried out first. Through a tourists exit survey conducted among more than 400 departing tourists, this study estimates the willingness to pay (WTP) for nature conservation in the Galapagos. The survey provides insights on the tourists' perceived value of different ecosystems and recreational services. With these findings some indications can be given about the socio-economic carrying capacity of the islands. In addition, the results can be used to analyze potential future scenarios for the tourism industry. The socio-economic value of the ecosystem services is measured through a mixed method approach of stated preference techniques, namely the Contingent Valuation (CV) and Choice Experiment (CE) methods.

The study reveals a significant WTP for additional nature management among visitors to the Galapagos Islands. Although non-national and high-income tourists have a higher WTP; almost all tourists assign considerable values to the Galapagos' ecosystems and recreational services. Marine ecosystems are found to be the most valuable, followed by the terrestrial ecosystems. The results of the tourist survey indicate that, on top of the current entry fee, visitors are willing to pay an additional amount of 240 USD per trip to conserve the marine environment of the Galapagos and of 140 USD to conserve the terrestrial environment. The socio-economic attributes of the Galapagos, measured in terms of crowdedness, are also of significant importance; however, they are valued less than the ecological attributes, which are measured in terms of the quality of the ecosystems and the abundance of species. Even though WTP should not be interpreted literally, the high WTP tourists have for additional nature conservation provides opportunities for the local government to increase current user fees for protection purposes.

The WTP values obtained from the tourist survey were then used to perform an extended cost-benefit analysis (CBA) of three different tourism growth scenarios: No Growth, Moderate Growth and Rapid Growth. These tourism growth scenarios have been proposed and partly analyzed in previous studies. The results of these existing studies were used to identify potential costs and benefits of each scenario. In addition, the WTP values obtained from the tourist survey were linked to some of these results.

The main results of the CBA indicate that:

- For the whole period of the analysis, the No Growth scenario has the highest total benefits of the three scenarios (a NPV of 6015 million USD) and the lowest costs (a NPV of 572 million USD), while the Rapid Growth scenario yields the lowest total benefits (a NPV of 5530 million USD) and accrues to the highest costs (a NPV of 1063 million USD).
- The Rapid Growth scenario reveals a negative correlation between the increase in the number of tourists and the yearly net benefits. This scenario presents a slowdown in the increase of net benefits, due to a decrease in the average added value per tourist. The net benefits for the year 2016 reach 392 million USD, and a decrease in total net benefits starts after 2018, to end with 192 million USD of net benefits in 2033. This scenario exceeds the Annual Receiving Capacity of the Protected Area (CAAP) already in 2016.
- Compared to the Rapid Growth scenario, the Moderate Growth scenario presents a more gradual slowdown in the increase of the yearly net benefits and a later decrease in net benefits, which occurs as of 2029. This also translates into a more gradual decreasing pattern in the average added value per tourist compared to the Rapid Growth scenario. This scenario exceeds the Annual Receiving Capacity of the Protected Area (CAAP) already in 2019, three years later than the Rapid Growth Scenario.
- The No Growth scenario is the only scenario with a continued increase in yearly net benefits, which in time surpass those of the Moderate Growth scenario, in 2016, and of the Rapid Growth scenario, in 2020. This is caused by a continued increase in the average added value per tourist in this scenario. This scenario does not exceed the Annual Receiving Capacity of the Protected Area (CAAP) in the period of the analysis.
- In terms of WTP values, it appears to be a direct link between the increase in the number of tourists and the decrease in the tourism value of nature as early as 2016. According to these results, the tourism value of nature appears to be more sensitive to high increases in the numbers of tourists and their related socio-environmental impact than the benefits derived from the economic sectors.

In practical terms, it would seem that none of the two growth scenarios analyzed represent a viable growth scenario for the Galápagos: the Moderate Growth scenario is

not sustainable in the long term, and the Rapid Growth scenario will be unsustainable even in the short term. A rapid increase of tourism arrivals yields higher values in the first 3 to 7 years of the analysis, depending on the growth scenario. However, the increased pressure of the tourism industry on the local environment may cause the tourism industry to collapse after the carrying capacity of the protected area is exceeded and the natural ecosystems are highly degraded. This would ultimately lead to lower net-benefits because tourists are willing to pay less to enjoy the degraded natural beauty of the Galapagos.

The results of the tourist survey and CBA further indicate that a tourism growth plan that will manage the number of tourists arriving to the Galapagos Islands to remain within the Acceptable Visitors Load (AVL) established by the Galapagos National Park (GNP), will probably be the most profitable as it will attract nature tourism that is willing to spend more for the natural experience. This is reflected in the WTP of tourists for nature management fees, as well as in their expenditures in the Galapagos economy. In contrast, an uncontrolled growth of tourism might continue attracting tourists and be more profitable in the coming 2 to 6 years, depending on the scenario. However, while tourism grows, there will be a the risk of a shift to mass tourism, comprised of tourists who are not necessarily interested in nature, may not be willing to pay for nature conservation and which may have lower spending patterns., thereby converting uncontrolled tourism growth into the least profitable option. The challenge for the decision makers will be to find the right balance and the appropriate management measures to achieve an optimal number of visitors, who are attracted to the Galapagos Islands, and are willing to pay, for the highly valued natural experience.

Resumen

Los ecosistemas de las Islas Galápagos sirven de soporte a una gran gama de actividades turísticas que dependen de la calidad del medio ambiente. El turismo es una de las fuentes de ingreso más importantes para la economía local y, debido a la fama internacional del archipiélago, el número de visitantes a las islas aumenta constantemente. Sin un manejo adecuado del crecimiento turístico, la expansión de esta industria puede convertirse cada vez más en una amenaza para el entorno natural, el mismo entorno que atrae a esa gran cantidad de turistas en primer lugar. A pesar de que el turismo depende en gran medida de la naturaleza, la contribución económica de los ecosistemas únicos del archipiélago a la industria del turismo en las Galápagos no ha sido cuantificada socioeconómicamente. Este estudio contribuye a la investigación existente, al proporcionar información sobre la dependencia económica de la industria del turismo de los ecosistemas de las Galápagos. Esta información puede ayudar a crear conciencia y asistir a los tomadores de decisiones en la creación de políticas a largo plazo para la gestión de la naturaleza y del turismo en las Islas Galápagos.

Para adquirir esta información, primero se realizó un estudio de valoración económica. A través de una encuesta de salida, realizada a más de 400 turistas que partían de Galápagos, este estudio estima la disposición a pagar (DAP (o WTP, por sus siglas en Inglés)) por la conservación de la naturaleza en las Islas Galápagos. La encuesta proporciona información sobre el valor percibido de los turistas de diferentes ecosistemas y servicios recreativos. Estos hallazgos permiten formular algunas indicaciones acerca de la capacidad de carga socio-económica de las islas. Además, los resultados pueden ser utilizados para analizar posibles escenarios de futuro para la industria turística. El valor socio-económico de los servicios ecosistémicos se mide a través de un enfoque de métodos mixto de técnicas de preferencias declaradas, específicamente el método de Valoración Contingente (VC (o CV, por sus siglas en inglés)) y el Modelo de Elección Discreta (MED (o CE, por sus siglas en inglés)).

El estudio revela una DAP significativa entre los visitantes de las Islas Galápagos por un mayor manejo de la naturaleza. Aunque los turistas extranjeros y de altos ingresos presentan la más alta DAP; casi todos los turistas asignan valores considerables a los ecosistemas y servicios recreativos de las Galápagos. Los ecosistemas marinos aparecen como los más valiosos, seguidos de los ecosistemas terrestres. Los resultados de la encuesta de turistas indican que los visitantes están dispuestos a pagar un monto adicional por viaje, por encima de la actual tasa de ingreso o entrada respectiva, de 240 USD para conservar el ecosistema marino y de 140 USD para conservar el medio ambiente terrestre de las Islas Galápagos. Los atributos socioeconómicos de las Galápagos, medidos en términos de aglomeración, también muestran una gran importancia; sin embargo, resultaron de un menor valor que los atributos ecológicos, medidos en términos de la calidad de los ecosistemas y de la

abundancia de especies. A pesar de que la DAP no debe interpretarse literalmente, la alta DAP demostrada por los turistas por una mayor conservación de la naturaleza proporciona oportunidades para el gobierno local para aumentar las actuales tasas de ingreso o entrada con el fin de utilizarlas para la protección de la naturaleza.

Los valores de la DAP obtenidos a través de la encuesta de turistas, fueron utilizados para llevar a cabo un análisis extendido de costo-beneficio (CBA, por sus siglas en inglés) de tres diferentes escenarios de crecimiento del turismo: Crecimiento Cero, Crecimiento Moderado y Crecimiento Rápido. Estos escenarios de crecimiento del turismo han sido propuestos y analizados parcialmente en estudios previos. Los resultados de estos estudios previos se utilizaron para identificar y calcular potenciales costos y beneficios de cada escenario. Además, los valores de la DAP obtenidos a través de la encuesta de turistas se vincularon a algunos de esos resultados para calcular los valores de la DAP en los diferentes escenarios.

Los principales resultados del CBA indican que:

- En relación al período total del análisis, el escenario de Crecimiento Cero presenta los beneficios totales más altos de los tres escenarios (un valor actual neto (VAN (o NPV, por sus siglas en inglés)) de 6015 millones USD) y los costos más bajos (un VAN de 572 millones USD), mientras que el escenario de Crecimiento Rápido presenta los más bajos beneficios totales (un VAN de 5530 millones USD) y devenga los costos más altos (un VAN de 1063 millones USD).
- El escenario de Crecimiento Rápido muestra una correlación negativa entre el incremento en el número de turistas y los beneficios netos anuales. Este escenario presenta un aumento decreciente de los beneficios netos anuales, debido a una disminución en el valor añadido promedio por turista. Los beneficios netos en el año 2016 llegan a 392 millones USD, y después del 2018 comienzan a disminuir para terminar en 192 millones USD de beneficios netos en el 2033. Este escenario excede la Capacidad de Acogida del Área Protegida (CAAP) ya a partir del 2016.
- En comparación con el escenario de Crecimiento Rápido, el escenario de Crecimiento Moderado presenta un decrecimiento más gradual en el aumento de los beneficios netos anuales, y una disminución más tardía de los beneficios netos, que se produce a partir del 2029. Esto también se traduce en un patrón decreciente más gradual del valor añadido promedio por turista, en comparación con el escenario de Crecimiento Rápido. Este escenario excede la Capacidad de Acogida del Área Protegida (CAAP) a partir del 2019, tres años más tarde que el escenario de Crecimiento Rápido.
- El escenario de Crecimiento Cero es el único escenario con un continuo crecimiento de los beneficios netos anuales, los cuales en determinado momento superan a los del escenario de Crecimiento Moderado, en el 2016, y del escenario de Crecimiento Rápido, en el 2020. Esto se da a causa de un aumento continuo en

el valor añadido promedio por turista en este escenario. Este escenario no excede la Capacidad de Acogida del Área Protegida (CAAP) en el período del análisis.

- En cuanto a los valores de la DAP, parece haber una relación directa entre el aumento en el número de turistas y la disminución en el valor de la naturaleza para turismo ya desde el 2016. De acuerdo con estos resultados, el valor de la naturaleza para el turismo parece ser más sensible a los altos aumentos en el número de turistas y el impacto socio-ambiental que esto conlleva, que los beneficios derivados de los sectores económicos.

En la práctica, parecería que ninguno de los dos escenarios de crecimiento analizados representa un escenario de crecimiento turístico viable para las Galápagos: el escenario de Crecimiento Moderado no parece ser sostenible a largo plazo, y el escenario de Crecimiento Rápido no sería sostenible aún en el corto plazo. Un aumento rápido en el número de llegadas de turistas produciría beneficios mayores que los del escenario de Crecimiento Cero en los primeros 3 a 7 años del análisis, dependiendo del escenario de crecimiento. Sin embargo, la creciente presión de la industria turística sobre el medio ambiente local podría causar un colapso de la industria turística después de que la capacidad de carga del área protegida sea excedida y los ecosistemas naturales estén sumamente degradados. Esto conduciría, en última instancia, a menores beneficios netos debido a que los turistas estarían dispuestos a pagar menos por el disfrute de una belleza natural degradada de las Galápagos.

Los resultados de la encuesta de turistas y del CBA indican, además, que un plan de manejo del turismo que controle el número de turistas que llegan a las Islas Galápagos para que se estabilice y permanezca dentro de la Cargas Aceptables de Visitantes (CAV), establecida por el Parque Nacional Galápagos (PNG), probablemente sea el más rentable, ya que podría atraer un turismo de naturaleza que está dispuesto a gastar y pagar más por la experiencia natural. Esto se refleja en la DAP de los turistas por tasas de ingreso o entrada que contribuyan a la gestión de la naturaleza, así como en sus gastos en la economía de Galápagos. Por el contrario, un crecimiento incontrolado del turismo podría continuar atrayendo turistas y ser más rentable en los próximos 2 a 6 años, dependiendo del escenario. Sin embargo, mientras que el turismo crece, podría haber un riesgo de un cambio hacia un turismo de masas, compuesto por turistas que no están necesariamente interesados en la naturaleza, que podrían no estar dispuestos a pagar por la protección de la naturaleza y que podrían tener patrones de gasto más bajos; convirtiendo de este modo al crecimiento turístico incontrolado en la opción menos rentable. El reto para los tomadores de decisiones será encontrar el equilibrio adecuado y las medidas de gestión propicias para alcanzar un número óptimo de visitantes, que se sienten atraídos hacia las Islas Galápagos - y estén dispuestos a pagar - por una experiencia natural de gran valor.

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1 Introduction

The Galapagos Islands are internationally known for their unique ecosystems, which inspired Charles Darwin for his famous evolution theory following his visit in 1835. Because of its international fame, the tourist industry is constantly growing (Epler, 2007; Mena et al., 2013), being a very important source of income for the local economy. In 2013 the Galapagos hosted a total of 204,395 tourists (Ministerio de Turismo, 2013) and it is expected that this number will increase even more in the near future. However, according to Pizzitutti et al. (2014) tourism is also the main driver of change on the Galapagos Islands, affecting the social and ecological systems. If the number of international visitors and the supporting facilities continue to grow this rapidly, there would be a need to question how this will affect the pristine biodiversity, natural environment and the social setting of the Galapagos Islands (Pizzitutti et al., 2014).

This research aims to perform a socio-economic valuation of the natural environment on the Galapagos for the tourism industry. This is done through a framework that is based on the valuation of ecosystem services, which are the benefits that human beings derive from ecosystems (Millennium Ecosystem Assessment, 2005). In order to determine the value of the ecosystems on Galapagos for the tourism industry preferences are quantified through measuring the willingness to pay (WTP) of tourists for additional nature management and expenditures of tourists. To do so, a tourist survey was conducted in April and May 2014. To measure the WTP, two valuation techniques are used: Contingent Valuation (CV) and a Choice Experiment (CE).

The tourism industry on the Galapagos has never been analyzed as such. The information can be used to develop transparent and balanced development scenarios for the archipelago. The research consists of two parts. The first part, which can be found in Chapter 3, focuses on a survey amongst visitors on the Galapagos to investigate the importance of nature for the tourism industry.

In the second part of the research (Chapter 4), the results from the tourism survey will be linked to the existing scenario analyses by Mena et al. (2013) and Mentefactura (2014), who investigated the effects of different tourism growth scenarios. The CBA will be based on three different growth scenarios: no growth, moderate growth and rapid growth. Costs and benefits are analyzed to determine which tourism growth scenario would potentially achieve the highest benefits. Chapter 2 provides first some background information on the Galapagos and its tourism industry. Furthermore, a literature review is included on comparable valuation methods and previous relevant studies done on the Galapagos and elsewhere. Chapter 5 finally discusses the main results and conclusions of the research. Some methodological details and more detailed results in relation to the research can be found in the Annexes.

2 Background

2.1 The Galapagos Islands

The Galapagos Islands are an oceanic archipelago approximately 1,000 kilometers west of continental Ecuador. The archipelago is being formed by volcanic processes in the ocean floor and currently comprises 16 large islands and over 100 islets and rocks (see Figure 1, which does not include all the small islands). The Galapagos Islands are home to many unique species and the archipelago still contains about 95% of its originally known biodiversity. Exactly this natural diversity inspired Charles Darwin for his theory of evolution following his visit to the archipelago in 1835. This unique environment is a world-renowned tourist destination, and has always been regarded as a prime site for academic research in the life and earth sciences, with a vast number of studies on these and related subjects (UNESCO, 2003)

Figure 1 The Galapagos Islands (Source: http://www.quido.cz)

The Galapagos has two protected areas: the terrestrial park established in 1959 and the marine reserve established in 1998, which entails about 138,000 square kilometers. The Galapagos Marine Reserve (GMR) is a protected area of multiple uses, created by the Ecuadorian Government as a response to the need to protect the diverse and unique terrestrial and aquatic flora and fauna that thrives because of the special

geographical characteristics of the Galapagos: an isolated site that receives the influence of different oceanic currents. With a management regime where 99.8% of the territory is a protected area, a unique opportunity is provided to conserve this archipelago, whilst attaining sustainable development. The legislation that aims to protect and conserve this precious environment is in the process of being updated and several proposed modifications that could have a negative impact on the ecosystem services of the GMR are being evaluated. (National Geographic, 2011; Villalta, 2013)

Due to its unique character, the economy of the Galapagos depends heavily on its marine and terrestrial ecosystem services (Epler, 2007). Industries such as tourism and fisheries rely on healthy and productive coastal waters, oceanic currents and terrestrial ecosystems. Annex B offers a more detailed description of the goods and services provided by the ecosystems on the Galapagos. Although the rich biodiversity and ecosystems of these islands are its most important natural assets, the Galapagos undergoes severe environmental pressures caused by, amongst others, coastal development, an increasing tourism industry, and effects of climate change (Watkins and Cruz, 2007). Annex C provides a list of threats facing ecosystem services of the Galapagos.

2.2 The Tourism Industry

The tourism industry on the Galapagos dates back to the late 1960s, during which roughly 2,000 tourists were accommodated annually (Epler, 2007). The industry has been expanding since the beginning. The most recent years show rapid increases in tourism arrivals. The rate of visitation increased by approximately 9% per year since 1991, coupled with industry revenues increasing by an astounding 14% per year (Epler, 2007). With 204,395 visitors in 2013 (an increase of 13%, equal to 23,564 visitors, with respect to 2012), the tourism industry is currently the engine behind the socio-economic development of the Galapagos Islands (Ministerio de Turismo, 2013; Parque Nacional Galápagos, 2014).

Tourists visit both the terrestrial national park and the marine reserve. Due to strict regulations visitors are not allowed into the park without the guidance of an official naturalist guide, trained and educated by the Galapagos National Park (GNP) (Epler, 2007). Various activities, like guided hikes, nature contemplation, snorkeling, diving and bird watching permit tourists to enjoy the natural environment of the Galapagos Islands. All these activities rely on a well-preserved natural state and healthy ecosystems with plenty of animals and vegetation. However, even though these activities rely on healthy ecosystems, little is known about the socio-economic value of nature, the natural processes and the recreational services the Galapagos offers to the tourism industry.

It is expected that the number of visitors to the Galapagos will continue to increase in the near future (Epler, 2007). Besides providing economic benefits, tourism also poses

a threat to the natural environment of the Galapagos Islands (Pizzitutti et al., 2014). If the number of visitors and coupled developments of infrastructure to support the consumptive needs of these visitors continue to grow at the current pace, there is a risk for the preservation of the natural environment and ecosystems (Pizzitutti et al., 2014). These are the very ecosystems that attract the visitors to Galapagos in the first place.

2.3 Existing Literature on Nature Related Tourism Values

Areas with high biodiversity values are more likely to be preserved if the value of conservation outweighs the opportunity costs and the direct costs of protection of the resource (Grossling, 1999). Moreover, traditional conservation benefits may be supplemented by tourism, which increases the economic justification for conservation (Lindberg and Huber, 1993). The current visitor entrance fees in the GNP are an attempt to monetize the value of visitors for the natural environment on the islands. The fees are the main source of income for the GNP and thus directly support conservation of the islands. Nevertheless, several WTP studies have shown that protected area visitors are generally willing to pay much higher fees than are currently charged (Tobias and Mendelsohn, 1991; Maille and Mendelsohn, 1993; Menkhaus and Lober, 1996). Since the establishment of its visitor entrance fees was not based on a market analysis or a WTP study, this could also be the case for the Galapagos (Benitez, 2001). The visitor fees are therefore not expected to resemble the true value that tourists attach to the recreational service provided by the natural environment of the Galapagos Archipelago.

Edwards (1991) has carried out one of the first studies that attempts to put a value on the recreational services provided by the GNP. This study concluded that, based on a visitor use fee of 770 United States (US) dollars and 34,722 tourist arrivals, the government of Ecuador could gain about 27 million US dollars in taxes (visitor use fees) per year from the tourist industry of the Galapagos. Since this study, various valuation studies have been conducted on the Galapagos. For example, Rodríguez (2012) has done an economic valuation to quantify the benefits of the giant tortoise conservation programs on the islands. In this study, the WTP of continental Ecuadorian households for preservation of the giant Galapagos tortoises is estimated. The study concluded that the mainland households have a positive WTP for the conservation of this species.

Despite the available valuation studies conducted on the Galapagos, no analysis exists on the general value of ecosystems on the Galapagos for the tourist industry. So far, the importance of different aspects of the natural environment for the attraction of tourists has not been socioeconomically quantified.

2.4 Existing research on tourism growth scenarios

Following the presidential commitment Nr. 20231 “Number of Tourists in Galapagos”, the Ecuadorian Ministry of Environment engaged the University of San Francisco de Quito together with the University of South Carolina to conduct a study. The study was intended to determine social, environmental and economic relations that would allow the development of potential scenarios of sustainability of the socio-ecologic system of the Galapagos Islands. The development of the scenarios was to be based on modelling processes, with an emphasis on the flow dynamics of visitors to the archipelago (Mentefactura, 2014).

Mena et al. (2013) developed three different scenarios for tourism growth in the Galapagos Islands. These scenarios are described in 4.1.2. Using the VENSIM modelling tool, the three different scenarios were analyzed on the basis of social, ecological and economical subsystems. The results of this analysis represent the impact of the different growth scenarios in each of the studied subsystems.

After the study by Mena et al. (2013) was concluded, it was determined that the analysis of the tourism growth scenarios did not elaborate on the economic component, whereby the results obtained did not determine the impact of the different growth scenarios on the economy of the Galapagos Islands (Mentefactura, 2014). Therefore, Mentefactura was engaged by the WWF to analyze the economic relation of the scenarios proposed by Mena et al. Mentefactura carried out this analysis drawing from the experience obtained with the construction of a Social Accountability Matrix with an Environmental Component for the Galapagos Islands, which was developed by Conservación Internacional Ecuador and Mentefactura (Utreras et al., 2014). For their scenario analysis, Mentefactura used an input-output model that incorporated the number of tourists and their total expenditures to determine the impact of the yearly tourist demand on the production of a series of key economic activities. The impact of the development of the tourism sector on other economic activities is determined as well.

The cost-benefit analysis (CBA) in this research will complement the previous studies by incorporating the WTP values obtained during the tourist survey to the comparison of the tourism growth scenarios, thereby quantifying the potential benefits of tourism in terms of the tourism value of nature in each of the scenarios.

3 Tourism value of nature on the Galapagos

3.1 Methodology

3.1.1 Ecosystem Assessment

In order to assess ecosystem services this research makes use of the framework developed by The Economics of Ecosystems and Biodiversity (TEEB) (Millennium Ecosystem Assessment, 2005). See Annex D for the detailed classification and valuation methodology used. Ecosystem services are described as the benefits that humans derive from these ecosystems (Millennium Ecosystem Assessment, 2005). Using the TEEB framework some main steps need to be followed in order to determine a tourism value of nature and related services on the Galapagos. First, the relevant ecosystems for the tourist industry need to be identified. Second, the services that the ecosystems deliver need to be assessed. Last, the benefits people obtain from these ecosystem services need to be quantified in order to determine their economic importance (Berghöfer, 2012).

Through stakeholder consultation, the most important ecosystems and their services for the tourism industry are identified. Annex B offers a more detailed description of the ecosystems and its goods and services on the Galapagos. The most important ecosystems are the open waters, the coral reef patches and rocky reefs on volcanic stone in the coastal waters, the littoral zone and the terrestrial vegetation. All these ecosystems provide an important habitat for many marine and terrestrial species that are important for the attraction of tourists. Hence, the habitat provision of these ecosystems to the species can be seen as one of the most important ecosystem services to the tourism industry.

In order to quantify the benefits people obtain from these ecosystem services, valuation techniques need to be specified. According to the definitions of Hein (2010) and van Beukering et al. (2007) tourism is identified as a direct-use value. It is different from a direct-use provisioning ecosystem service like fisheries, in the sense that there are no physical goods that represent the benefits. The benefits can be seen as intangible experiences. For this reason, a market valuation technique is not always possible, as the services are not necessarily traded on a market. Tourists can easily benefit from the ecosystems on an individual basis (e.g. going to a beach or snorkeling). Therefore, besides a market valuation technique, the ecosystem services are quantified through stated preference methods, which reveal the WTP of tourists for specific environmental services (van Beukering et al., 2007).

Two methods are used in order to determine the WTP. The Contingent Valuation (CV) method involves directly asking people, in a survey, what they are hypothetically willing

to pay for the preservation of the relevant ecosystem services (van Beukering et al., 2007). The second WTP measurement comprises a Choice Experiment (CE). This is also a stated preference method, similar to CV in that it can be used to estimate economic values for virtually any ecosystem good or service (Hanley et al., 1998). Choice-modelling is based on the idea that any good can be described in terms of its attributes (McCartney, 2011). Changes in attribute levels essentially result in a different good. Since people have to make hypothetical tradeoffs between different combinations of attributes, the value of changes in attributes helps to determine the WTP for a specific attribute (van Beukering et al., 2007).

The CE is different from the CV method in that it asks respondents to select between a set of alternatives, rather than asking directly for values (McCartney, 2011). The values can be derived from the responses by including a payment vehicle or money as one of the attributes in the scenarios (van Beukering et al., 2007). Both CV as CE represent a hypothetical payment, which has led to criticism from scientists and policy makers alike. Nevertheless, Carson et al. (2000) argue that as long as the value is not interpreted too literally in an economic sense, it can be a good indicator for the economic value of an ecosystem service. Moreover, the results from a CE make it possible to compare the relative importance of the different attributes that determine the value of nature and recreational services on the Galapagos (van Beukering et al., 2007; McCartney, 2011).

In order to calculate the total economic value of ecosystems services, most valuation studies use a Net Factor Income calculation. This Net Factor Income calculation uses data on what people are actually paying to participate in activities that depend on the natural environment to estimate the added value of the tourism industry. To calculate this added value, it is necessary to determine the revenues that are earned by suppliers in the tourist industry, but also the costs of providing the goods and services. Mentefactura (2014) estimated the added value of the tourism industry and calculate a multiplier that reflects the spillover effects to other economic activities on the archipelago. Their calculations are based on tourist expenditures.

3.1.2 Survey Method

In order to investigate the WTP a tourist exist survey was carried out. The survey was conducted face-to-face on the Galapagos in the months of April and May 2014. Departing tourists were asked to participate in a short interview (i.e. around 15 to 20 minutes) in which various issues were discussed. The interviewers were trained to stay neutral during the entire interview to minimize interviewer bias.

Among other things the survey included questions about the sites visited, tourists' activities, the perception about nature management and the conservation of the Galapagos. Questions on the activities and the perception of the Galapagos enabled the verification of consistency in the answers. Some additional demographics, such as

income, education and age were also recorded. To determine the tourists' attitudes towards the environment and acquire more information on the support of environmental measures, a number of questions were included on the environmental awareness of the respondents. Moreover, in order to get insights in the revenues of the tourism industry, expenditures were registered for different categories. Most importantly for the calculations of the WTP, the CV question and CE were included.

The surveys were conducted on the two islands that have an airport that hosts flights from the mainland, being Baltra Airport near Santa Cruz and San Cristóbal Airport. This justifies a simple random sample (Bryman, 2008). Nevertheless, due to the short check-in time San Cristóbal Airport, most of the surveys that were collected on this island needed to be collected on the boulevard instead of the airport. The total sample consists of 423 respondents, of which 110 (26.0%) were conducted on San Cristóbal and 313 (74.0%) on Baltra Airport near Santa Cruz. This division is based on tourism statistics collected in 2013 by the GNP. Moreover, the surveys that have been collected by the Ecuadorian Ministry of Tourism in 2013 also had a division of 73.89% respondents on Baltra Airport and 26.11% on San Cristóbal Airport (Observatorio de Turismo, 2013). English as well as Spanish surveys were conducted in order to reach a representative distribution of Latin American and especially Ecuadorian tourists and non-Latin and non-national tourists.

3.1.3 The Choice Experiment

In this research, the CE consists of five attributes which are used to construct different scenarios. The experiment contains six rounds and in every round a different choice card is displayed. Every choice card demonstrates three different scenarios of which one is the same in each round, namely the *opt-out scenario*. This scenario represents the most likely outcome if no additional environmental management were to be implemented. The scenarios are constructed in such a way that there is no best alternative and tradeoffs need to be made in each choice card. This means that the choice of a particular scenario reveals the importance of the attributes to the respondent.

Eight different sets of choice cards are designed, each containing six choice cards. This design is generated using the software Ngene. In total, 48 different choice cards are created after a pre-test on 20 respondents in order to check the understanding of the choice experiment and to derive prior coefficient values for the final design of the experiment. All respondents are shown the same example card, which serves to explain the purpose of the choice experiment. Annex E contains an example of a choice card in English. After instructions, respondents are randomly shown one of the eight choice sets and asked to choose their most preferred alternative for the six cards. The eight different sets of choice cards are equally distributed in the sample to make sure that each choice set is used the same amount of times. The attributes and their

levels are chosen through stakeholder consultation. This way, the attributes are representing realistic scenarios for the tourism sector of the Galapagos. The attributes and levels that are included are the following:

$250 per person per visit

Additional fee per visit is additional to the fee that visitors currently pay (100 USD for foreigners, 50 USD for visitors from the Andean Community, 25 USD non-national students studying in Ecuador, 6 USD for nationals). The fee will be used for environmental management and species protection on the islands. This fee would be paid by every visitor.

Seven possible levels: $0 - $25 - $50 - $75 - $150 - $250 - $400

No change

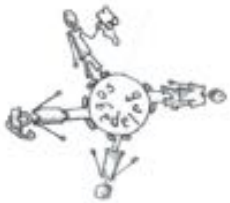
Number of marine species. This takes into account the amount and diversity of marine species and the number of encounters (how likely it is that you spot the animals).

Three possible levels: Higher – No Change - Lower

No change

Number of land species. This takes into account the amount and diversity of the land species and the number of encounters (how likely it is that you spot the animals).

Three possible levels: Higher – No Change - Lower



300,000 visitors (increase)

Number of visitors. This takes into account the crowdedness on the beaches and dive sites, the number of hotels, the traffic across the islands etc.

Four possible levels: 100,000 visitors (decrease) – 200,000 visitors (current) – 300,000 visitors (increase) – 400,000 visitors (increase)

12 months

Time necessary to book in advance takes into account the time that could become necessary to book your trip in advance in the future.

Four possible levels: No times necessary to book in advance – 6 months – 12 months – 24 months

The additional fee is the payment vehicle that determines how much people are willing to pay for the attributes on the island. A common critique on WTP measurements is that the results are often overstated and unrealistic (Hanley et al., 2001; Kahneman and Knetsch, 1992; Arrow et al., 1993). In order to tackle this critique and derive a more realistic WTP, the respondents are made specifically aware of the payment of an additional entry fee. This is done through placing the fee as the first attribute on the choice cards and restating the payment of an additional entry fee after every choice by asking if the respondent is certain about his / her choice considering the level of the entry fee. Depending on the size of the additional fee and the state of the other attributes, the WTP for a change in each attribute can be determined.

3.1.4 Combined Stated Preference Methods

The state preference methods CV and CE are often used to measure WTP to value intangible and immaterial environmental goods. The CE method has increased in popularity and is gradually replacing the more traditional CV method (Hoyos, 2010). A reason for this increase is that it has been argued that CEs may overcome some of the biases that have been associated with the CV method (Hoyos, 2010). Some studies have evaluated the difference between welfare estimates obtained using the CE method in comparison with the welfare estimates obtained using the CV method; however, no significant differences in the WTP values have been found (Adamowicz et al., 1998; Mogas et al., 2006). It is examined whether this also holds for this study, i.e. whether WTP estimates obtained using the CE are the same as estimates obtained with the CV method.

When a valuation measure influences another valuation measure, this is called anchoring, i.e. respondents anchor their answers for the second valuation measure based on the first valuation measure and a starting point bias occurs (Lechner et al., 2006). Furthermore, Botzen and van Beukering (2014) currently conduct research on the anchoring effect using the CV as well as CE method in order to estimate the WTP for nature protection in different areas. This on-going research reveals that it faces an anchoring effect as well.

This study measures how the order of the CV and CE valuation questions in the survey influences the WTP estimates for the goods and services. Given the rapidly growing

popularity of CEs in environmental valuation and their use in policy making, it is important to gain better understanding of anchoring in choice models. Since little academic research on this subject exists, this research will contribute to existing literature about the anchoring effect.

3.1.5 Analytical Focus

In this study, some analytical divisions are made. First, liveaboard and stay-over tourists are separated, since the two types of tourists often fit different profiles and participate in different activities. It is also measured if this will influence their WTP based on the CV. Another division is made between national tourists and non-national tourists. Since non-national tourists currently pay a considerably higher entrance fee than national tourist to enter the Galapagos Islands, it is investigated if this influences their WTP in the CE as well as the CV.

3.1.6 Limitations and scope

Due to the methodological scope, valuation techniques used, analytical focus, and data collection this research holds some limitations. Most important is that monetary assessments will only partly capture the total importance of ecosystems services. Since most ecosystems provide a bundle of services and the use of one service usually affects the availability of other services, (economic) valuation should not only consider values of individual services but also take due account of the “stock” value (i.e. the entire ecosystem) providing the total bundle of services (Millennium Ecosystem Assessment, 2005). Nevertheless, a complete analysis of this kind lies outside of the scope of this research, as this research values only the relevant ecosystems for tourism, in isolation of the entire system. For an inclusive analysis of the value of nature on the Galapagos all ecosystem services described in Annex B need to be assessed.

On the basis of data collection, this research is prone to interviewer bias. Since the surveys were conducted face-to-face, the way an interviewer approaches a respondent and the way he or she poses the questions can influence the respondent. Nevertheless, a face-to-face approach also holds advantages. For example, the interviewer can provide extra explanation when necessary (McCartney, 2011). Moreover, the complexity of a CE could lead to cognitive burden: there is a maximum amount of information that people can meaningfully handle while making decisions (McCartney, 2011). This cognitive burden can lead to respondents getting tired after a few choice cards and start giving more random, irrational answers without consciously considering the tradeoffs. To avoid cognitive burden, the number of attributes, the number of scenarios and the total amount of choice cards in the CE have been minimized.

As Brander et al. (2007) state, the methods used in ecosystem valuation related to tourism are dependent on the geographical location of the study site, which parts of the

tourism sector have been included, which goods and services are assessed and the assumptions that have been made. Van Beukering et al. (2011) also indicate that different types of valuation methods generate different results. One of the reasons for this methodological impact is that different techniques often value different things. The valuation of ecosystem services is therefore highly dependent on the techniques used and also prone to quite some uncertainty, as the values to measure are not always easily identified. For that reason, the results of valuation studies need to be interpreted in a responsible way, not too literally in an economic sense but as an indicator for the value of ecosystems (Carson et al., 2000).

Moreover, one should keep in mind that the TEEB method used is based on some assumptions and that the values are estimates with a degree of uncertainty. The valuation techniques used give insights in stated preferences, which are based on hypothetical scenarios and payments. As Carson et al. (2000) state, monetary assessment should therefore not be literally perceived. Nevertheless, it gives insight in the tradeoffs that exist and supports transparent decision-making. In that sense, this research will give general insights in the economic importance of ecosystem services to the local and / or national economy.

3.2 Research Findings

This section covers the findings of the tourist exit survey conducted on the Galapagos Islands. Through the analysis, where possible and logical, the previously explained division is made between liveaboard and stay-over tourists and national and non-national tourists. First, the demographics of the tourists are described in detail. This is followed by some insights about the length of stay, the activities tourists have participated in and their experience on the islands. Then, the environmental awareness of the tourists is presented. Next, the willingness to return will be evaluated, which will give insights in the socio-economic carrying capacity of the islands. Last, some information is given about expenditures and packages deals. The next chapter will focus on the findings from the CV and CE in order to determine the WTP, which is used to derive the socio-economic value of the Galapagos from a tourist perspective.

3.2.1 Representativeness

In order to see whether our sample is representative for the entire tourist population, we compare these survey results with the 2013 TCT (Tarjeta de Control de Tránsito) data of the GNP (Figure 2). Every tourist that visits the Galapagos Islands needs to fill in the TCT form before entry. When comparing the data, it shows that the sample is a good representation of the entire population. The division between surveys conducted on Baltra Airport and San Cristobal is almost equal to the actual division of visitors

entering the Galapagos. However, the national tourists are slightly underrepresented on both islands.

When the division between liveaboard and stay-over tourists is made, it can be seen that 30.5% of the sample went on a liveaboard trip, while 69.5% made use of accommodation on land. Figure 3 shows the division between stay-over and liveaboard tourists based on place of residence. It can be seen that of the 30.3% of liveaboard tourists, most are from Europe and North America. The Latin American and national tourist are on the other hand mainly making use of accommodation on land.

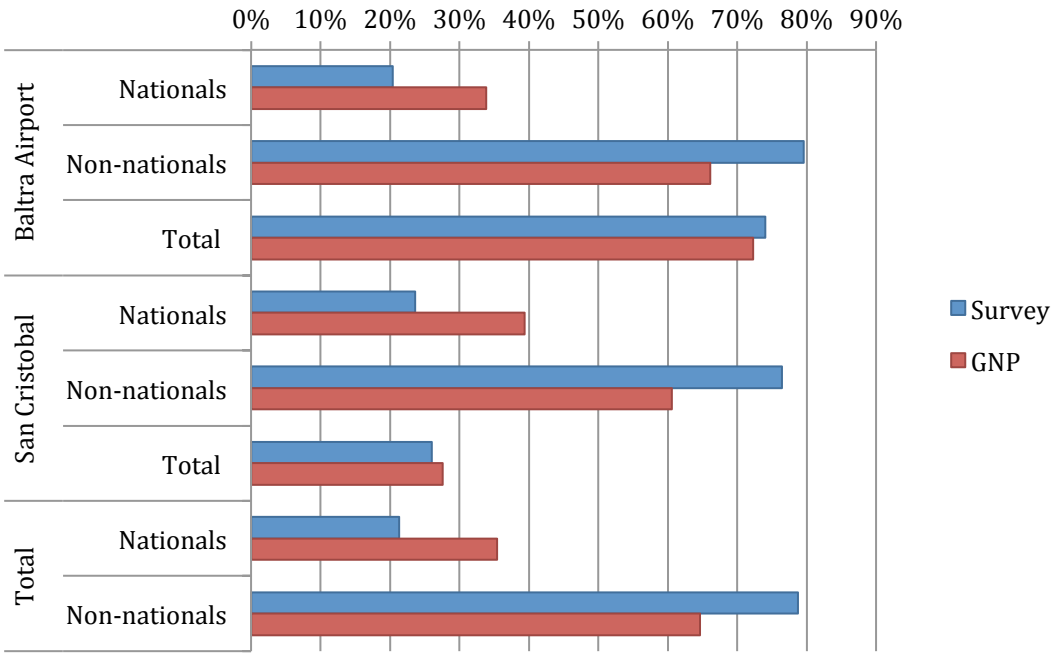


Figure 2 The survey sample distribution compared with the population (Source: GNP TCT data (2013) and survey)

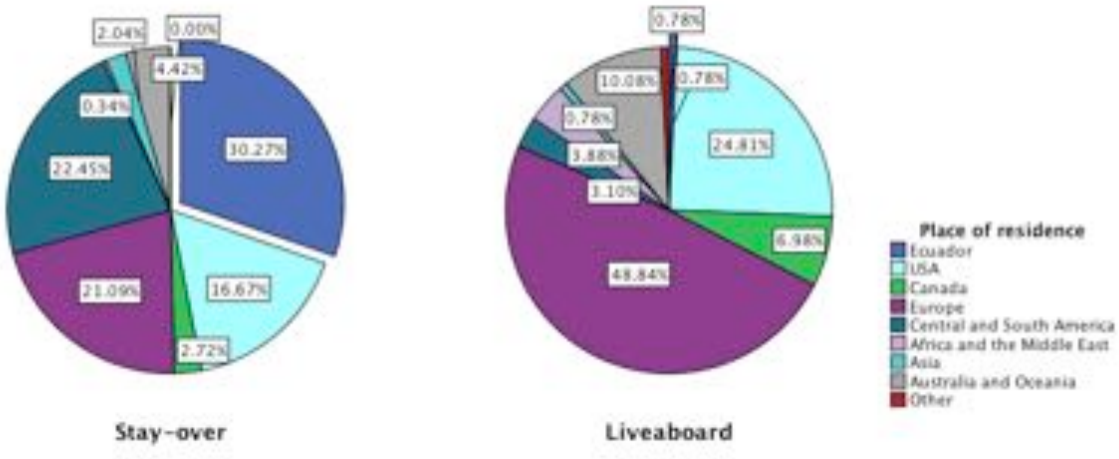


Figure 3 Liveaboard and Stay-over tourist distribution based on place of residence

These results were expected, as liveaboard trips are generally more expensive than accommodation on land. When the respondents are divided by income categories, this expectation is being confirmed, as Figure 4 shows that the higher income categories are making more use of liveaboard trips than the lower income categories. Income is recorded as monthly household income before income taxes in United States (US) dollars. As has been mentioned previously, the division between liveaboard and stay-over tourists is made, since it is expected that the two types of tourists fit different profiles. Figure 4 implies that based on income, the profiles of these types of tourist do indeed differ.

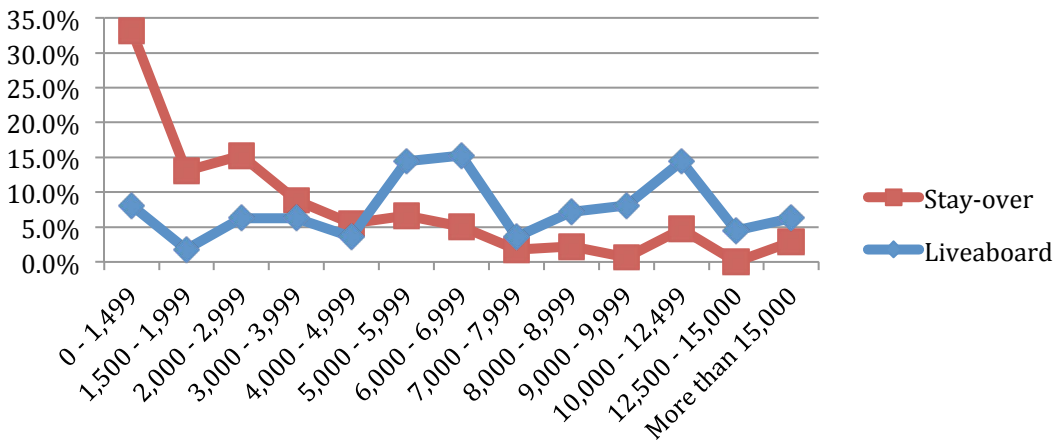


Figure 4 Income distribution for cruise and stay-over tourists (before income tax in USD per month)

As shown in Figure 5, the Galapagos tourist is highly educated. Around 90% of both national and non-national tourists has obtained a College / Bachelor degree. Only a very small percentage has only finished High School or lower education levels. We identify a small difference in the share of University graduates, which is 61.2% for non-nationals and 47.8% for nationals.

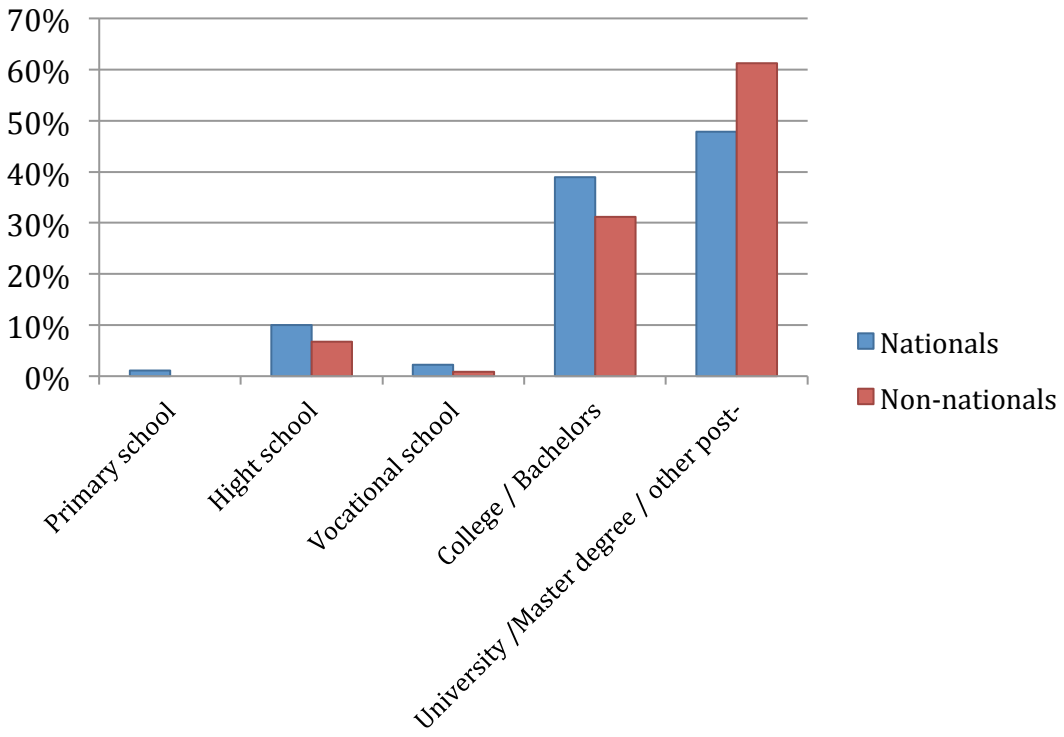


Figure 5 Highest completed education level of nationals and non-nationals

3.2.2 Stay, Activities and Experience

Stay and Daytrips

As shown in Table 1, the average amount of days for visiting the Galapagos is seven days for national tourist, while it is nine days for the non-national tourist. It should be noted that these means can be somewhat manipulated by outliers. The non-nationals in the sample show a maximum of 110 days and a median of seven, which shows that the mean is most likely influenced by extreme outliers.

Table 1 Average duration of a holiday to the Galapagos Islands for national and non-national tourists.

	Mean	Count	Std. Deviation	Median	Minimum	Maximum
Nationals	7.133	90	6.0674	5	1	40
Non-nationals	8.823	333	9.4949	7	2	110

Figure 6 shows where the respondents stayed during their holiday on the Galapagos. Various respondents stayed on different islands or went on a liveaboard trip next to island stay-over, so the percentages add up to over a 100%. Nevertheless, the distribution illustrates which islands are receiving most stay-over tourists. As expected, the most populated island Santa Cruz receives most stay-over tourists, followed with the second most populated island San Cristóbal. The least populated island Floreana receives very little stay-over tourism.

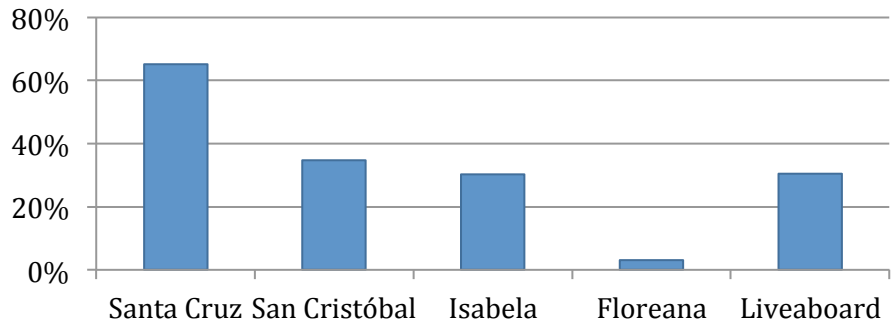


Figure 6 Location of stay on the Galapagos

Interisland travel and the availability and popularity of daytrips are increasing, which will give tourist the possibility to enjoy the various islands of the Galapagos without being forced to go on a liveaboard trip. From all the respondents 56.7% went on a daytrip. Table 2 shows which daytrips the respondents participated in.

Table 2 Daytrips

	Count	*Percentage*
Floreana	54	*12.8%*
San Cristóbal	95	*22.5%*
Isabela	115	*27.3%*
Santa Cruz	33	*7.8%*
Santa Fé	26	*6.2%*
Bartolomé	20	*4.7%*
Seymour	19	*4.5%*
Tour Plazas	13	*3.1%*
Tour de Bahia	35	*8.3%*
Other	12	*2.8%*

The islands Isabela and San Cristóbal are the most popular daytrip destinations. It is likely that these islands are therefore also receiving more pressure from tourism. Together with Figure 6, which shows the location of stay, one can get clear insights on the amount of tourists the various islands receive and the relative pressure this puts on local ecosystems.

Marine-based Activities

The Galapagos is internationally known for its unique marine environment (Epler, 2007). Consequently, marine-based activities are an important reason for tourists to visit the Galapagos. The success of most of these activities depends heavily on the state of the marine ecosystems. Figure 7 presents the share of tourists that participate in a particular marine activity. The figure presents the total participation rate per activity as a percentage of the total sample. Additionally, the figure displays the participation rate of liveaboard and stay-over tourist per marine activity as a percentage of the total of the tourist category. It can be seen that snorkeling and beach visits are by far the most frequently conducted marine activities among both liveaboard and stay-over tourists. Furthermore, it can be noted that there are no big differences between the marine activities of liveaboard and stay-over tourists, except for the dinghy rides. Most of the liveaboard tourists participate in dinghy rides, while only around 20% of the stay-over tourists participate in the dinghy rides. This can be explained because the liveaboard tourists need to make use of the dinghy rides in order to get on shore. Furthermore, the stay-over tourists make slightly more use of the additional marine activities like surfing and kayaking.

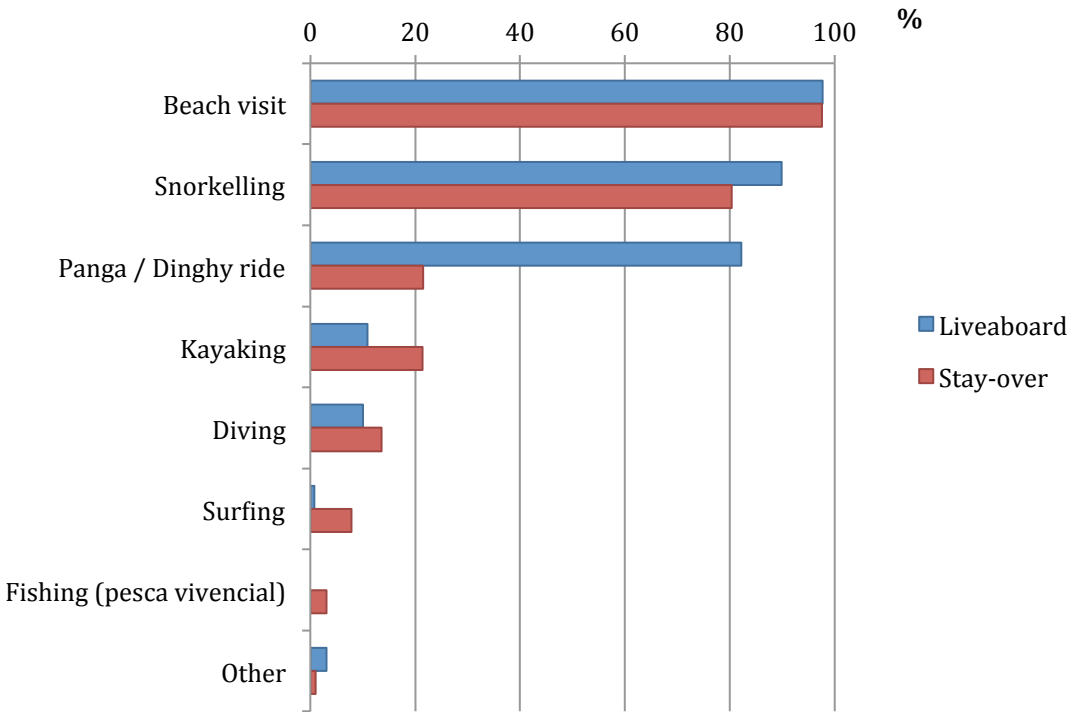


Figure 7 The participation rate in marine-based activities (total as a % of total visitors; tourist category as a % of the total of the tourist category)

Land-based Activities

Equal to the marine-based activities, Figure 8 presents the total participation rate per activity as a percentage of the total sample, and the participation rate of liveaboard and stay-over tourist per activity as a percentage of the total of the tourist category. The figure shows that there is not a big difference in the type of land-based activities liveaboard tourists and stay-over tourists participate in. It shows that a larger share of the liveaboard tourists participates in bird-watching activities. Also, more stay-over tourists enjoy biking activities and the nightlife, which is expected, as both activities are difficult to undertake when participating in a liveaboard trip.

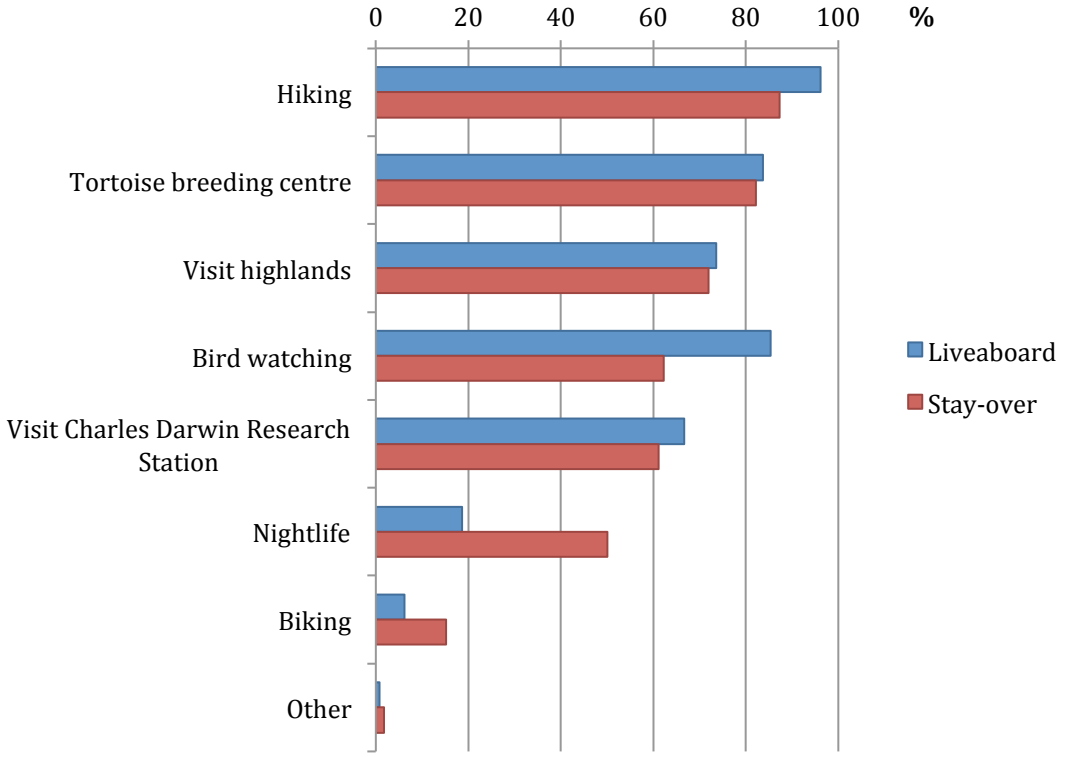


Figure 8 The participation rate in land-based activities (total as a % of total visitors; tourist category as a % of the total of the tourist category)

Experience

Figure 9 shows a ranking of the aspects tourists enjoyed the most on the Galapagos, defining their overall experience on the islands. Respondents were asked to make a top-4 ranking of the aspects that were presented to them in the survey, with one being the aspect they enjoyed the most. In order to analyze the data, the ranking was converted into scores from one to four. Aspects that were ranked one are assigned four points, rank two gets three points, rank three is allocated two points and rank four gets one point. The total score of each aspect is divided by the total amount of respondents resulting in a comparative scale that provides a clear image about the most appreciated islands aspects to the visitors. It should be noted that the aspects that are ranked highest, like the marine and land species and diving / snorkeling, are heavily dependent on the state of the natural environment.

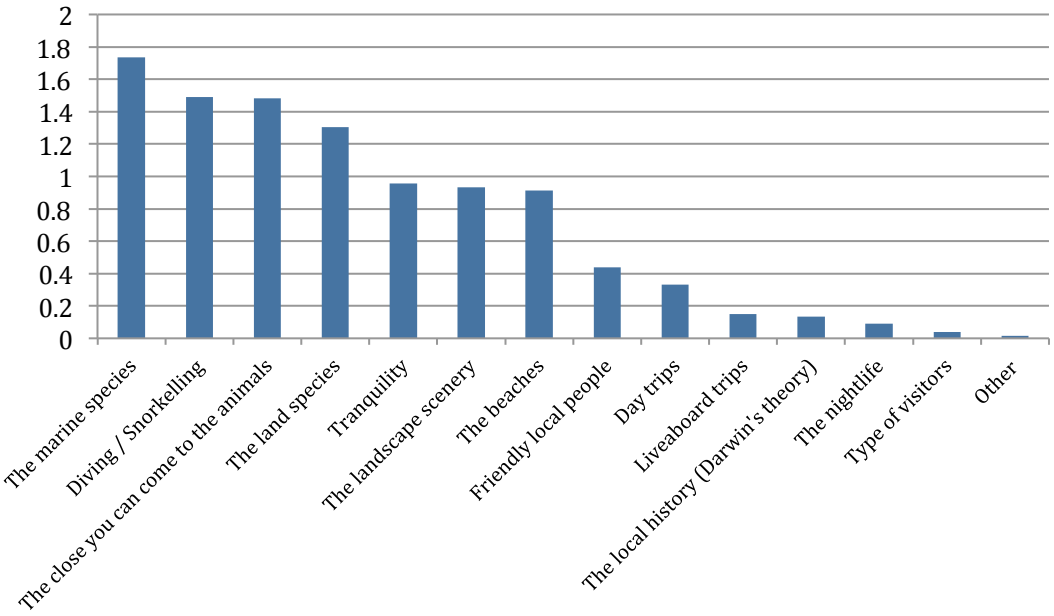


*Figure 9 "Select the four aspects that you **enjoyed most** on the islands and rank them in a Top-4 (1 = most enjoyed, and rank up to 4 aspects)."*

3.2.3 Environmental Awareness

Figure 10 provides an indication of the environmental awareness of the tourists visiting the Galapagos. The respondents were asked how important they consider some suggested potential threats to the natural environment of the Galapagos. The respondents had to rank the proposed threats from one to five. A division is made between national and non-national tourists; however, except for the threat of increasing tourism, which is perceived slightly more important to non-national visitors, there is not much difference between the groups. Overall, the tourists rank all potential treats relatively high, which indicates that most tourists are environmentally aware of the threats facing the Galapagos.

Respondents were also asked whether they had a local guide during their visit to the Galapagos, and if so, about their satisfaction with the local guide. Of the total respondents, 75% had a local guide. Figure 11 shows the satisfaction rate of liveaboard and stay-over tourists. Liveaboard tourists seem to make more use of local guides, which is expected, as most liveaboard trips have a local guide included in the package. Furthermore, most tourists, liveaboard as well as stay-over tourists, seem to be satisfied with the services of the local guides. Only 14% of the liveaboard and 8% of the stay-over tourists were not satisfied with their local guide. The guides often provide information that could make the tourists more aware about the local situation and the possible environmental threats. However, no significant correlation was found between the presence of an environmentalist guide and the awareness about threats.

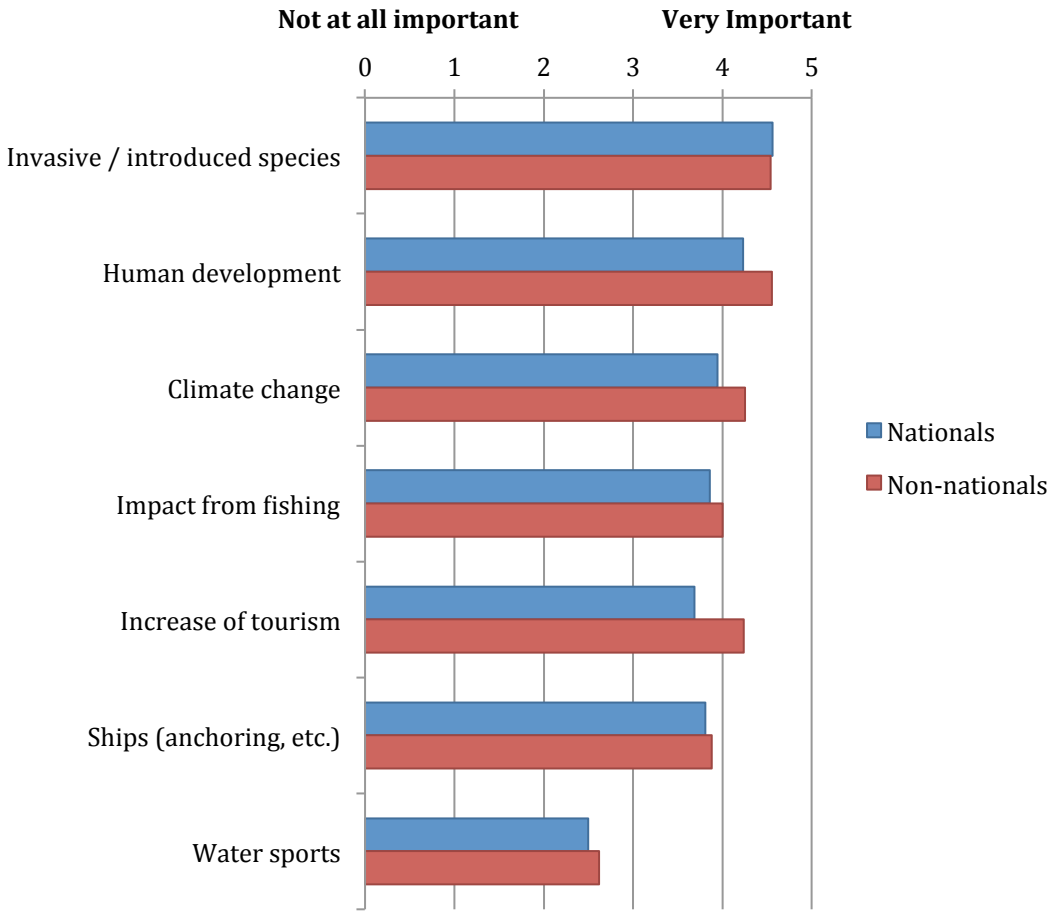


Figure 10 "How important do you consider the following potential threats to the natural environment of the Galapagos? (1 = not at all important; 5 = very important)

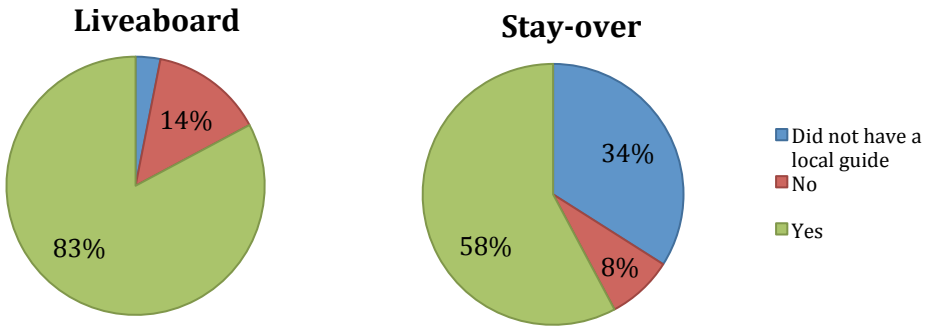


Figure 11 Where you satisfied with the local guide(s)?

3.2.4 Willingness to Return

Often the Galapagos is being described as a 'once in a lifetime experience' (National Geographic, 2011). Due to the entry fee tourists need to pay and its remote geographical location, the rate of tourists returning to the Galapagos is not expected to be high, especially not for non-national visitors. The tourists exit survey included various questions in order to establish if the respondent has visited the Galapagos before and is expected to return. These questions are used to get an indication of the expected return rate of tourists to the Galapagos.

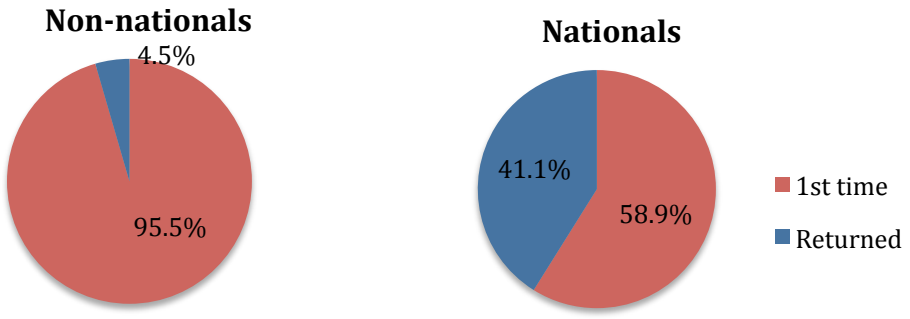


Figure 12 The percentage of national and non-national tourists that have previously visited the Galapagos

Only 12.4% of the total sample has returned to the Galapagos from a previous vacation. Figure 12 shows that of the non-nationals, 95.5% visits the Galapagos for the first time. This is different for the nationals, of which more than 41.1% has already visited the Galapagos and has now returned. This was as expected due to the more remote geographical location and higher entrance fee for non-national visitors. Also, nationals are more likely to visit the Galapagos for other reasons than just leisure, such as visiting friends and family and combining a business trip with leisure.

Next to the actual return rate, Figure 13 presents the percentage of tourists that is willing to return in the future. As expected, we see a difference in the actual return rate and the percentage of people willing to return. This can be explained because the willingness to return resembles a hypothetical situation. We cannot say with certainty that the people that are indicating to be willing to return will actually return. Nevertheless, the answers give an indication about the popularity of the destination. In addition, some return questions were asked in order to give a prediction about the return rate in the perspective of various possible future scenarios for the Galapagos. As stated before these questions will provide insights in the socio-economic carrying capacity of the islands. Will tourists still return to the Galapagos if the islands are more developed and suffer from degraded ecosystems? Figure 13 shows that both the quality of the natural environment and crowdedness influence the willingness to return.

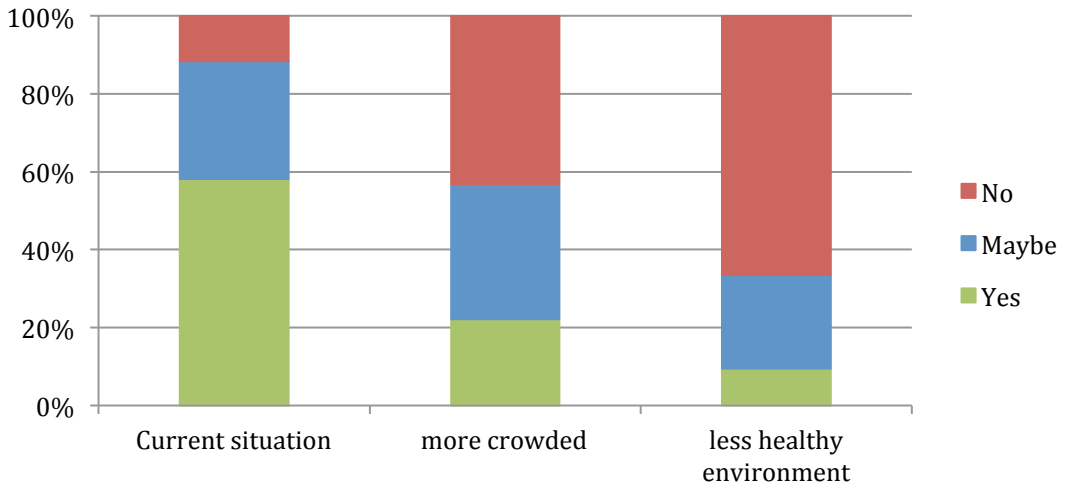


Figure 13 The percentage of tourist that is willing to return to the Galapagos in the current situation, if the islands are more crowded, or if the environment severely degrades.

It can be concluded that the state of the natural environment as well as the number of tourist visiting the Galapagos has a big impact on the willingness of tourists to return. From the 58% of tourists that are in principle willing to return, only 22% is still willing to return if the islands would become more crowded. Only 10% is willing to return if the natural environment of the islands would be in a less healthy condition. Ecosystem quality can be, therefore seen as one of the most, if not the most, important aspect determining the attractiveness of the Galapagos as a holiday destination.

3.2.5 Expenditures

Package Deals

When one would calculate the total revenue that the Galapagos receives from the tourism sector it is important to take into account that many tourists purchase a package deal for their visit to the Galapagos. Table 1 shows the total of package deals and the divisions between liveaboard and stay-over tourists and national and non-national tourists.

It should be noted that liveaboard tourists are more likely to buy a package deal than stay-over tourists. This is as expected, as most of the liveaboard trips are offered as a package deal. Furthermore, national tourists are not likely to buy a package deal, while the non-nationals show almost an even distribution between the tourists that bought a package deals and the tourist that individually arranged their holiday.

Table 3 Travel arrangements between liveaboard and stay-over tourists and nationals and non-nationals

	Travel package	***Percentage***	Individual arranged	***Percentage***	Total	***Percentage***
Total	173	*40.9%*	249	*58.9%*	422	
Liveaboard tourists	87	*67.4%*	42	*32.6%*	129	*100%*
Stay-over tourists	86	*29.4%*	207	*70.6%*	293	*100%*
Nationals	23	*25.6%*	67	*74.4%*	90	*100%*
Non-nationals	150	*45.2%*	182	*54.8%*	332	*100%*

It is problematic that we do not know which share of the package price went to a particular category, which implicates that these cannot be used when calculating the revenues per income category that the Galapagos receives from tourism. It is important to keep in mind that this will cause an undervaluation of the revenues per income category. Also, interviewers noted that some packages included visiting other parts of Ecuador as well.

Expenditures

In order to get an indication of the revenues Galapagos receives from tourism, expenditures were asked for different categories. Respondents had the possibility to give expenditures per person per day or for the entire duration of the stay. This may complicate the comparison since holiday durations differ. Expenditures are therefore transformed to daily expenditures per person. Table 4 presents the average daily expenditures per person per category. Also, the division is made between liveaboard trip visitors and stay-over visitors, as well as between nationals and non-nationals.

As explained before, tourists cannot enter the park without the supervision of an official guide. For that reason, in order to enter the boarders of the national park and undertake activities like diving, tourists need to book official tours. The expenditures on the day tours and diving are therefore a suitable resemblance of the total value these recreation services hold for the tourism industry.

When looking at the totals of all the categories, the table shows that overall, non-nationals tend to spend more during their stay on the Galapagos than nationals. Also, liveaboard tourists seem to spend more than stay-over tourists, which is as expected considering the high prices of liveaboard trips, which are included in the calculation. However, it should be noted that the liveaboard trip expenses in Table 4 only resembles the liveaboard expenses of liveaboard tourists that booked their trip on the island. The tourists that booked their vacation through a package deal are not included in this calculation, as the package prices cannot be divided among the various categories. Nevertheless, these visitors are included when calculating the averages, which is why the total averages of the categories do not resemble the total expenses of

tourists. The average package price per person per day should also be included in the calculation in order to see the total expenses of the groups.

For that reason, the last two rows contain the average daily package expenses per person and the total expenses when these package deals are included. As expected liveaboard tourists as well as non-national tourists have higher package deal expenses when compared with stay-over tourists and national visitors. This has consequences for the total average expenses (including average daily package expenses) as can be seen in the last row. A T-test run in SPSS demonstrates that on a 99% confidence interval the total average expenses (including average daily package expenses) of liveaboard and stay-over, as well as national and non-national tourists significantly differ (see Annex F for the SPSS output).

The data gives an indication of the total revenues obtained from tourism per tourist category and in total including package deals. Nevertheless, it should be noted that the revenues from package deals are often not entering the local economy of the Galapagos completely. The package deals are often bought from foreign companies or tour operators based in mainland Ecuador. Furthermore, Mentefactura (2014) estimates an average tourism expenditure of 463 USD per day. This is a considerably higher amount compared to the expenditures recorded in this survey.

Table 4 Average daily expenditures per person per category, per package deals and totals

	Total average daily	**Std. Deviation**	**Liveaboard**	**Stay-over**	**Nationals**	**Non-nationals**
Accommodation	$18.74	30.04	$10.82	$22.22	$20.89	$18.16
Bike rental	$0.62	2.45	$0.13	$0.83	$0.81	$0.56
Local transportation	$5.16	12.07	$2.74	$6.23	$7.19	$4.62
Day tours	$18.33	39.54	$4.37	$24.45	$20.39	$17.77
Liveaboard trip(s)	$34.69	210.54	$111.61	$0.94	$1.67	$43.62
Diving	$8.29	30.56	$6.90	$8.90	$4.15	$9.41
Food and beverages (in restaurants)	$18.02	27.96	$9.81	$21.63	$20.44	$17.37
Shopping (including groceries)	$15.02	74.78	$6.63	$18.70	$17.11	$14.46
Other	$2.21	22.92	$1.26	$2.62	$6.67	$1.00
Total categories	**$121.08**		**$154.27**	**$106.52**	**$99.31**	**$126.97**
Daily package expenses per person	$166.34	288.31	$350.74	$85.42	$39.59	$200.59
Total ***(including daily package expenses)***	$287.78	336.32	$505.32	$192.32	$138.95	$328.00

3.3 Tourism Willingness to Pay

3.3.1 Contingent Valuation (CV)

Respondents were asked about the maximum amount they are willing to pay for better protection of the natural environment, in addition to what they currently pay *(100 USD for foreigners, 50 USD for visitors from the Andean Community, 25 USD for non-national student studying in Ecuador, 6 USD for nationals*). This question was formulated using the CV method, which is based on an open question in which people are directly asked what they are hypothetically willing to pay for the preservation of an ecosystem. The CV method is explained in more detail in section 3.1.1. The WTP values obtained with the CV question are presented in Table 5. This table presents the average WTP including and excluding the 36% of the respondents that are not willing to pay. National visitors pay a considerably lower entrance fee than foreigners. The results do not show a statistically significant difference in the principle WTP between national and non-nationals; however, the WTP values are significantly lower for national tourists (see Annex F for the statistical output).

Table 5 WTP (CV) for better protection of the natural environment through environmental management. If the people that were not willing to pay were included in the calculation, the WTP of these respondents was set at 0 USD.

Are you in principle willing to pay?	**Yes**	**No**
Count	269	152
Percentage	64%	36%
	Mean	**Median**
National tourists	16 USD	10 USD
International tourists	114 USD	80 USD
Tourists that are WTP	93 USD	50 USD
Non WTP included	60 USD	20 USD

Preferred organizations to manage the collected funds

When respondents stated to be willing to pay in the CV question, they were asked if they had a preference for an organization to manage the collected funds. The results are shown in Figure 14.

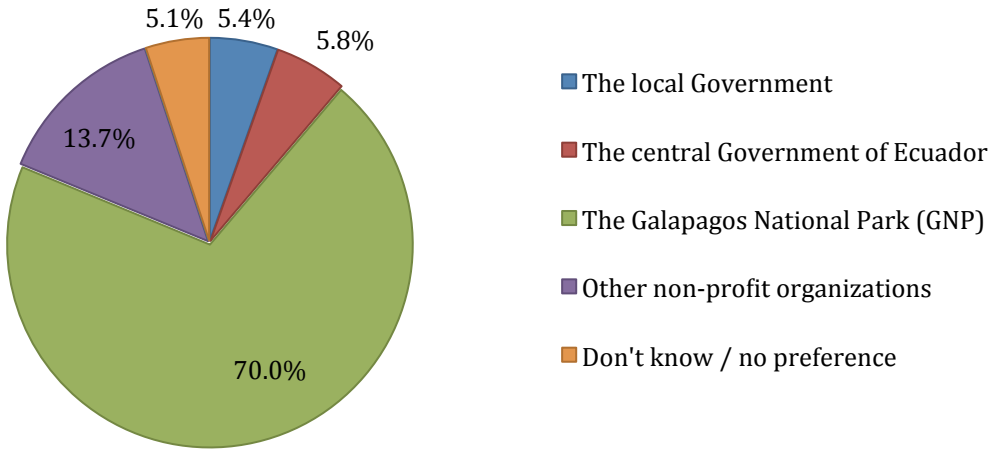


Figure 14 Preferred organizations to manage the collected fees

Reasons for not being willing to pay

When respondents stated not to be willing to pay in the CV question, they were asked about their main motivations. Various reasons were suggested and the answers of the 30.1% of the respondents that were not willing to pay are displayed in Figure 15. As the figure shows, the main reason why a respondent would not be willing to pay is because the respondent feels he/she pays enough already.

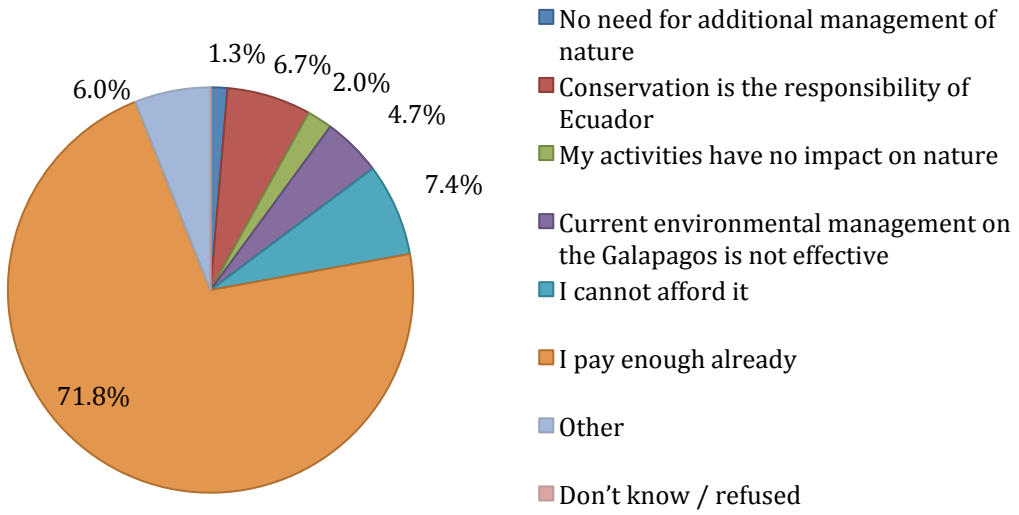


Figure 15 Main reasons why respondents are not willing to pay to improve the environment of the Galapagos

3.3.2 Choice Experiment (CE)

The second method used to determine the WTP of the respondents is the CE. In the CE the WTP is derived from people's choices between different scenarios of environmental quality. The CE method is explained in more detail in sections 3.1.1 and 3.1.3. The scenarios in the CE were constructed with five different attributes.

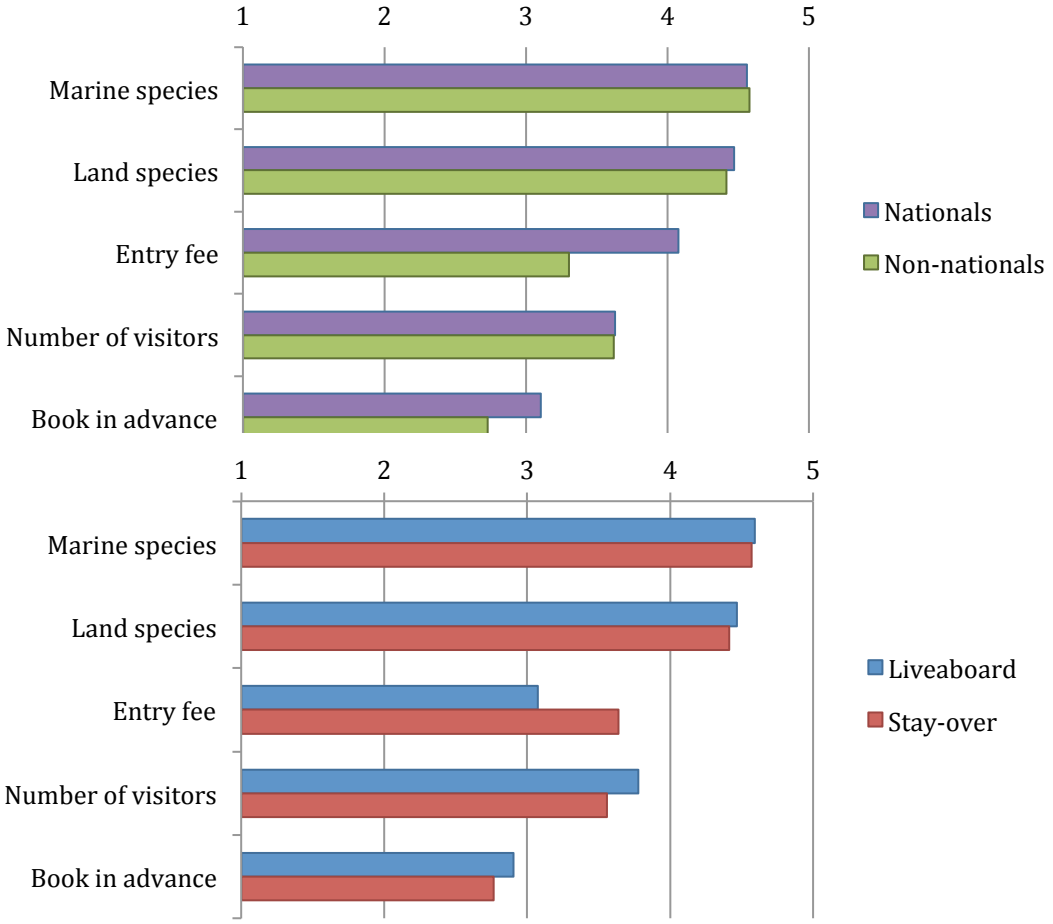


Figure 16 presents the importance of each attribute for the respondents to make their choices between scenarios. Overall, the results are in line with the outcome of the CV, namely that the abundance of marine species is the most important to respondents, followed by the terrestrial species.

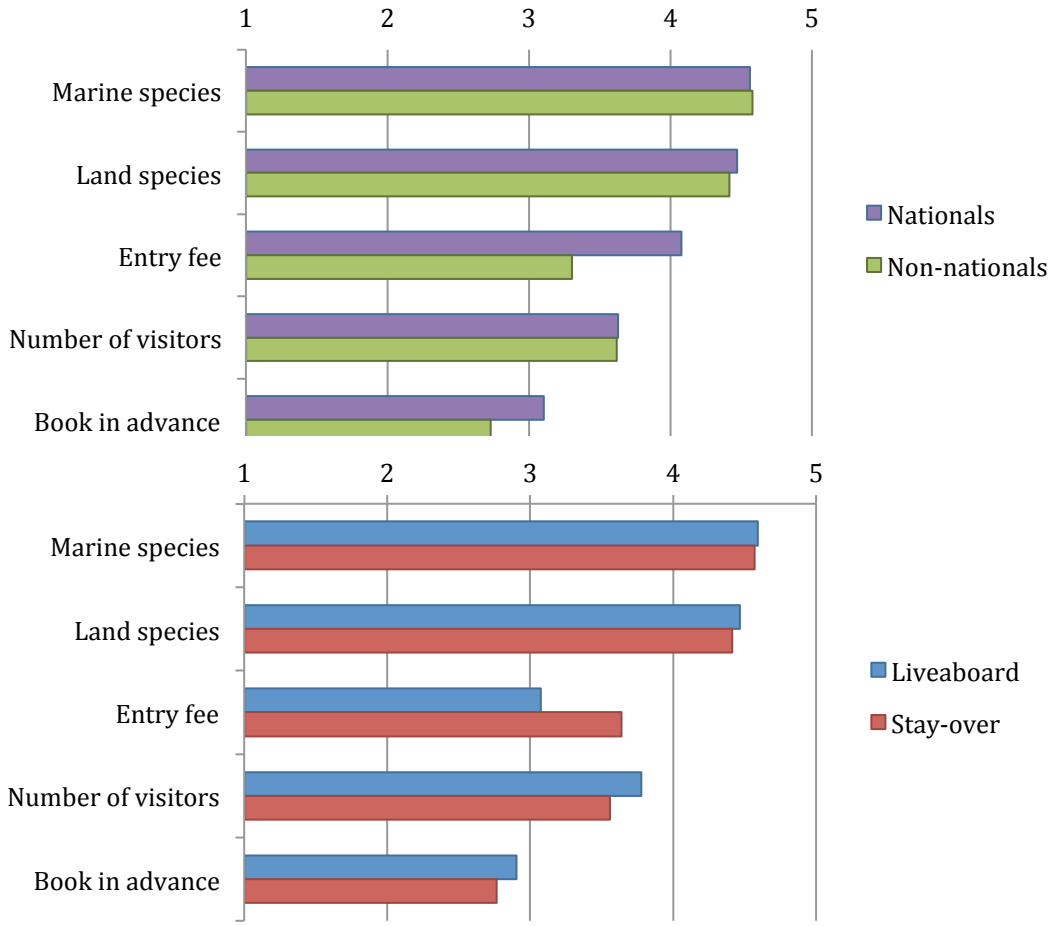


Figure 16 does not show any major difference, apart from the importance of the additional entry fee attribute. Based on this measure, nationals seem to be more sensitive to the additional entry fee than non-nationals. This is in line with the CV values where nationals have a significant lower WTP than non-nationals. Also, stay-over tourists seem to be more sensitive to the additional entry fee than liveaboard tourists.

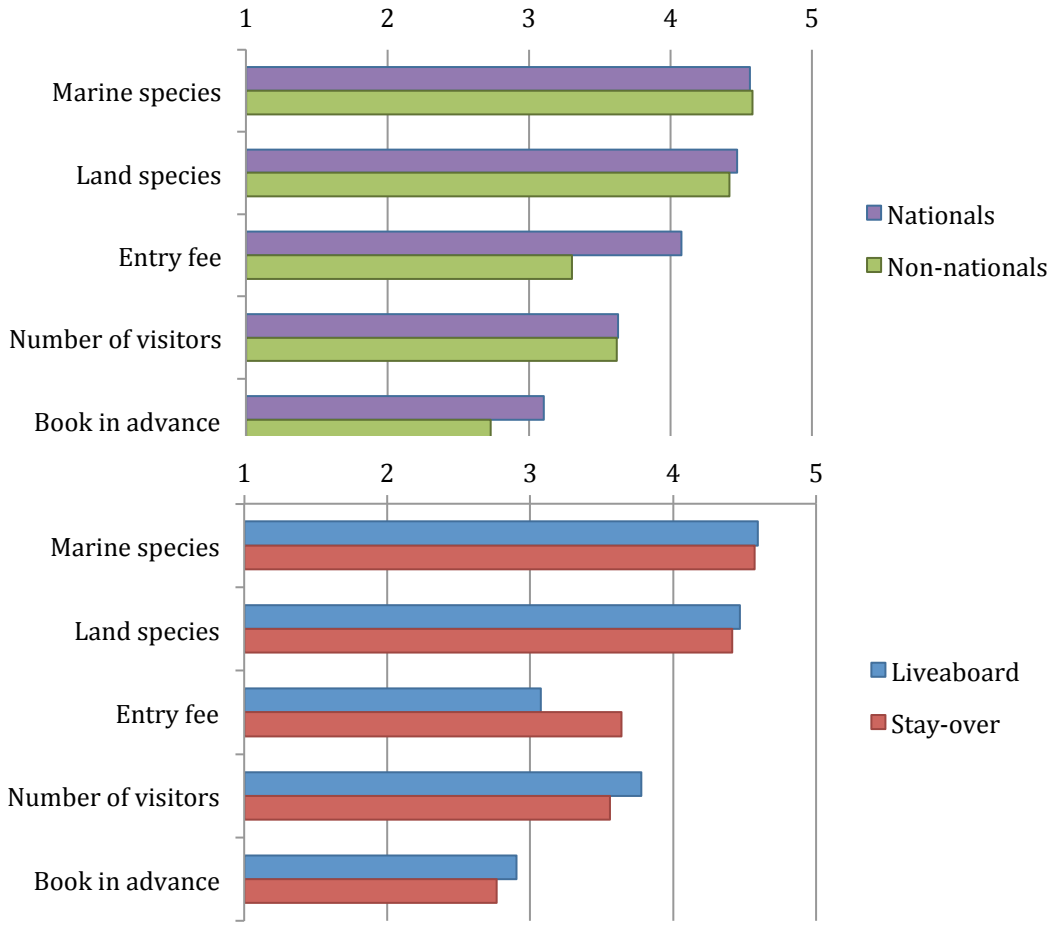


Figure 16 Influence of the attributes on the choices between scenarios in the choice experiment. (Answer to the question: "In making your choices, how important were the following items to you?" 1 = Not at all important; 5 = Very important)

WTP values based on the CE

The panel error correction mixed logit model[1] is used to calculate the WTP values since this model provides the best fit of the data. Table 6 shows the maximum WTP values of respondents for the attribute levels according to the attributes only model. One should be aware that the results of the CE are liable to a reasonable amount of uncertainty due to hypothetical bias. Absolute WTP results should therefore be treated with caution and do not reflect actual income for the Galapagos. WTP values of crowdedness and time for booking in advance are negative, meaning that, on average, people have a *positive* WTP for *a lower* time to book in advance and a *reduction* in visitors. These signs are as expected.

The results indicate a large positive WTP for additional environmental management on the Galapagos. Especially the attributes that measure the state of the environment are important to the respondents. On average, people are willing to pay up to 240 USD to maintain the quality of the marine environment and up to 350 USD for an increase in quality. The WTP for the terrestrial quality is 140 and 232 USD for respectively

[1] For more information please refer to the annex A.

maintaining the quality and improving it. The WTP for receiving 100,000 visitors is 0 USD; for every increase of 100,000 additional visitors the WTP decreases by 47 USD. For each month that it is necessary to book a visit in advance, the WTP decreases by 4 USD.

Table 6 Average willingness to pay (WTP) values based on the CE. Amounts are relative to the omitted categories (decrease in marine quality, decrease in terrestrial quality, 100,000 visitors per year, and no time to book in advance).

Variable	**Maximum WTP per person**
Current marine quality	240 USD
Improved marine quality	350 USD
Current terrestrial quality	140 USD
Improved terrestrial quality	232 USD
Crowdedness	-47 USD per 100,000 visitors
Time for booking in advance	-4 USD per month

Source: Botzen (2014)

4 Cost-benefit analysis (CBA) of tourism scenarios

4.1 Methodology

4.1.1 Existing research and assumptions

In the previous chapter, a socio-economic valuation of the natural environment of the Galapagos for the tourism industry was presented based on the results of the tourist survey. The objective of this CBA is to use the results of this valuation to perform an economic analysis of the potential economic, social and ecological costs and benefits of three proposed tourism growth scenarios, measured in terms of the Net Present Value (NPV) of each of the scenarios. The scenario specific results should make it possible to compare the scenarios in terms of the net benefits that each of them would represent for the Galapagos Islands in the short-term and longer term.

This CBA builds on existing research aimed at obtaining an insight on what would be an appropriate number of tourists arriving at the Galapagos Islands. A brief summary of the other two main research studies that have served as input for the CBA has been set out in Section 2. We further explain below how the results of those reports have been used for the purpose of this CBA. We assume that the concepts and results of those two reports are known to the reader and do not need to be explained in detail here. For the purpose of the CBA, we have further assumed the correctness of the VENSIM model developed by Mena et al. (2013), of all the data and assumptions that were used to build that model, as well as the validity of the results obtained by the studies of Mena et al. (2013) and Mentefactura (2014).

Mena et al. (2013)

For the purposes of this CBA, we have used the output data of the VENSIM model developed by Mena et al. (2013) with respect to a number of variables in the subsystems in the model that were relevant to determine certain costs or benefits in the CBA. The variables that were taken into consideration, either directly or as an indicator for a cost or benefit are listed in the CBA Framework in Annex H. However, in order to use Mentefactura's results, it was necessary to match the numbers of tourists arriving each year in each growth scenario to the tourist numbers used by Mentefactura (2014). Therefore, we ran new simulations in the VENSIM model using the initial number of tourists as used by Mentefactura (2014). As a result thereof, the output of the variables that we used in the CBA does not necessarily match the results, in terms of values, of the corresponding variables in the report by Mena et al. (2013).

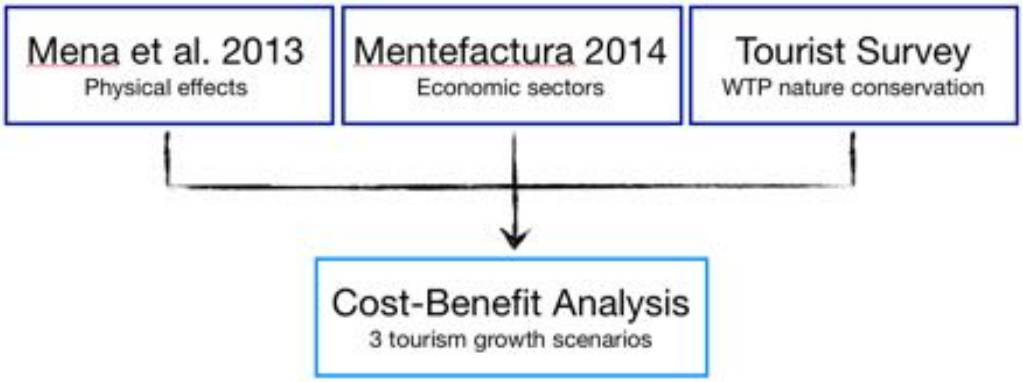


Figure 17 Framework for cost-benefit analysis

Mentefactura (2014)

In the CBA, we have used the three tourism growth scenarios defined by Mentefactura (2014). We have also used the initial production values for the tourism activities and the other economic activities as set out by Mentefactura (2014) (in their Tables 12, 14 and 16) as benefits in our analysis for the three scenarios These initial values are changed according to the modification values set out in Tables 11, 13 and 15 of their report. In order to match the time frame of the CBA results with the output of the VENSIM model by Mena et al. (2013), which runs until 2033, we have extrapolated the modifications to the economic production obtained by Mentefactura (2014) from 2023 until 2033. For this extrapolation, the average annual growth rate of the production values over the period 2013 until 2022 was calculated. This annual growth rate was then used to calculate the annual production values for 2023 until 2033. The CBA will further use the results obtained through the tourist survey in order to expand the previous two comparisons of the tourist scenarios by also incorporating the tourism value of nature.

4.1.2 Tourism scenarios

Mentefactura (2014) followed closely the tourism growth scenarios developed by Mena et al. (2013). However, some differences in the exact numbers of tourists where determined while comparing both studies. In order to be able to use the results obtained by Mentefactura (2014) as benefits in the CBA, we have used the tourist numbers from Mentefactura's Moderate Growth and Rapid Growth scenarios. However, for the No Growth scenario, we have kept the original number of tourists (180,831) proposed by Mena et al. (2013) as the difference of 831 tourists in comparison with the number used by Mentefactura was considered to be of limited impact to the overall results. In addition, the CBA starts from 2013, since it was considered of limited relevance to include the year 2012 in the analysis. Both of these changes were included in the simulations that were run using the VENSIM model created by Mena et al. (2013). Taking the above into account, the CBA looked into the tourism growth scenarios as described in Table 7.

Table 7 Overview of scenarios

	# Tourists in 2013	Growth	Management type
Scenario 1 – No Growth	180,831	Cero	Maximum tourist quota and waiting list
Scenario 2 – Moderate Growth	204,395	7066 visitors per year	None
Scenario 3 – Rapid Growth	204,395	8% per year	None

- Given the current trend in tourism growth in the Galapagos Islands, the Rapid Growth is considered the business as usual scenario if no measures are taken to manage tourist arrivals.
- The No Growth scenario might not seem realistic, given that the actual number of tourist arrivals registered for 2013 already exceed the 180,831 visitors used in this scenario. However, we have included it in the CBA as the scenario that showcases the potential costs and benefits of implementing a management system to control the number of tourists arriving to the Galapagos Islands. Mena et al. (2013) already assumed the implementation of a management measure when proposing the No Growth scenario, but did not elaborate this further. We have built on this assumption by factoring a management measure into the No Growth scenario. This management measure comprises setting a tourist quota of 180,131 tourists per year. By comparing this yearly quota with the number of tourists that may arrive each year in the business as usual scenario (Rapid Growth), we obtained the number of months that a tourist will need to wait each year of the analysis in order to obtain admission to the Galapagos Islands. We have further linked these waiting times with the results of the WTP for the time that is required to book in advance in order to obtain the benefits from this management measure.
- The Moderate Growth scenario is less extreme in terms of growth than the Rapid Growth scenario and probably more viable to achieve in practice than the No Growth Scenario. However, given the current trend in tourism growth, which is depicted in the Rapid Growth scenario, a management measure will also need to be implemented in order to realize this scenario. Such management measure has not been explored in the CBA.

4.1.3 Cost-benefit analysis (CBA)

The CBA is a tool designed to compare costs and benefits of a specific policy scenario. The results of a CBA should demonstrate what policy is favored and how costs and benefits relate to each other (Cellini & Kee, 2010). The results of a CBA allow for comparison of different policy scenarios, this facilitates the opportunity to assess which scenario yields the largest net benefits.

In the current CBA, the costs and benefits of each of the three tourism growth scenarios have been calculated based on certain social, ecologic and economic variables and results obtained by Mena et al. (2013) and Mentefactura (2014). Building on these previous results, we have further linked the results obtained in the survey discussed in the previous chapter to certain of those variables in order to calculate the tourism value of nature in each of the scenarios. The translation of all these results into monetary costs and benefits allowed us to carry out an extended cost-benefit analysis of the potential economic, social and ecological costs and benefits of the three tourism growth scenarios, measured in terms of the Net Present Value (NPV) of each of the scenarios. The scenario specific results can be viewed as the result of the CBA and allow for comparison among the three scenarios.

4.1.4 Limitations

Given the all-encompassing impact of the proposed tourism growth scenarios in all ecologic, economic and social aspects of the Galapagos Islands, the scope and time frame of the CBA did not allow for a complete consideration of all potential costs and benefits. For example, on the costs side, it would also be interesting to consider the costs involved in water subsidies, waste management and control of invasive species in each of the scenarios. Regarding waste management, potential benefits can also be realized from recycling materials, but these have not been included in the analysis either. A selection of some of the most relevant costs had to me made in good faith on the basis of the available information. In terms of transparency, the production values for the tourism sector and other selected sectors as taken from Mentefactura (2014) may also include some hidden costs. In their report, the added values of activities are given, which means that material and capital costs are deducted from total revenues. In terms of economic benefits, these added values were considered the best and most comprehensive results that could be used to estimate the value of economic activities for the CBA.

Within the scope of this CBA, it was not possible to develop an indicator that would relate the abundance of marine species and/or the quality of the marine ecosystems to the number of tourists in the Galapagos Islands. Even though there is a baseline study of the state of the marine ecosystems in the Galapagos Marine Reserve (see Danulat and Edgar, 2002), it seems that there has been no comprehensive analysis of the trends in marine species abundance and marine ecosystem health that would provide

indications of the changes throughout the time (Cubero-Pardo, 2008). Therefore, the results of the WTP for the conservation of marine species could not be linked directly to the abundance and health of the marine species in Galapagos.

The alternative that has been found is to link the results of the WTP for marine species to the Annual Occupation of the Protected Area (Mena et al., 2013), which presents an index of the occupation of the marine and terrestrial sites of the GMR and GNP in relation to the Acceptable Visitor Load (AVL) determined by the administration of the Galapagos protected area, as aggregated in the Yearly Receiving Capacity of the Protected Area (CAAP, for its initials in Spanish). The Annual Cruise Occupation index in Mena et al. (2013), which is a factor of the AVL for marine sites, only considers the yearly number of liveaboard tourists. However, stay-over tourists also visit the marine sites, but it is difficult to quantify exactly how many of them. Therefore, while AVL of the marine sites for scuba diving incorporate ecologic considerations and the AVL for the terrestrial sites are mainly based on management considerations, it was considered that using the AVL of the marine sites as the only indicator for the WTP for marine species would not provide an accurate representation of the potential impact of total tourist occupation in the marine ecosystems.

Furthermore, it has to be noted that the WTP is a hypothetical value that should be considered as an estimate for the actual WTP for environmental management. Although a positive WTP indicates that visitors are prepared to pay an additional entry fee to the Galapagos, numbers should not be treated as absolute.

4.2 Research findings

This section presents the main results obtained from the CBA, which allow a comparison of the three tourism growth scenarios. In order to facilitate the review of the results, some particular insights obtained in the results of the analysis are also described. The comparison of the scenarios needs to be viewed in terms of which of the three scenarios may potentially realize the greatest value for the Galapagos Islands while representing the lowest threat for its social and environmental systems.

4.2.1 CBA Results

Table 8 shows an overview of the costs and benefits that were taken into consideration in each scenario. The CBA Framework in Annex H shows the relation between these costs and benefits and the relevant variables and results from the already mentioned sources.

Table 8 Overview of costs and benefits

Costs	Benefits
Management costs (scenario 1 only)	WTP Crowdedness – liveaboard tourists
CO2 emissions	WTP Crowdedness - stay-over tourists
Subsidies on electricity	WTP Marine Species – liveaboard tourists
Subsidies on fuel for transport	WTP Marine Species - stay-over tourists
	WTP Terrestrial species –liveaboard tourists
	WTP Terrestrial species -stay-over tourists
	WTP Booking in advance –liveaboard tourists
	WTP Booking in advance -stay-over tourists
	Management fees
	Production tourism sector
	Production other selected sectors

As mentioned above, these costs and benefits do not intend to be exhaustive at all and it is not the intention of this analysis to present them as the only potential costs or benefits from the different tourism growth scenarios. Costs and benefits were selected only with the purpose of providing a way to compare the different scenarios using information readily available. Additional costs or benefits could be added in a subsequent analysis if it would be desirable to increase the scope of the comparison. A reader that is familiar with CBA results will probably note that, other than the management costs, the costs on the left column do not represent investments, as it would be typical in a CBA, but in this case they represent potential expenses from the central or the local government. The benefits, on the other side, represent potential sources of income or perceived value for the Galapagos' economy. The management and environmental effects of the impact of the different tourism growth scenarios in a number of ecologic and social variables has been related to the results of the tourism survey to obtain the potential additional revenues that tourism may generate. The production values for the tourism and other selected economic sectors, as taken from Mentefactura (2014), represent the impact in the economic sectors of the tourism growth scenarios.

The three tourism growth scenarios have been compared on the basis of the identified potential costs and benefits. Table 9 presents the main results of this comparison given in terms of net present value. For a detail of the results for each of the identified costs and benefits in each of the scenarios, please see Annex G. For the calculation of the NPV, a discount rate of 5% has been used in all three scenarios. Please see Annex I for the results of the sensitivity analysis that was made to assess the robustness of the CBA results using different discount rates.

Table 9 Comparative summary of main CBA results (Discount rate = 5%)

	Scenario 1 - No growth	Scenario 2 – Moderate Growth	Scenario 3 – Rapid Growth
Total costs (x Million USD)	572	733	1063
Total benefits (x Million USD)	6015	5602	5530
Total NPV (x Million USD)	5443	4867	4467
B/C ratio	10.51	7.64	5.20

As shown in Table 9, none of the scenarios present a benefit/cost (B/C) ratio lower than 1, i.e. in all three scenarios the potential benefits are higher than the potential costs. This result might be misleading, but it can be explained by the fact that in all three scenarios, the identified potential benefits are greater than the identified potential costs. As set out in the limitations in section 4.1.4, the CBA only contemplates a limited number of costs. These B/C ratios will of course decrease and show different values if more costs are added to the analysis, for example in relation to potential water subsidies; costs of waste management; costs of controlling and combating invasive species; costs of increasing installed capacity at airports or at sea ports to accommodate more boats importing goods or transporting passengers inter-island, etc. Therefore, the B/C ratios in this CBA only show the ranking of the scenarios in terms of which of the three scenarios has the highest potential benefits when related to the potential costs. The No Growth scenario, scores the best B/C ratio as it has the highest total benefits of the three scenarios for the whole period of the analysis (6015 million USD) and the lowest costs (572 million USD). On the other end, the Rapid Growth scenario, with an exponential tourism growth, yields the lowest total benefits for the whole period of the analysis (5530 million USD) while accruing the highest costs (1063 million USD).

As mentioned above, the net benefits of the three scenarios, represented by their total net present value (NPV), and the development of the net benefits through the years, as the number of tourists arrivals change, represent a more insightful result of the CBA, in terms of showing the potential value that each of the scenarios may represent for the Galapagos Islands.

Figure 18 A shows the yearly developments of the net benefits (benefits minus costs) of each of the three scenarios, resulting from the CBA, and their relation with the growth in tourist arrivals per year. Figure 18 B is a close-up of the results shown in Figure 18 A, for the years 2013 until 2024, which allows for a better comparison of the developments of the yearly net benefits for the three scenarios up until 2024.

In the Rapid Growth scenario, as the number of tourists increases over the first 5 years, so do the yearly net benefits. However, there is a decreasing growth rate from the start of the analysis. Around 2018, the increase in net benefits peaks at 400 million USD and starts decreasing rapidly afterwards, to finish at 192 million USD in 2033. This indicates that in this scenario, already from 2016, while the number of tourists continues increasing, the value of these tourists for the Galapagos Islands starts decreasing. This decrease can be related to lower values for the WTP of tourists as the natural ecosystems deteriorate and the Galapagos becomes more crowded, as well as to a slow down and subsequent decrease in production of the economic activities as a result of a lower spending per tourist (Mentefactura, 2014).

The same trend is visible for the Moderate Growth scenario, but in this case, the decrease of the growth rate is more gradual. In this scenario, the decrease in yearly net benefits commences in 2029, where they reach 395.87 million USD, to finish at 392 million USD in 2033. The more gradual slowdown and later decrease in yearly net benefits as compared to the Rapid Growth scenario can be explained because the thresholds for deterioration of the natural capital are reached later in time compared to the Rapid Growth scenario.

Due to the lower number of tourists, the No Growth scenario yields lower yearly net benefits than the Rapid Growth scenario in the first years, up until approximately 2020, where the net benefits of the No Growth scenario for that year reach 404 million USD and surpass the net benefits of the Rapid Growth scenario, which are 393 million USD in that year. The No Growth and Moderate Growth scenario yield relatively comparable yearly net benefits until 2016, where the net benefits of the No Growth scenario reach 370 million USD and surpass the net benefits of 367 million USD in the Moderate Growth scenario in that same year. The results indicate a growing trend from the beginning in the yearly net benefits for this No Growth scenario, which will end at 574 million USD for the year 2033. This sustained increase in yearly net benefits can be explained by higher WTPs of tourists in view of the preservation of the natural ecosystems and low levels of crowdedness, as well as a steady increase in the production by economic activities attributed to higher levels of spending per tourist (Mentefactura, 2014). This higher level of spending depends on the increased comparative advantage of the Galapagos through higher quality ecosystems compared to other tourism destinations (Mentefactura, 2014).

These results are consistent with the production modifications as proposed by Mentefactura (2014) and with the predictions by Mena et al. (2013) of the point in time at which the Moderate Growth and the Rapid Growth scenarios would reach and surpass the CAAP established by the DPNG (see Figure 20 C).

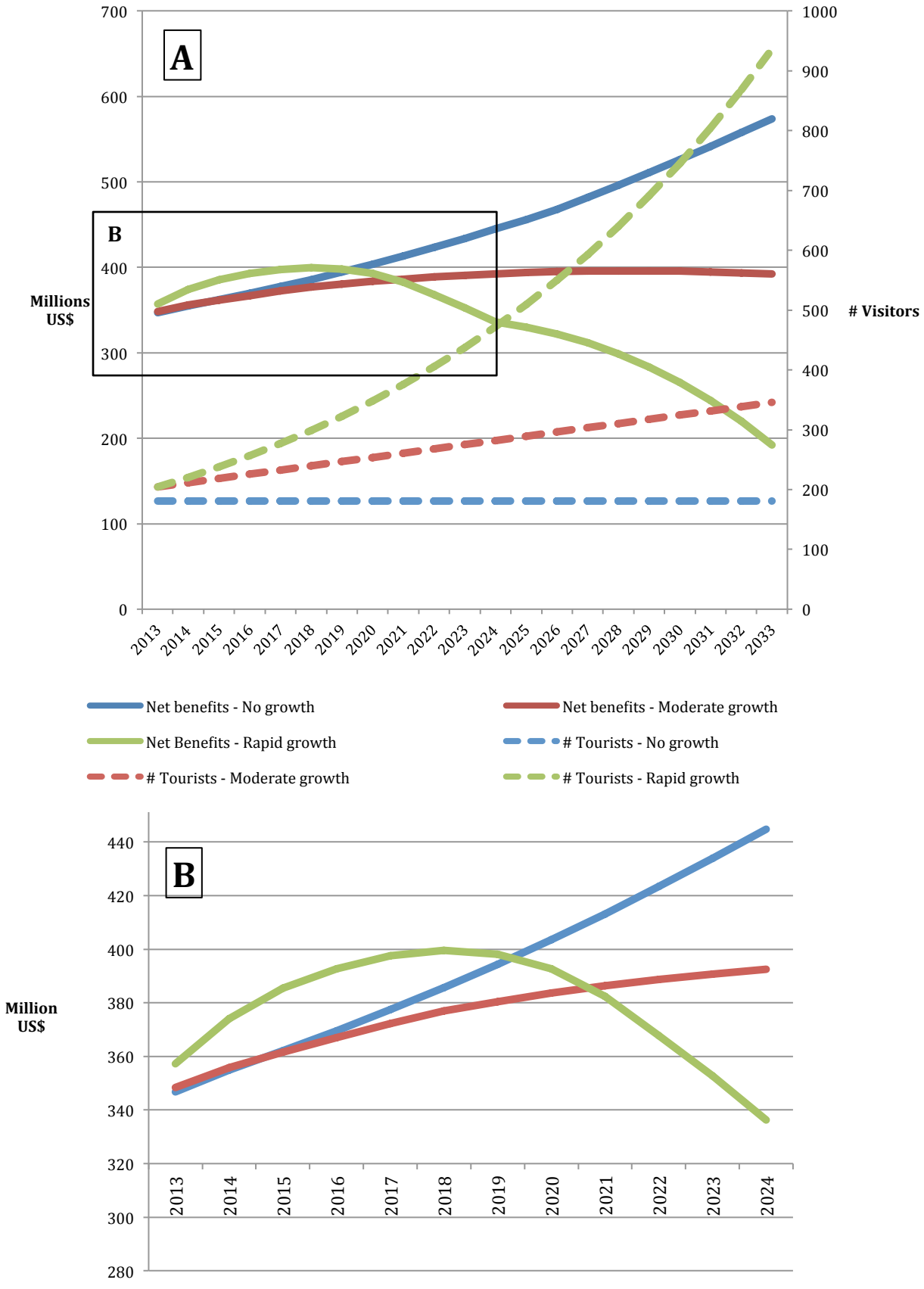


Figure 18 A) Net benefits and number of visitors per year; B) Net benefits per year

In Figure 19 the average added value per tourist is presented as a function of time. This comparison shows the relative direct financial benefits and WTP per tourist in each of the scenarios, based on the CBA. Results show that the earnings per tourist decrease in the Rapid Growth and Moderate Growth scenarios, while the average added value increases for the No Growth scenario. While in all three scenarios the average added value per tourist starts at around 600 USD per tourist, already in 2020 a difference of almost 100 USD per tourist per year appears to exist between the Moderate Growth scenario (571 USD) and the Rapid Growth scenario (474 USD), and of approximately 400 USD between the Rapid Growth and the No Growth scenario (873 USD). The difference between the scenarios appear to increase over the following years to end at 1,394 USD for the No Growth scenario, 518 USD for the Moderate Growth scenario and 177 USD for the Rapid Growth scenario. WTP for conservation appears to decrease in all three scenarios due to a continuous trend in ecosystem degradation. However, the WTP for the No Growth scenario decreases at a significantly lower rate.

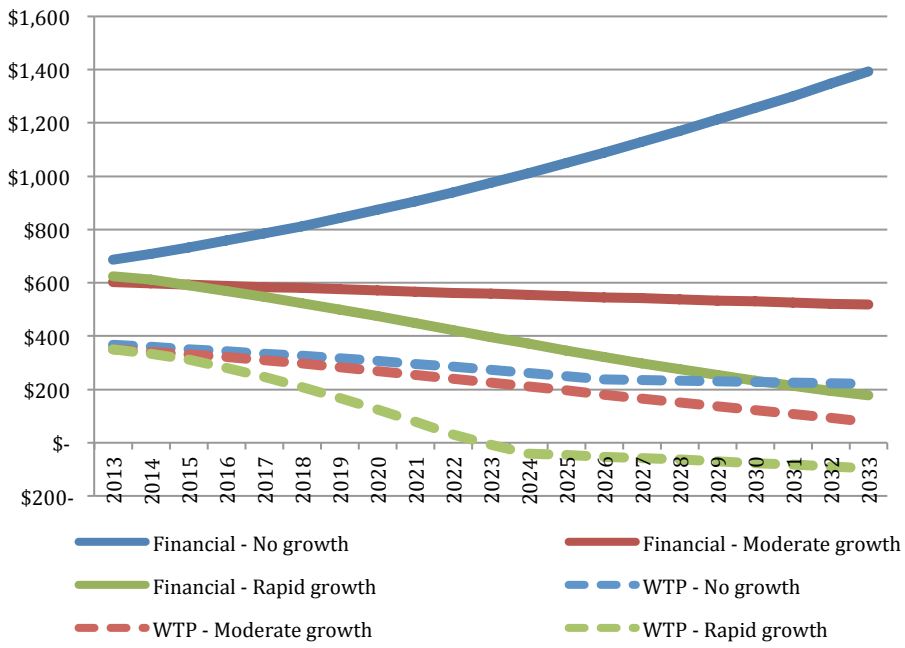


Figure 19 Added values per tourist in the tourism sector and average WTP

4.2.2 Other insights

In Figure 20, we have disaggregated the discounted value over the years for the two groups of benefits identified in the CBA, the financial values from the economic activities and the tourism value of nature calculated using the WTP values obtained in the survey.

Some interesting insights can be extracted from the comparison of these figures in Figure 20:

- In terms of economic activities, increase in production values for the Rapid Growth and Moderate Growth scenarios is shown as the number of tourists increase over the years. However, in both scenarios a point of saturation occurs, after which the increase in economic benefits slows down, 2018 and 2026, respectively, and later on decreases while the number of tourists continuously increases.
- The values for the WTP resulting from the CBA increase only in the first couple of years for the Rapid Growth and Moderate Growth scenarios, but start decreasing sharply in the years 2016 and 2018, respectively. In the No Growth scenario, they decrease slightly at the beginning and stabilize towards the end of the analysis period. This graph shows that the tourism value of nature in the Galapagos, measured in terms of the WTP values, is much more sensitive to the changes in tourist numbers over the years than the Galapagos' economic sectors. This seems to be in accordance with the general assumption from Mentefactura (2014) that in the Moderate Growth and Rapid Growth scenarios, the total spending per tourist will decrease each year as a result of the deterioration in the natural capital, which would be reflected in lower tourism spending each year. However, the trends shown in the CBA could also indicate that the assumptions by Mentefactura (2014) could have been conservative for the Moderate Growth and the Rapid Growth scenarios (a reduction of 0,5% in tourism spending annually) and too optimistic for the No Growth scenario (an increase in tourism spending of 5% per year). In terms of WTP values, there is a direct link between the increase in the number of tourists and the decrease in the tourism value of nature as early as 2016.
- The index of Total Occupation of the Protected Area indicates that none of the Moderate Growth or Rapid Growth scenarios are sustainable in terms of the yearly capacity of the protected area to receive tourists (Mena et al., 2013). The years in which the WTP values start to decrease in the Rapid Growth and Moderate Growth scenarios show a relation with the years in which these two scenarios surpass the Annual Receiving Capacity of the Protected Area (CAAP), 2016 and 2019, respectively. The index of Total Occupation of the Protected Area is a factor in the determination of the WTP for marine species in the CBA, but the other WTP values are determined by other factors.

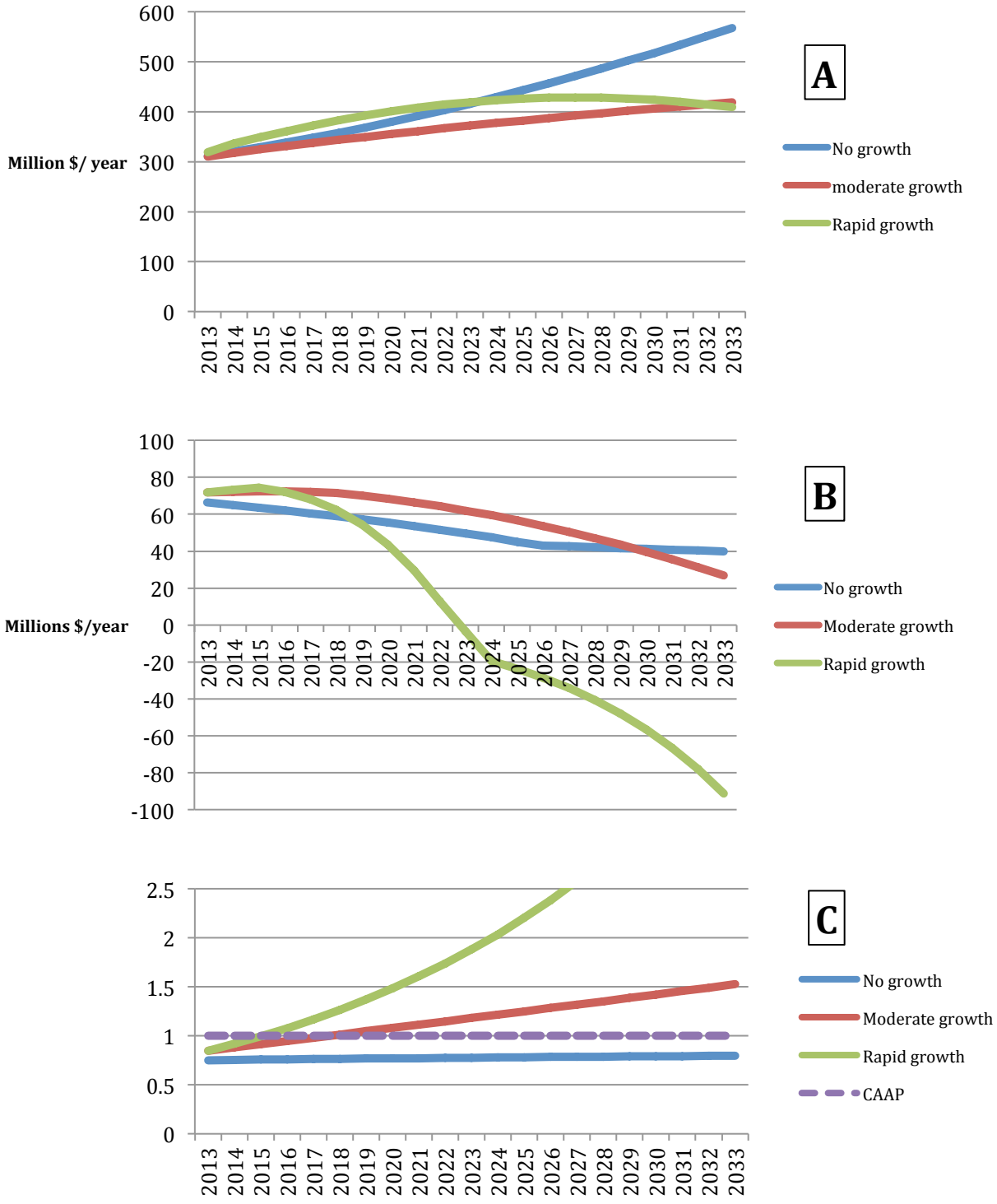


Figure 20 A) Net-benefits of production by economic activities per scenario; B) Total WTP values in each scenario; C) Total Occupation Protected Area index

5 Discussion and conclusions

The natural environment of the Galapagos Islands attracts a steadily increasing number of tourists to the archipelago. The growing tourism sector contributes significantly to the Galapagos economy. However, the growth trends in tourism, as well as the potential shift in the type of tourist that visits Galapagos has prompted key questions for the future of the islands. One of these questions relates to finding and managing an optimal number of yearly tourist visits to the Galápagos Islands, which would continue to render high economic benefits without endangering the Galapagos' most valuable asset: unique and fragile natural ecosystems.

This research aimed to perform a socio-economic valuation of the natural environment on the Galapagos for the tourism industry and to use the results of this valuation to compare three tourism growth scenarios on the basis of a cost-benefit analysis.

On the basis of a tourist survey conducted using the CV and CE methods, the study reveals that tourists on the Galapagos seem to be willing to pay more than the current entrance fees to protect the nature on the Galapagos. Results indicate that visitors are willing to pay an additional amount of 240 USD per trip to conserve the marine environment of the Galapagos and 140 USD to conserve the terrestrial environment. Nevertheless, caution is required, as the results of stated preference methods are liable to a reasonable amount of bias because of the hypothetical nature of the values. For that reason, the results of valuation studies should never be interpreted literally, but instead should be used as an indicator for the value of ecosystems (Carson et al., 2000).

Nevertheless, the high values tourists assign for additional nature protection on the Galapagos provides opportunities for the local government to increase current user fees for protection purposes. Moreover, the results from the CE, together with the results of the survey questions enable to compare the relative importance of the different ecosystems and recreational services that contribute to the value of nature on the Galapagos Islands from a tourist's perspective.

The findings have shown that the marine ecosystem is the most valuable for the tourism industry, followed by the terrestrial ecosystems. The scenario analysis indicates that even though crowdedness has a negative effect on the willingness to return, degradation of the natural environment has an even bigger negative effect on willingness to return. The socio-economic carrying capacity has a limit; however, the ecological carrying capacity seems to be of higher importance to visitors.

The CBA demonstrates that when analyzing different tourism scenarios in the Galapagos, it is not enough to only look at the benefits from the tourist arrivals derived from the economic sectors. The interrelation between the tourism sector and the unique natural capital of the archipelago is the reason to consider the tourism value of nature as a potential benefit in a scenario analysis. In terms of WTP values, the CBA

indicates a direct link between the increase in the number of tourists and the decrease in the tourism value of nature as early as 2016. According to these results, the tourism value of nature appears to be more sensitive to high increases in the numbers of tourists and their related socio-environmental impact than the benefits derived from the economic sectors. Getting a better understanding of the sensitivity of the WTP values could allow a better estimation of the changes in spending patterns of tourists depending on different levels of health of the natural environment.

It could also be considered in the future to extend the scope of the CBA to include some of the costs that could not be analyzed within the current scope; for example costs of waste management, water subsidies, control of invasive species and increase in the port infrastructure as a result of the increased number of tourists in the Moderate Growth and Rapid Growth scenarios were not included in the analysis.

The main results from the CBA indicate that:

- For the whole period of the analysis, the No Growth scenario has the highest total benefits of the three scenarios (a NPV of 6015 million USD) and the lowest costs (an NPV of 572 million USD), while the Rapid Growth scenario yields the lowest total benefits (an NPV of 5530 million USD) and accrues to the highest costs (an NPV of 1063 million USD).
- The Rapid Growth scenario reveals a negative correlation between the increase in the number of tourists and the yearly net benefits. This scenario presents a slowdown in the increase of net benefits, due to a decrease in the average added value per tourist. The net benefits for the year 2016 reach 392 million USD, and a decrease in total net benefits starts after 2018, to end with 192 million USD of net benefits in 2033. This scenario exceeds the Annual Receiving Capacity of the Protected Area (CAAP) already in 2016.
- Based on the results obtained in the CBA as well as in previous studies, the Rapid Growth scenario does not appear to be a plausible scenario. It is highly unlikely that tourism will keep growing at a rate of 8% per year for the coming 20 years. A more realistic scenario would be to contemplate the probability of a tourism collapse due to the potential degradation of the archipelago's ecosystems and the surpassing of the carrying capacity of the Islands. Unfortunately, due to the scope and time frame of this research, it was not possible to analyze this scenario in the context of the CBA.
- Compared to the Rapid Growth scenario, the Moderate Growth scenario presents a more gradual slowdown in the increase of the yearly net benefits and a later decrease in net benefits, which occurs as of 2029. This also translates into a more gradual decreasing pattern in the average added value per tourist compared to the Rapid Growth scenario. This scenario exceeds the Annual Receiving Capacity of the Protected Area (CAAP) already in 2019, three years later than the Rapid Growth Scenario.

- The No Growth scenario is the only scenario with a continued increase in yearly net benefits, where in time its yearly net benefits also surpass those of the Rapid Growth scenario, in 2020, and of the Moderate Growth scenario, in 2016. This is caused by a continued increase in the average added value per tourist in this scenario. This scenario does not exceed the Annual Receiving Capacity of the Protected Area (CAAP) in the period of the analysis.

In practical terms, it would seem that none of the two growth scenarios analyzed represent a viable growth scenario for the Galápagos: the Moderate Growth scenario is not sustainable in the long term, and the Rapid Growth scenario will be unsustainable already in the short term.

The No Growth scenario does not represent a realistic number of tourists, because the current number of tourist arrivals already exceeds the numbers used in the scenario. However, the results obtained in the CBA indicate that controlling the number of visitor arrivals to the Galápagos Islands to a maximum within the carrying capacity of the natural system is the only option that will render increasing economic benefits for the Islands in the short and long term. It would therefore appear that the only viable tourism development option might be a scenario where growth is allowed in the next couple of years within the limits of the AVLs of the protected area, while an integral management system for the control of the number of visitors is developed to stabilize the number of visitors to an acceptable maximum. There is currently a management system in place for the number of liveaboard vessels in the GMR, which has the indirect effect of controlling the number of liveaboard tourists. However, there is no management system to control the arrivals of stay-over tourists. Given the trend towards an increase in the number of stay-over tourists and a decrease in liveaboard tourists (Mena et al., 2013), if the tourism growth is to be controlled, it seems necessary to implement an integral management system that controls both the number of stay-over tourists and live-aboard tourists that are allowed to access the Islands. It would also appear that the existing system to estimate the acceptable visitor loads (SIMAVIS) could be used as a starting point to set the number of stay-over tourists that the protected area is capable of receiving. Once such a management system is in place, tourism arrivals could be stabilized at levels where the conservation of the Galapagos' ecosystems, and therefore the benefits derived from the tourism sector, are not at risk.

The results of the tourist survey and CBA further indicate that a tourism growth plan that will manage the number of tourists arriving to the Galapagos Islands to remain within the ALVs established by the PNG, will probably be the most profitable as it will attract nature tourism that is willing to spend more for the natural experience. This is reflected in their WTP for nature management fees, as well as in their expenditures in the Galapagos economy. In contrast, an uncontrolled growth of tourism might continue attracting tourists and be more profitable in the coming 2 to 6 years, depending on the scenario. However, while tourism grows, there will be a risk of a shift to mass tourism, comprised of tourists who are not necessarily interested in nature, may not be willing to

pay for nature conservation and which may have lower spending patterns, thereby converting uncontrolled tourism growth into the least profitable option. The challenge for the decision makers will be to find the right balance and the appropriate management measures to achieve an optimal number of visitors, who are attracted to the Galapagos Islands, and are willing to pay, for the highly valued natural experience.

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Annex A - Modelling the Choice Experiment

Attribute Only Model Results Galapagos

In this research, next to the CV method a CE has been conducted in order to determine the WTP for an additional fee for environmental management of the Galapagos. The utility of the environmental protection options (Alternatives A and B) is expressed as a function of the attributes shown in options A and B, and the utility of the opt-out option (Alternative C) is modeled using a constant parameter. Formally, the indirect utility functions of the alternatives can be represented by the following equation:

$U_{environmental\ protection} = \beta_1 \times current\ marine\ quality + \beta_2 \times improved\ marine\ quality + \beta_3 \times current\ terrestrial\ quality + \beta_4 \times improved\ terrestrial\ quality + \beta_5 \times crowdedness + \beta_6 \times booking\ in\ advance + \beta_7 \times additional\ fee$

$U_{opt\text{-}out} = \alpha_1 \times constant.$

As is common, the attributes with qualitative levels (marine quality and terrestrial quality) are included in the model as dummy variables. For example, the number of marine and terrestrial species is categorized between a lower, no change and a higher state. The coefficient shows the importance of such a state compared to the lowest possible state, which is the omitted dummy variable. Dummy variables of the levels of current and improved quality of these attributes are included in the equation, while the dummy variables of the lower quality levels are excluded. Crowdedness, booking in advance and the additional fee are modeled as continuous variables.

Table 10 Attributes only model results for the WTP level with 99% confidence intervals (in USD) estimated by a standard logit model

Variable	Coefficient
current marine quality	1.1353***
improved marine quality	1.6161***
current terrestrial quality	0.6645***
improved terrestrial quality	1.1075***
crowdedness	-0.2192***
time for booking	-0.0197***
entrance fee	-0.0048***
constant	-2.3391***
Number of observations	2411
McFadden R^2	0.19
AIC	1.3838
Log likelihood	-1660

*Notes: *** stands for significance at the 1% level. Source: Botzen (2014)*

Table 10 shows the results of a standard logit model. All coefficients are highly statistically significant (at the 1%), meaning that they differ from zero, meaning that we can state that they influence the choice for a specific scenario. All coefficients have the expected sign. In particular, the utility of environmental protection is positively related with marine and terrestrial quality, and negatively related with crowdedness, time required to book in advance and the entrance fee. Moreover, the utility of improved marine and terrestrial quality is higher than keeping these attributes at constant levels.

Next, more advanced models are estimated to test and relax some of the assumptions that underlie the standard logit model. This is done in two steps. First, a panel error correction logit model is estimated. While the standard logit model assumes that the error terms of the model are independent, the panel model accounts for possible dependence between errors for each individual. In other words, the panel model accounts for the fact that each respondent answered six choice cards, meaning that not every observation in the data is independent as the standard model assumes. Moreover, an error correction component was included by adding a normally-distributed zero mean error correction component, which allows for different variances of the environmental protection alternatives and the opt out option (Scarpa et al., 2007). The standard deviation of this error component appear to be statistically significant, which implies a considerably larger variance of the utility specification of the environmental protection alternatives than of the opt out. This is in line with others who find that the variance of utility of hypothetical alternatives is larger than the opt out, which has been called the 'status quo' effect in choice experiments (Hess and Rose, 2009; Hu et al. 2009; Botzen and van den Bergh, 2012; Botzen et al., 2013).

Second, random distributions of the parameters of the attributes were added to the model, resulting in a panel error correction mixed logit model. These random distributions can detect the presence of significant heterogeneity of preferences between respondents. Following common practice, uniform distributions were specified for coefficient of dummy variables and normal distributions were specified for the continuous variables crowdedness and time required for booking in advance (e.g. Train, 2003). The parameters of these latter two variables appear to have significant standard deviations, while no significant preference heterogeneity exists (at the 5% significance level) for the coefficients of the other variables. Therefore, the final attribute only model was estimated[2] using a panel error correction mixed logit model that only models preference heterogeneity for the attributes crowdedness and time required for booking in advance, while the other variables are specified as having non-random parameters.

Table 11 shows the results of this final attributes only model. This model provided a better fit of the data than the standard logit model, as is reflected by a lower AIC and higher pseudo-R^2. Overall the pseudo-R^2 vale of 0.42 reflects a good fit for this type of models (Train, 2003). The main results are similar to the findings of the standard logit

[2] This model was estimated using simulations of 1,000 halton draws (e.g. Train 2003).

model. In addition, the results show that the standard deviations of the error correction component and of the coefficients of crowdedness and time required to book in advance are highly statistical significant. In other words, respondents' preferences for these attributes exhibit significant heterogeneity.

Table 11 Attributes only model results estimated by a panel error correction mixed logit model

Variable	Coefficient
current marine quality	1.3587***
improved marine quality	1.9784***
current terrestrial quality	0.7898***
improved terrestrial quality	1.3103***
crowdedness	-0.2661***
time for booking	-0.0245***
entrance fee	-0.0057***
constant	-5.1063***
standard deviation of the error component	2.6922***
standard deviation of the coefficient of crowdedness	0.3865***
standard deviation of the coefficient of time to book	0.0570***
Number of observations	2411
McFadden R^2	0.42
AIC	1.2850
Log likelihood	-1538

*Notes: *** stands for significance at the 1% level. Source: Botzen (2014)*

Complete Model Results Galapagos

A variety of models have been estimated to examine how preferences for the attributes differ with respect to various socio-economic and other characteristics of the respondents. This is done by including interactions of these variables with the attributes, and testing whether such interactions are statistically significant. Table 12 shows the results of a panel error correction mixed logit model with only significant interactions, meaning that variables with insignificant interactions terms were excluded from this model.[3]

[3] The following variables have been tested in order to know if they have an influence on preferences for the attributes, which turned out to be having insignificant effects: (not) having a local tour guide, being a national resident, total undertaken diving and snorkeling sessions, numbers of days and times the respondent visited the Galapagos, education level, age, current fee and gender.

Table 17 defines the variables for which interactions turned out significant. Several additional insights result from the complete model shown compared with the attribute only model results. In particular, respondents with children place a lower value on marine quality. These respondents may engage less often in diving activities. Moreover, the significant interactions with the fee variable show that the effect of placing the CV question before the choice experiment is to increase sensitivity to price. In other words, respondents who answered the CV question first are more price-conscious and have a lower WTP. This is in line with the expected anchoring effect presented at the beginning of this thesis. Moreover, respondents with higher than average income have smaller coefficients of the fee, meaning that they have on average higher WTP values.

Table 12 Complete model results estimated by a panel error correction mixed logit model that includes significant interactions with the attributes and respondent characteristics

Variable	**Coefficient**
current marine quality	1.5810***
current marine quality × children	-0.1847***
improved marine quality	2.2779***
improved marine quality × children	-0.1829*
current terrestrial quality	0.8851***
improved terrestrial quality	1.4582***
crowdedness	-0.2512***
time for booking	-0.0238***
entrance fee	-0.0067***
entrance fee × contingent valuation effect	-0.0022***
entrance fee × high income	0.0033***
constant	-4.9749***
standard deviation of the error component	2.6686***
standard deviation of the coefficient of crowdedness	0.3946***
standard deviation of the coefficient of time to book	0.0640***
Number of observations	2197
McFadden R^2	0.44
AIC	1.2508
Log likelihood	-1359

*Notes: ***,**,* stands for significance at the 1%, 5% and 10% level. Source: Botzen (2014)*

It is interesting to see whether anchoring effects also work the other way around; in other words, whether the CE has an influence on the CV values. The results of a T-test are presented in table 13. The table indicates that the average CV value for questionnaire version two is indeed higher when compared with the average CV value for questionnaire version one. Nevertheless, the T-test has not shown to be significant, which is why, based on these results, it cannot be stated with confidence that respondents who answered the contingent valuation question after the CE were influences by the payment vehicle in the CE, making them less price-conscious and giving higher CV values.

Table 13 CV values dependent on questionnaire version (no significant difference between groups with 90% confidence intervals)

	Mean	Count	Std. Deviation	Std. Error Mean	Median	Minimum	Maximum
Version 1	81.8	125	140.8791	12.6006	50	2	1000
Version 2	104.49	145	104.2762	8.6597	70	3	500
Total	**93.985**	**270**	**122.874**		**50**	**2**	**1000**

Table 14 shows the maximum WTP values of respondents for the attribute levels according to the complete model. The results are split according to the CV effect on WTP (questionnaire version). The column "with contingent valuation" effect presents the WTP results of the questionnaire version in which the CV question is placed before the CE. This resulted increase in price consciousness causes substantially lower WTP values as the comparison with the second column shows.

Table 14 Willingness-to-pay (WTP) values per attribute based on the complete model

Variable	WTP with contingent valuation effect	WTP without contingent valuation effect
current marine quality	192 USD	272 USD
improved marine quality	286 USD	405 USD
current terrestrial quality	119 USD	168 USD
improved terrestrial quality	195 USD	277 USD
crowdedness	-33 USD per 100,000 visitors	-47 USD per 100,000 visitors
time for booking	-3 USD per month	-5 USD per month

Source: Botzen (2014)

Coding of the Variables

Table 15 Variables of the attributes of the choice experiment

Variable	Description
current marine quality	Dummy variable, 1=keep marine quality at current levels, 0=otherwise
improved marine quality	Dummy variable, 1=improve marine quality, 0=otherwise
current terrestrial quality	Dummy variable, 1=keep terrestrial quality at current levels, 0=otherwise
improved terrestrial quality	Dummy variable, 1=improve terrestrial quality, 0=otherwise
crowdedness	Continuous variable, number of tourists per 100,000
time for booking	Continuous variable, time required to book in advance in months
fee	Continuous variable, fee in USD

Source: Botzen (2014)

Table 16 Variables with insignificant interactions with the attributes of the choice experiment

Variable	Description
no local guide	Dummy variable, 1=respondent did not have a local tourist guide, 0=otherwise
national resident	Dummy variable, 1=respondent is a resident from Ecuador, 0=otherwise
total diving and snorkelling sessions	Continuous variable of the number of diving and snorkelling sessions during stay on the Galapagos
days visit	Continuous variable of the number of days that the respondent visited the Galapagos
times visit	Continuous variable of the number of times that the respondent has visited the Galapagos
female	Dummy variable, 1=respondent is female, 0=male
discounted current fee	Dummy variable, 1=respondent currently paid a lower fee than 100 USD, 0=respondent paid 100 USD
university education	Dummy variable, 1=highest completed education level is a university degree
age	Continuous variable of age of the respondent in years

Source: Botzen (2014)

Table 17 Variables with significant interactions with the attributes of the choice experiment

Variable	Description
contingent valuation effect	Dummy variable, 1=questionnaire version in which the contingent valuation question was included before the choice experiment, 0=questionnaire version in which the contingent valuation question was included after the choice experiment
high income	Dummy variable, 1=respondent income is above average (>4000 USD net income per month), 0=otherwise
children	Continuous variable of the number of children of the respondent

Source: Botzen (2014)

Annex B - The Galapagos' ecosystems and their goods and services

This annex describes the ecosystems that contribute significantly to the national economy and from which this contribution will substantial change when nature degrades. Four ecosystems are identified with their goods and services[4] delivering benefits to the community of Galapagos. The four ecosystems are open waters, coral reef patches and rocky reefs, littoral zone and terrestrial vegetation. Note that additional scoping is needed to determine more specific ecosystems that need to be included.

1. Due to the rich ocean currents the **open waters** around the Galapagos Islands are abundant in pelagic species including sharks and marine mammals. These species are of significant importance for tourism and (illegal) fisheries.

2. The **coral reef[5] patches and rocky reefs** on volcanic ground in coastal water are important to these islands. This ecosystem provides a source of income for the island's coastal communities through tourism and fishing. Coral reefs contain a wealth of biodiversity and are a vital and valuable natural resource. Coral reefs nurse numerous culturally and economically significant fish and coral species and produce ornamental resources. They play a role in protecting coastlines from erosion, flooding and storm damage[6]. These coral reefs patches are nurseries for commercial fish species, regional biodiversity, and research and dive tourism. Coral reefs contain biochemical, natural medicines, pharmaceuticals, and genetic resources.

3. The **littoral zone** includes mangroves, beaches and lagoons and is an important habitat for the nursery of many marine species and offers an extremely important habitat for small animals for instance invertebrates like mollusks and crabs, which make the coastal habitats important foraging areas for birds. The coastal ecosystem protects the islands by functioning as natural windbreaks and the roots of the tree stabilize the sand, thus helping to prevent beach erosion. This is important to protect all economic development such as tourist resorts, agriculture and residential and business properties.

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[4] The Millennium Ecosystem Assessment (MA) recognizes certain main ecosystem types and principal services that each provides. MA identifies as an ecosystem an Island and as services from this ecosystem: food, biodiversity regulation, air quality and climate, cultural and amenity (Bishop et al., 2004).

[5] Functions from coral reefs are for example accretion of calcium carbonate, accumulation of organic matter and sediment, recycling of nutrients and organic matter, consumption of suspended organic matter, production of sediment e.g. parrotfish droppings, slow or divert water currents and protection from storm damage by reducing wave energy.

[6] Healthy reefs and mangroves can absorb 70% - 90% of the energy in wind-generated waves, thus protecting shorelines from storms and hurricanes. (Braat et al., 2008).

4. The **terrestrial vegetation** can be divided into three different types: dry zones, transition zones and humid zones. Although the dry areas are most common on the archipelago all zones function as important habitats for the endemic and other species that are so important for the biodiversity of the Galapagos. These attract tourists and the rich forests have a cultural value; it gives its residents a sense of pride and offer recreational possibilities. Other benefits that can be derived are spiritual and religious benefits, knowledge and education, social traditions, inspiration, and aesthetic benefits.

Annex C - Threats to the Ecosystem Services of the Galapagos

Direct benefits of ecosystems to humans such as food, clean water, protection against flood, and aesthetic experiences all depend on biodiversity, as does the productivity and stability of natural systems. In the report of Braat and ten Brink (2008) 'Cost of Policy Inaction', biodiversity is defined as the diversity of species, populations, genes but also communities, and ecosystems. This report sums up losses of biodiversity worldwide and some of them are described beneath:

- The human caused rate of species extinction is estimated to be 1,000 times more rapid than the "natural" rate of extinction (Millennium Ecosystem Assessment, 2005).
- 60% of the Earth's ecosystem services that have been examined have been degraded in the last 50 years, with human impacts being the root cause (Millennium Ecosystem Assessment 2005).
- Around 20% of world's coral reefs have been effectively destroyed by fishing, pollution, disease and coral bleaching (Braat and ten Brink, 2008).
- Current rates of species extinction are at least two orders of magnitude above background rates and are expected to rise to at least three orders above background rates while 20% of all species in those groups that have been comprehensively assessed are believed to be threatened with extinction in the near future (Millennium Ecosystem Assessment, 2005).
- The ratio of fish caught for each 'unit of effort' is estimated to have declined by up to 70% over these two decades (CARSEA,[7] 2007).

Through stakeholder consultation and literature review, some specific threats for the Galapagos Islands are identified and described beneath:

- Population and tourism growth causes an increasing pressure on all ecosystems of the Galapagos archipelago.
- Physical impacts from anchors, boat groundings, and divers have an adverse effect on reefs.
- Degradation of ecosystem services caused by recreation, such as waste on beaches, and not careful recreational boating.
- Poaching by fisherman on pelagic species, sharks and sea cucumbers. The use of illegal fishing gear, especially long lining.

[7] In 2004 Caribbean Sea Ecosystem Assessment (CARSEA) has been conducted as a sub-global assessment of the Millennium Ecosystem Assessment, which measured the economic valuation of total Caribbean reefs in two areas: tourism and fisheries, more information at www.thecropperfoundation.org/carsea.

- Invasive species in terrestrial and in marine environments contribute to biodiversity loss of native and endemic species.
- Land based sources of pollution, sewage discharge, agricultural runoff, sewage and waste of ships into the surrounding ocean.
- Additional threats of warming seas, fiercer storms, sea-level rise, and other climate-related changes loom on the horizon, causing less resilient reefs and other harmful effects such as coral bleaching and disease incidence. Also ocean acidification caused by rising atmospheric carbon dioxide levels may hinder coral growth and regeneration going forward (Orr et al., 2005).

The ecosystems are very vulnerable and diverse set of causes makes the ecosystems less resilient against natural disasters or disease outbreaks.

Annex D - Classification and Methodology Ecosystem Service Valuation

The classification of the ecosystem services that will be used in this research is the classification from the Economics of Ecosystem and Biodiversity (TEEB) as defined in their 2008 interim report derived from the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2005):

- Provisioning services (products obtained from ecosystems, such as food and building materials)
- Regulating services (benefits obtained from regulation of ecosystem processes, such as erosion control and storm protection)
- Cultural services (nonmaterial benefits obtained from ecosystems, through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences)
- Supporting (services that are necessary for the production of all other ecosystem services, such as nursery service and gene pool protection)

It is often not possible to make a fully consistent classification, especially for supporting and regulating services. It will be dependent on the island and is therefore always context specific. Also note that this study only aims to value the ecosystem services related to tourism. Essential for valuation of the ecosystem services related to tourism, is to find ways to measure benefits which do not enter markets and so have no directly observable monetary benefits. Therefore different approaches have been developed to assign a value. Van Beukering et al. (2007) define two important concepts:

Willingness to Pay (WTP) and Willingness to Accept (WTA). Economic value can be measured by the amount of money an individual is willing to pay or the minimum amount of money an individual requires in order foregoing a good or service.

The Total Economic Value divides the value of ecosystem goods and services into use and non-use values. Use values are divided into direct use, indirect use and option values. Non-use values are option, existence and bequest values. While direct use values comprise consumptive uses and non-consumptive uses[8]. See Figure 21 for an overview of the composition of Total Economic Value.

[8] Consumptive or extractive use refers to utilization of resources that are not returned to the ecosystem from which the resource is withdrawn. Non-consumptive or non-extractive uses utilize the services of an ecosystem without extracting any elements from that ecosystem. (Source: van Beukering et al. 2007)

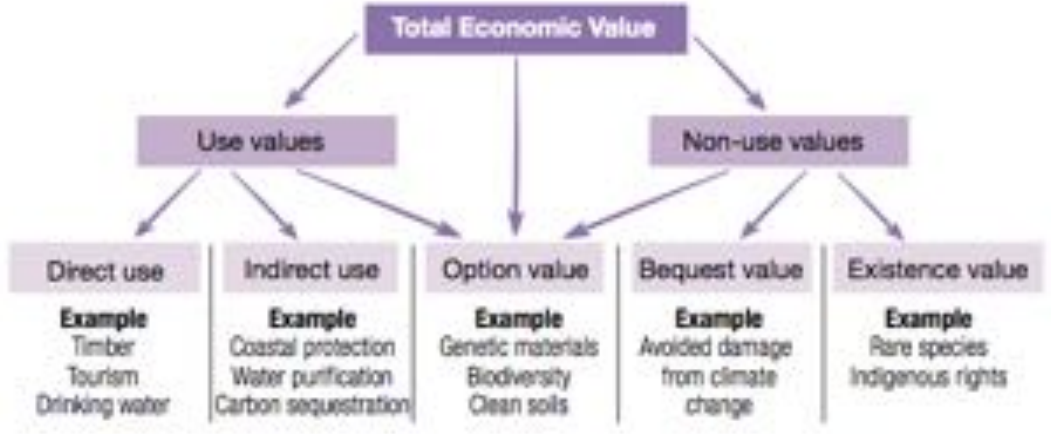

*Figure 21 The composition of Total Economic Value (*Source: Beukering et al. 2007)

Examples of the different values are:

- Direct use consumptive value: food, such as fish.
- Direct use non-consumptive value: recreation on the beach.
- Indirect use: coastal protection.
- Option value: preserving use of ecosystem goods and services for the future.
- Bequest value: value for future generations.
- Non-use value: value humans place on the knowledge that a resource exists (existence value).

To estimate the value of changes in the provision of environmental goods and services, environmental economists have developed a number of valuation methods:

- *Direct market price methods* where markets for environmental goods and services exist.
- *Revealed preference methods*, based on actual consumer or producer behavior. Specific methods are: replacement costs, damage cost avoided, mitigating expenditure, net factor income, production function method, hedonic pricing method and travel cost method.
- *A stated preference method elicits* information concerning environmental preferences from individuals through the use of surveys, questionnaires, and interviews. Specific methods are: Contingent valuation and Choice modeling (conjoint analysis).
- *Value transfer*, estimation of value of environmental good or service based on the results of valuation studies of environmental services at other locations.

Note however, that there is a high degree of uncertainty in most economic valuation studies. The accuracy of the analysis is of course dependent on the availability of good data. Therefore sensitivity analysis is executed. Also attention should be paid to the assumptions made and the caveats attached to their results.

For more information on socio-economic valuation of ecosystem goods and services on small islands the following book is recommended: ‘Valuing the Environment in Small Islands - An Environmental Economics Toolkit’ by van Beukering et al. (2007).

Annex E - Example Card Choice Experiment

EXAMPLE CARD

	Option A	Option B	Option C
Additional fee per visit	 $400 per person per visit	 $50 per person per visit	$0 per person per visit
Number of marine species	 Higher	 No change	 Lower
Number of land species	 Higher	 No change	 Lower
Number of visitors per year	 100,000 visitors (decrease)	 400,000 visitors (increase)	 400,000 visitors (increase)
Time necessary to book in advance	 24 months	 6 months	 No time necessary to book in advance

Annex F - Additional tables and figures survey Findings

Table 18 Liveaboard and Stay-over tourist distribution

	Liveaboard	***Stay-over***	***Total***
Count	*129*	*294*	*423*
Percentage	*30.5%*	*69.5%*	*100%*

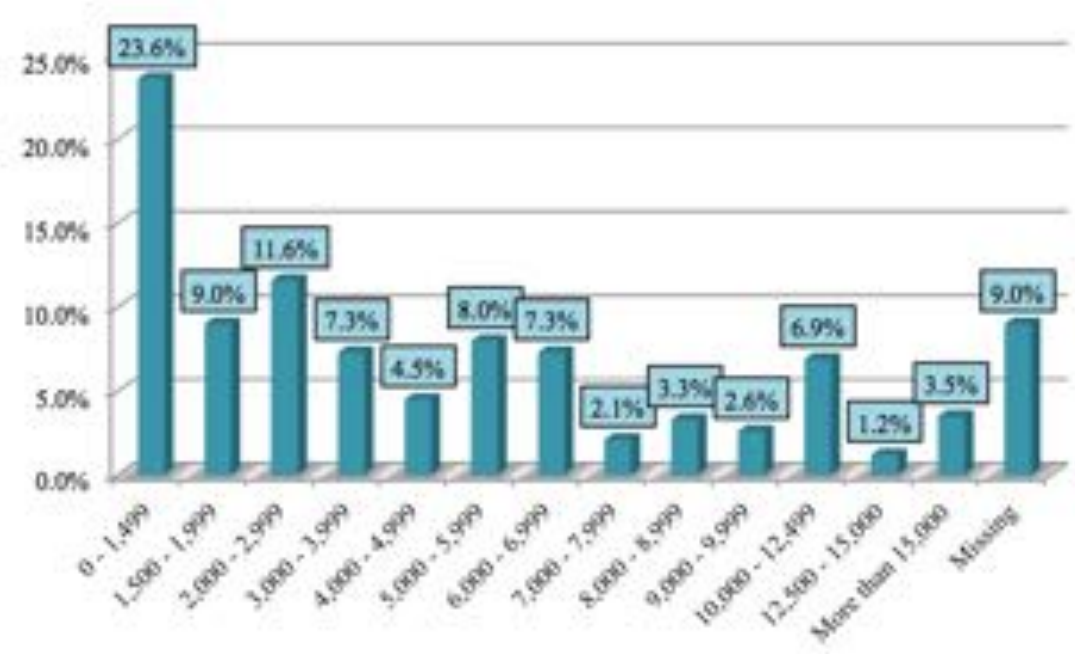

Figure 22 Distribution of the sample based on income

Table 19 Place of stay (because various respondents stayed on more than one island, the total exceeds the number of total respondents - 423)

	Count	***Percentage***
Santa Cruz	*275*	*39.7%*
San Cristóbal	*147*	*21.2%*
Isabela	*128*	*18.5%*
Floreana	*13*	*1.9%*
Liveaboard	*129*	*18.6%*
Total	***692***	*100%*

Table 20 Environmental awareness for nationals and non-nationals (average of ranking)

	Nationals	***Non-nationals***	***Total***
Threat: Invasive / introduced species	*4.56*	*4.54*	
Threat: Human development	*4.23*	*4.55*	
Threat: Climate change	*3.94*	*4.25*	
Threat: Impact from fishing	*3.86*	*4.00*	
Threat: Increase of tourism	*3.69*	*4.24*	
Threat: Ships (anchoring, etc.)	*3.81*	*3.88*	
Threat: Water sports	*2.49*	*2.62*	
Threat: Other	*.*	*4.90*	
Total	*90*	*331*	*421*

Table 21 Answers to question: "Were you happy with the local guide that provided information about the natural environment?"

	Yes	***No***	***Did not have a local guide***	***Total***	***Missing***	***Total***
Count	*276*	*42*	*104*	*422*	*1*	*423*
Percentage	*65.2%*	*9.9%*	*24.6%*	*99.8%*	*0.2%*	*100%*
Total tourists with guide	***318***	*.*	***104***	***422***	***1***	***423***
Percentage	*75.2%*	*.*	*24.6%*	*99.8%*	*0.2%*	*100%*
Valid percentage	***75.4%***	*.*	***24.6%***	***100%***		
Liveaboard	*106*	*18*	*4*	*128*	*1*	*129*
Percentage	*82.8%*	*14.1%*	*3.1%*	*99.2%*	*0.8%*	*100%*
Stay-over	*170*	*24*	*100*	*294*	*.*	*294*
Percentage	*57.8%*	*8.2%*	*34.0%*	*100.0%*	*.*	*100%*

Table 22 Return for nationals and non-nationals

	Nationals	***Non-nationals***	***Total***
1st time	*53*	*315*	*368*
	58.9%	*95.5%*	*87.6%*
Returned	*37*	*15*	*52*
	41.1%	*4.5%*	*12.4%*
Total	*90*	*330*	*420*
	100%	*100%*	*100%*
Total	*90*	*330*	*420*
			(Missing: 3)
	21.4%	*78.6%*	*100%*

Table 23 Times visited the Galapagos for nationals and non-nationals

	Nationals	***Non-nationals***	***Total***
1st time	*53*	*315*	*368*
	58.9%	*95.5%*	*87.6%*
2nd time	*21*	*13*	*34*
	23.3%	*3.9%*	*8%*
3rd time	*10*	*0*	*10*
	11.1%	*0.0%*	*2.4%*
4th time	*5*	*0*	*5*
	5.6%	*0.0%*	*1.2%*
5th time or more	*1*	*2*	*3*
	1.1%	*0.6%*	*0.7%*
Total	*90*	*330*	*420*
	100%	*100%*	*100%*
Total	*90*	*330*	*420 (Missing: 3)*
	21.4%	*78.6%*	*100%*

Table 24 SPSS T-test output for total daily expenses (including daily package deal expenses) of national and non-national tourists

Group Statistics

	Place of residence (national vs. non-national)	N	Mean	Std. Deviation	Std. Error Mean
RECODE.TOTAL. Expenditures. per.person.per. day. includingpackages	1.00	90	138.9496	112.11723	11.81819
	2.00	333	327.9983	364.38165	19.96799

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									99% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
RECODE.TOTAL. Expenditures. per.person.per. day. includingpackages	Equal variances assumed	32.144	.000	-4.856	421	.000	-189.04872	38.92724	-289.77520	-88.32224
	Equal variances not assumed			-8.148	415.256	.000	-189.04872	23.20324	-249.09222	-129.00522

Table 25 SPSS T-test output for total daily expenses (including daily package deal expenses) of liveaboard and stay-over tourists

Group Statistics

	Liveaboard trip	N	Mean	Std. Deviation	Std. Error Mean
RECODE.TOTAL Expenditures. per.person.per. day. includingpackages	1.0	129	505.3211	452.81315	39.86798
	.0	294	192.3214	208.21818	12.14353

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									99% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
RECODE.TOTAL Expenditures. per.person.per. day. includingpackages	Equal variances assumed	42.384	.000	9.744	421	.000	312.99977	32.12207	229.88208	396.11746
	Equal variances not assumed			7.510	152.280	.000	312.99977	41.67638	204.28693	421.71261

Table 26 SPSS T-test output for CV values based on national and non-national tourists

Group Statistics

	Place of residence (national vs. non-national)	N	Mean	Std. Deviation	Std. Error Mean
Max Amount WTP	1.0	56	16.179	13.0218	1.7401
	2.0	214	114.346	130.4436	8.9169

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									99% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Max Amount WTP	Equal variances assumed	27.570	.000	-5.617	268	.000	-98.1672	17.4777	-143.5096	-52.8249
	Equal variances not assumed			-10.805	228.250	.000	-98.1672	9.0851	-121.7662	-74.5682

Table 27 SPSS T-test output for CV values based on questionnaire version

Group Statistics

	Questionnaire version	N	Mean	Std. Deviation	Std. Error Mean
Max Amount WTP	1.0	125	81.800	140.8791	12.6006
	2.0	145	104.490	104.2762	8.6597

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									90% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Max Amount WTP	Equal variances assumed	.034	.854	-1.517	268	.131	-22.6897	14.9608	-47.3834	2.0041
	Equal variances not assumed			-1.484	225.480	.139	-22.6897	15.2894	-47.9422	2.5629

Table 28 Preferred organizations to manage the collected funds for the respondents willing to pay from the CV question

	Count	*Percentage*
The local Government	15	*5.4%*
The central Government of Ecuador	16	*5.8%*
The Galapagos National Park (GNP)	194	*70.0%*
Other non-profit organizations	38	*13.7%*
Other	0	*0.0%*
Don't know / no preference	14	*5.1%*
Total answered question	277	*100%*
Total WTP	269	

Table 29 Main reason why respondent is not willing to pay to improve the environment of the Galapagos

	Count	*Percentage*
No need for additional management of nature	2	*1.3%*
Conservation is the responsibility of Ecuador	10	*6.7%*
My activities have no impact on nature	3	*2.0%*
Current environmental management on the Galapagos is not effective	7	*4.7%*
I cannot afford it	11	*7.4%*
I pay enough already	107	*71.8%*
Other	9	*6.0%*
Don’t know / refused	0	*0.0%*
Total answered question	149	*100%*
Total not WTP	152 (Missing: 3)	

Table 30 Influence of the attributes on the choices in the choice experiment (Answer to the question: "In making your choices, how important were the following items to you?")

	Total mean	Count		
Importance: Marine species	4.575	416		
Importance: Land species	4.428	416		
Importance: Number of visitors	3.623	416		
Importance: Additional Entry fee	3.466	416		
Importance: Book in advance	2.808	416		
	Nationals	**Non-nationals**	**Liveaboard**	**Stay-over**
Importance: Marine species	4.563	4.578	4.592	4.567
Importance: Land species	4.471	4.416	4.464	4.412
Importance: Additional Entry fee	4.08	3.304	3.072	3.636
Importance: Number of visitors	3.632	3.62	3.776	3.557
Importance: Book in advance	3.103	2.729	2.904	2.766

Annex G - CBA NPV results

Table 31 Scenario 1: 0 growth

Costs		**Benefits**	
Type	**NPV (Million USD)**	**Type**	**NPV (Million USD)**
Management costs (salary of 2 Support Public Servants-1, Administrative Assistants)	0.4	WTP Crowdedness - liveaboard	-26.6
CO2 emissions	405.8	WTP Crowdedness - stay-over	-61.4
Subsidies on electricity	151.6	WTP Marine Species - liveaboard	186.2
Subsidies on fuel for transport	14.5	WTP Marine Species - stay-over	428.5
		WTP Terrestrial species -liveaboard	87.2
		WTP Terrestrial species -stay-over	194.1
		WTP Booking in advance -liveaboard	-32.3
		WTP Booking in advance -stay-over	-89.8
		Management fees	152.6
		Income tourism sector	2172.7
		Income other selected sectors	3004.0
Total costs	**572.3**	**Total Benefits**	**6015.1**
B/C ratio	**10.51**		

Table 32 Scenario 2: Moderate growth

Costs		**Benefits**	
Type	**NPV (Million USD)**	**Type**	**NPV (Million USD)**
Management	0.0	WTP Crowdedness - liveaboard	-74.7
CO2 emissions	534.4	WTP Crowdedness - stay-over	-193.2
Subsidies on electricity	180.6	WTP Marine Species - liveaboard	205.6
Subsidies on fuel for transport	18.1	WTP Marine Species - stay-over	466.1
		WTP Terrestrial species -liveaboard	116.3
		WTP Terrestrial species -stay-over	267.2
		WTP Booking in advance -liveaboard	0.0
		WTP Booking in advance -stay-over	0.0
		Management fees	221.9
		Income tourism sector	1894.5
		Income other selected sectors	2698.1
Total costs	**733.1**	**Total Benefits**	**5602.0**
B/C ratio	**7.64**		

Table 33 Scenario 3: Rapid growth

Costs		**Benefits**	
Type	**NPV (Million USD)**	**Type**	**NPV (Million USD)**
Management	0.0	WTP Crowdedness - liveaboard	-176.1
CO2 emissions	789.2	WTP Crowdedness - stay-over	-487.1
Subsidies on electricity	244.8	WTP Marine Species - liveaboard	135.4
Subsidies on fuel for transport	28.8	WTP Marine Species - stay-over	252.9
		WTP Terrestrial species -liveaboard	153.7
		WTP Terrestrial species -stay-over	367.2
		WTP Booking in advance -liveaboard	0.0
		WTP Booking in advance -stay-over	0.0
		Management fees	362.7
		Income tourism sector	2051.1
		Income other selected sectors	2869.9
Total costs	**1062.8**	**Total Benefits**	**5529.7**
B/C ratio	**5.20**		

Annex H - CBA framework

Category	Variable	Source	Relation with other indicators	Unit
Economic indicators Tourists arrivals	Liveaboard	Mena et al. 2013		# People
	Stay-over	Mena et al. 2013		# People
	Total amount of tourists on Galapagos	Mena et al. 2013		# People
	National tourists	Mena et al. 2013		# People
	International tourists	Mena et al. 2013		# People
	-Cuenca Andina	Tourist survey		# People
	-Other international	Tourist survey		# People
Fossil fuels	Fuel consumption ground vehicles	Mena et al. 2013		Gal
	Fuel consumption inter-island boats (day trips)	Mena et al. 2013		Gal
	Electricity production from fossil fuels	Mena et al. 2013		Kwh
Residents	Total	Mena et al. 2013	$Residents_y=5.194.7+(0.110276*Tourists_y)$	# People
Environment				
Threats	Global C02 emissions (all activities)	Mena et al. 2013		Kg
State of the environment	Terrestrial species	Mena et al. 2013		Native

	abundance			species index
Acceptable Visitor Load (AVL) saturation	Total	Mena et al. 2013	(tourist arrivals) /AVL	Index
	Terrestrial	Mena et al. 2013	stay-over tourist arrivals) /Terrestrial AVL	Index
	Marine (Annual Occupation Cruise)	Mena et al. 2013	(live-aboard tourist arrivals)/Marine AVL	Index
Policy				
Management	Excess demand of visitors		Fast growth - zero growth	
	Waiting list zero growth		Difference between baseline tourist arrivals, capacity	Months
	Entrance fee (Nationals)	Tourist survey	Total national tourists * 6 USD	USD
	Entrance fee (internationals)	Tourist survey	Total international tourists * 100 USD	USD
	Entrance fee (Cuenca Andina)	Tourist survey	Total Cuenca Andina * 50 USD	USD
CBA				
Costs	Management costs (salary of 2 Support Public Servants-1, Administrative Assistants)	Website PNG	Waiting list	USD
	CO2 emissions	Mena et al. 2014, World Bank 2014	Tones C02 emissions (all activities) * 1 USD	USD

	Subsidies on electricity	DNPG 2008, Mena et. al	Kwh produced with fossil fuels* 0.23 USD (weighted average)	USD
	Subsidies on fuel for transport	DNPG 2008, Mena et. al	Fuel ground vehicles + inter-island boats * 1.41 USD (weighted average)	USD
	Total costs			**USD**
Benefits	WTP Crowdedness - liveaboard	Tourist survey	Tourist arrivals, residents	USD
	WTP Crowdedness - stay-over	Tourist survey	Tourist arrivals, residents	USD
	WTP Marine Species - liveaboard	Tourist survey	Tourist arrivals, total AVL saturation	USD
	WTP Marine Species - stay-over	Tourist survey	Tourist arrivals, Total AVL saturation	USD
	WTP Terrestrial species - liveaboard	Tourist survey	Tourist arrivals, terrestrial species abundance	USD
	WTP Terrestrial species - stay-over	Tourist survey	Tourist arrivals, terrestrial species abundance	USD
	WTP Booking in advance -liveaboard	Tourist survey	Tourist arrivals, excess demand	USD
	WTP Booking in advance -stay-over	Tourist survey	Tourist arrivals, excess demand	USD
	Management fees	Tourist survey	Tourist arrivals, entrance fees	USD
	Income tourism sector	Mentefectura 2014		$x1.000.000
	Income other selected sectors	Mentefectura 2014		$x1.000.000
	Total Benefits			**USD**

Annex I – Sensitivity Analysis

In order to assess whether the results of the CBA would be different if other discount rates would have been used, we carried out a sensitivity analysis using other discount rates. The sensitivity analysis should reveal whether the CBA results change if no discount rate is applied (i.e. looking at the short term) or if higher discount rates are used. The results of this sensitivity analysis are shown in Figure 23. The results demonstrate that the CBA results are robust. At present, the legal interest rate in Ecuador is 8.34% (Central Bank of Ecuador, 2014). Therefore, discount rates between 5% and 10% are considered acceptable in the context of this research. For all acceptable discount rates the favorable scenario is the No Growth scenario, followed by the Moderate Growth Scenario. The Rapid Growth scenario yields the lowest NPV up to a discount rate of 20%.

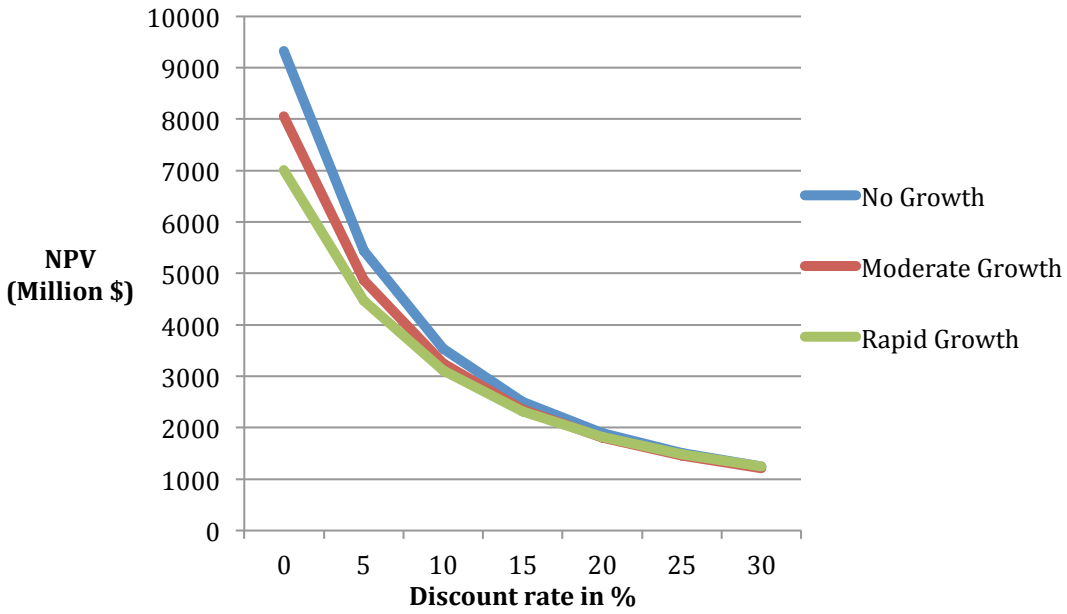

Figure 23 Sensitivity analysis of the NPV with regard to different discount rates.