Economical feasibility of the implementation of the Jardines de la Reina Nacional Marine Park.

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Introduction

Marine Protected Areas (MPAs) are passive management strategies, proposed to preserve and recover marine resources. Lately, MPAs have become one of the favorite tools for management, conservation and recovery of marine resources (Roberts *et al.*, 2001; Green and Donnelly, 2003 Sale, 2008).

MPAs provide a large array of benefits to both human and non-human components of marine ecosystems (Cesar, 2000). The benefits of MPAs protection might be divided in two large groups: those which impacts could be appreciated in extractive activities like fishing, and others that benefit contemplative activities like tourism. Many authors report that after MPAse declaration, fishing increased outside MPAs (McClanahan and Mangi, 2000; Roberts *et al.*, 2001), while others have observed an increase of fish density; biomass and richness inside and outside MPAs (Newman et. al., 2006, Pina-Amargós, 2008).

Socioeconomic studies play a fundamental role in the implementation, maintenance and not less important, the approval of MPAs by different stakeholders. That is why involving the main actors in those studies regarding the direct or indirect uses of resources and environmental services of MPAs, is very important.

Almost 200 articles about environmental functions or environmental goods and services (EGS) of coral reefs have been published until now. None the less, those articles referring to MPAs, where other ecosystems have been represented, are no more than a few dozens. In most cases, articles refer more to the evaluation of the environmental goods of extractive uses and less to socio – cultural services (Brander *et al*., 2007). Regarding the use of cost – benefit analyses to assess the economic feasibility of conservation (in this context the establishment of a MPAs), we have found only around 10 papers (Cesar *et. al*. 2000; Hodgson and Dixon, 2000; Angulo-Valdés, 2005).

In Cuba, only one economic evaluation of EGS of a MPAs has been published (Angulo-Valdés, 2005). This research presents a cost – benefit analysis, but does not take into account the cash flow for a certain time. Angulo-Valdés (2005) does not take into account that protection effects are ecologically variable. For that reason, economic analysis must be done from mid to long term. This study does not make a comparison with another area regarding the value of the EGS either, as no other investigation on the issue currently exists in the country. For this reason, it is very important to carry out economic feasibility studies for the establishment of a MPAs, because of its sensibility and high management costs.

In the case of valuation studies of EGS in the world, there is abundant literature, especially from the last 20 years. Many authors sustain that ecosystem management could not be successfully implemented without an appropriate evaluation of the EGS of ecosystems (Barbier *et al*., 2008). None the less, these studies are infrequent in the case of Cuba, (Gómez-País, 2002, Angulo-Valdés, 2005, Zequeira-Álvarez, 2008), this strengthens the importance of this kind of study to support decision making.

In the last 10 years, a lot of scientific information from Jardines de la Reina has been gathered, but this information mainly focuses on ecological issues. There is no research on the environmental benefits of ecosystems. This area is still pending approval as a National Park (JRNP), thus an analysis of economic benefits is compelling to determine the goods and services the area could generate as a result of the conservation of its natural resources (new management tools), evaluating in the long term if it is feasible or not.

MATERIALS AND METHODS

The Jardines de la Reina archipelago stretches from Cayo Bretón to Cabeza del Este, off the south central coast of Cuba (Figure 1). It is about 135 km long and comprises 661 keys. Since 1996, about 950 km^2 were declared as a Zone under Special Regime of Protection and Use (ZBREUP), under Resolution 562/96 of the Ministry of Fisheries, equivalent to the internationally known Marine Reserves. The Marine Reserve of Jardines de la Reina is the largest in the Caribbean Region (Appeldoorn and Lindeman, 2003).

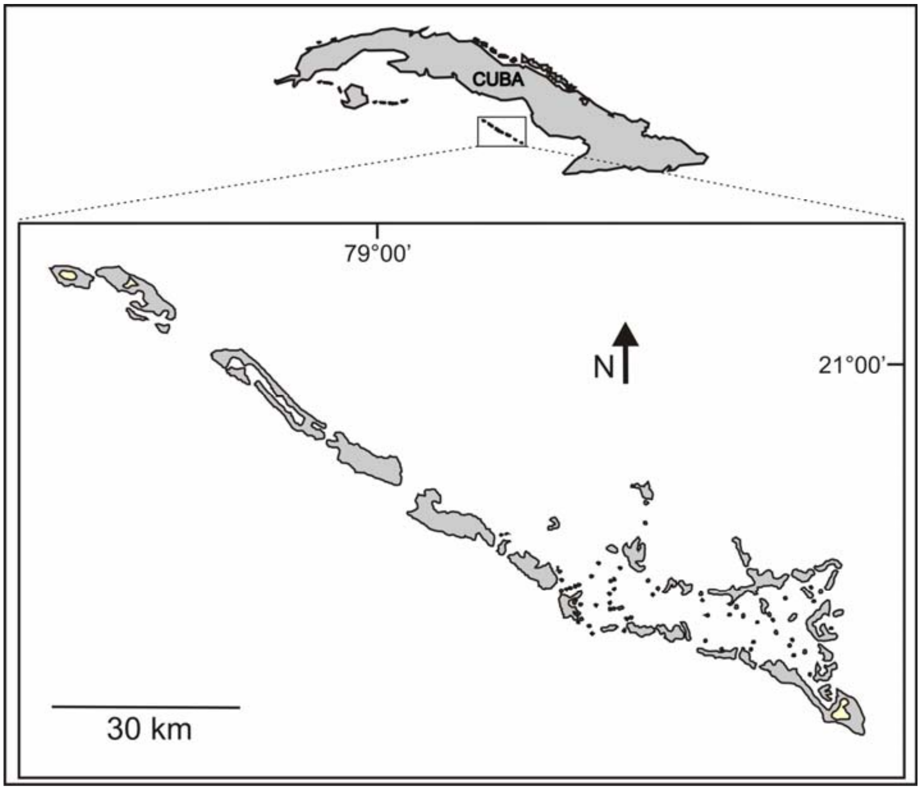

Fig. 1. Study Area, Jardines de la Reina Archipelago

The only kind of commercial fishing allowed in the area is that of spiny lobster *(Panulirus argus)*, while tourist activities are recreational fishing (mainly tarpon and bonefish) and SCUBA diving. Currently, the main users of the area are the Ministry of Food (formerly Ministry of Fisheries) (spiny lobster capture), and the Ministry of Tourism (MINTUR) (AZULMAR catch and release recreational fishing and SCUBA diving), the National Enterprise for the Protection of the Flora and the Fauna (land tenant) and the Ministry of Science, Technology and Environment (research activities, monitoring and management of the area by scientific institutions, mainly the Coastal Ecosystems Research Center).

The proposal of Jardines de la Reina as a National Park it is still pending approval by the Executive Committee of the Council of Ministers of the Republic of Cuba. From now on the study area will be referred as the Jardines de la Reina National Park (JRNP).

Cost – benefit methodology (Barzev and Jaime, 1999; Barzev, 1999, 2002; Angulo-Valdés, 2005) was used to evaluate whether the most feasible scenario is the current one or the future one. The future one aims at the implementation of new management and conservation tools and the improvement of tourism infrastructure in the

JRNP. To do that, the Net Present Value (NPV) (Zequeira Alvarez, 2008) was used, through the projection of a cash flow (Barzev and Jaime, 1999; Barzev, 1999, 2002) for a period of 15 years, with a discount rate of 10 %. This technique is defined by the following formula:

$$NPV = \sum_{t=0}^{i} (B_t^P + B_t^{NP} + B_t^{IE} + B_t^C + B_t^{Pr} + B_t^{PE} + B_t^E - C_t) / (1+r)^t$$

Where:
B_t^P – Fishery Benefits
B_t^{NP} – Non Fishery Benefits
B_t^{IE} – Educational and Research Benefits
B_t^C – Cultural Benefits
B_t^{Pr} – Process Benefits
B_t^{PE} – Ecosystem and population Benefits
B_t^E – Species Benefits
C_t – Conservation Costs
r – Discount Rate
i – Temporal Horizon

To calculate benefits for both scenarios, Total Economic Value Methods (Costanza *et al*., 1997; Gómez, 2002; Angulo-Valdés, 2005) were used. In this case, valuation methods that use market prices, the revealed willingness of consumers or the expressed willingness to pay was mixed.

EGS of the area were identified by revising area studies (CIEC, 2006 and Pina-Amargós, 2008) and through desk work with researchers (specialists on fishes, corals, marine and terrestrial flora, physical – and chemical processes). After that, EGS to be economically valuated were defined, starting from the information collected, choosing the most important ones. EGS were classified adapting the methodology from Dixon and Sherman (1990); Sobel (1996); Constanza (1997); Bohnsack (1998); Cesar (2000) and National Academy of Sciences (2001).

Different methods were used for the evaluation of EGS, like the Contingent Valuation method (Barzev 1999 and 2002, Hall and Murria, 2002), regarded in the literature as one of the most widely used methods (Brander *et al*. 2007); Travel Cost Method (Barzev, 1999 and 2002; Angulo-Valdés, 2005; Brander *et al*., 2007), Transfer Method (Angulo-Valdés, 2005, Brander *et al*., 2007) and the analysis of statistical and financial data from users of the area. Every calculation was made upon a year – basis period and was converted to USD taking in to account the official exchange rate in the country.

A questionnaire was applied using personal interviews; it is more direct and guarantees the quality of surveys, (time control, information presented, order of questions and use of visual materials). Questionnaires are open format and dichotomy format (Barzev et al., 1999; Babbie and Benaquisto, 2002). The segment of the market surveyed was that of foreigners visiting Jardines de la Reina. Sample was randomly chosen. Surveys were applied between May 2007 and July 2008.

Socio – economic information on extracting fishing activities in the area was obtained from data gathered by Júcaro and Santa Cruz del Sur fisheries. Information about AZULMAR was collected through open interviews to workers and administrative officers and from the financial data of the enterprise. Semi – structured interviews were performed to complement the information about tourism incomes, particularly from tips.

All the values used were converted to USD. Values referring to Cuban Pesos (CUP) and Cuban Convertible Pesos (CUC) were converted using the current exchange rate of Cuba. Benefits were calculated upon a year – period basis.

For Scenario I, fishing economic benefit was evaluated through finfishing. Calculation of this benefit was made taking into account the estimated amount of fish captured reported on a Pina-Amargós (2008) study regarding the catches of spiny lobster boats, private fishermen and AZULMAR. Total annual catch of the area is of 64 t. Out of them, 60 t are illegal capture and 4 t correspond to AZULMAR catch. In the case of spiny lobster boats and private anglers, the price used to calculate benefits was that of underground market ($ 10.00 Cuban Pesos per pound). In case of AZULMAR, the price used was $ 3.50 Cuban Convertible Pesos, corresponding to wholesale prices for enterprises (seafood market prices).

Second fishing economic benefit is spiny lobster catch. For this benefit, the annual average catch of spiny lobster in the area, (from 700 to 1 000 t) was taken in to account. To estimate this benefit, annual mean catch (850 t), multiplied by the average price of a ton (10 000.00 Cuban Convertible Pesos) was used. This is the international market price. Total amount includes the benefits anglers directly perceive.

Third economic fishing benefit is the spillover of species with high commercial value. This environmental service consists on fish movement through marine reserve limits, due to an abundance gradient (Pina-Amargós, 2008). To value this benefit, studies on fish movement were carried out by Pina-Amargós (2008). In this study, the exportation rate for two months in 1 km for high commercial value species was estimated. This rate was applied to the number of individuals that go out of the marine reserve perimeter (225 km) and the average weight of fishes from AZULMAR catch (Pina-Amargós, unpublished), resulting in a biomass export of 86 400 kg. The international market export price was used in this case.

SCUBA diving tourism and catch and release game fishing were identified in the case of non – fishing economic benefit. Income values from these activities were obtained from economical and financial data of AZULMAR enterprise between 2001 and 2007.

For non – economic benefits of scientific research, the most important projects in the zone were taken in to account. Estimations were made upon the basis of the project average budget for a year.

Two environmental services (Enhance aesthetic experiences and opportunities and Enhance conservation appreciation) were chosen to give value to cultural non – economic benefits. For the former, TCM adapted to this study were used. The average cost of an air ticket from and to the 16 countries which sent visitors to the area in 2007 was obtained from the travel agency related to AZULMAR. Data of the average package cost for anglers and divers in the area (accommodation, food, souvenirs, SCUBA diving or fishing gears, transfers, gratuities) were obtained from AZULMAR. The information about country of origin and number of visitors to the area corresponding to 2005, 2006 and 2007, were taken from financial data of the said enterprise. Values were calculated assuming that the number of visitors to the area will remain the same. (AZULMAR predicts an increase in the number of visitors).

In case of Enhance conservation appreciation, fees for fishing licenses were taken into account. This is the only charge to enjoy the environmental goods and services of the area ecosystems.

Four services were identified regarding abiotic components. The first one is mangrove as species refuge and protection. To valuate it, transfer methods according to Gómez – País (2002), made for mangrove ecosystems in Cuba were used. In this study, the average value proposed for this service is 190.8 USD/ha/year. Mangrove area of the JRNP was estimated in 13 500 ha.

The second benefit is the regulation of global climate, specifically through carbon sequestration. In this case, transfer methods were used too, including services from mangrove and oceanic systems. In a study by Costanza et al. (1997), authors proposed a value of 38.0 USD/ha/years for oceanic systems. The proposal of Gómez – País (2002), was taken in to account for mangrove ecosystems. In this study, benefits from carbon sequestration were estimated in 310.5 USD/ha/years. The area of the JRNP oceanic system has been estimated in 200 472 ha.

The third service is transformation, detoxification and sequestration of pollutants. Following the same methodology, Costanza *et.al.* proposed an index of 6.696 USD/ha/years for mangrove ecosystems.

The fourth service was allowed for suitable nutrients cycles and the same methodology was followed. Costanza *et.al.* proposed a 19.002 USD/ha/years index for sea grass contribution related with this service. In case of mangrove ecosystems, authors proposed an index of 118.0 USD/ha/ years for this service.

For ecosystem and population benefits, the environmental services of ensure biodiversity protection were identified. Value was assigned on account potential goods of unexploited mangroves. We worked with the study of Gómez-País (2002), where he proposes a minimum economical estimate for wood extraction of 68.9 USD/ha/years and for apiculture a minimum economical estimate of 90.8 USD/ha/ years.

In the case of Scenario II, the first economical benefit coincides with Scenario I (finfishing benefits). Estimates were made upon the basis of fish catch (4 t) by AZULMAR according to Pina-Amargós (2008). In this scenario we only took into account this catch because surveillance and access to the protected area will make impossible illegal catch. The wholesale price for enterprises (3.50 Cuban Convertible Pesos per kg) was used to make this calculation (price for companies without catch license).

Second fishing economic benefit is spiny lobster catch, like in Scenario I. We took into account the fact that with the conservation of the area and new protection measures for the species (spiny lobster is the species of highest commercial value in the JRNP), top catch will be maintained (1 000 t). To estimate international market average price, 10 000.00 Cuban Convertible Pesos per ton was used. The total amount includes direct benefits perceived by fishermen.

Third economic fishery benefit for Scenario II is the spillover of species with high commercial value. Values for Scenario I were calculated taking into account future increase of spillover resulting from new protection conditions in the area (catch decrease). Increase of spillover was calculated through the increase of fish abundance rate in the area, according to Alcolado *et al*. (2001) and to Pina-Amargós (2008). Assuming that mean weight of fishes would remain constant; we calculated spillover increase by multiplying the calculated abundance rate by the exportation rate in a year.

In the case of non – fishery economic benefits, SCUBA diving tourism and catch and release game fishing were identified. Values will be the same as in Scenario I.

For Non – economic benefits of research, the educational and research opportunity services were taken into account. The proposal to use the future National Park as a field station for PhD and Master dissertations and other research by foreign students, common practice in protected areas of the world was used in the case of educational services.

In the case of research services, two research projects to be undertaken in the zone in next few years were used. These projects will fill in the gaps of earlier investigations and research programs of the country, and priority lines of the Coastal Ecosystems Research Center (leading research institution in the protected area).

To value cultural non - economic benefits, two environmental services (enhance aesthetic experiences and opportunities and enhance conservation appreciation) like in Scenario I were assessed. In the case of the former, the information obtained from CVM and TCM, determining the average expenses of every visitor in the area were combined.

Through the CVM, the willingness of surveyed visitors to return and the average number of times were obtained. This number is higher than the proposal in Scenario II, where we only took into account the increase of divers resulting from the increase of accommodation capacity of tourism facilities. Still, the number of visitors continues to be lower than the carrying capacity of the destination, 320 divers per day (CIEC, 2006).

In the case of abiotic components, four services were identified: mangroves as refuge and protection for species, the regulation of global climate, specifically through carbon sequestration, allow for suitable nutrient cycles and transformation, detoxification and sequestration of pollutants. The value of these services was calculated like in Scenario I. The same process followed for valuation of population and ecosystem benefits in Scenario II.

For valuation of biotic components, four environmental services were identified:, prevent lost of protect keystone and dominant species vulnerable species, prevent lost of rare species and protection of long – lived species. In all four cases, valuation was made according to research sub – projects focusing on the study of species with certain features, to be undertaken in the next few years.

For protect keystone and dominant species, sub – projects for the study of the Black Urchin (*Diadema antillarum*) and Hogfish (*Lachnolaimus maximus*) were included. The first one is the controller of algal abundance on coral reefs, and of great importance for ecosystem health. On the other hand, the Hogfish is an indicator of fishery levels, as it is one of the most susceptible species to overfishing due to its behavior (Pina – Amargós, 2008).

Values of sub – projects of Whale Shark (*Rhincodon typus*) and Goliath Grouper (*Epinephelus itajara*), were used for prevent lost of vulnerable species. The Whale Shark is considered an endangered species and Goliath Grouper is classified as a critically endangered species according to UICN (Hudson and Mace, 1996).

To prevent lost of rare species, sub- projects for the study of insect species, sub – species of birds and potential mollusk species, all of them new for Cuba, were proposed.

Finally, for the protection of long – lived species, future investigations on Tarpon (*Megalops atlanticus*) and sharks were taken into account. Tarpon lives about 70 years (Andrews *et.al*, 2001) and sharks about 50 years (Compagno, 1984).

For the estimation of conservation cost, the classification of Dixon et al. (1993) and Pendletton (1995) was followed. They divided conservation costs into direct, indirect and opportunity costs. For Scenario I, tourism activities and research costs were included in the direct costs. For the opportunity cost, existing values calculated for Scenario II were taken, thus without conservation, all the environmental services could be lost. It is important to keep in mind that these values represent only a part of the truly existing value. In the case of indirect costs, non of both Scenarios were included, because fishing is the activity affected with the establishment of the Zone under Special Regimen of Use and Protection, and it is clear that fishing effort has not decreased, but has been moved to other fishing areas (sometimes even closer) which existed prior to restrictions. If there is any cost increase for some fishermen it is not of high importance. For Scenario II, conservation costs and tourism costs were calculated as direct costs, like in Scenario I. Among conservation costs, management of resources, protection of resources, capacity building, environmental education, scientific research, administration, construction and maintenance, and cooperation and collaboration were taken into account. Every value of conservation cost was taken from the 2004 Executive Management Plan for the protected area. In the case of opportunity cost, benefits not perceived by spiny lobster fishermen and private fishermen due to park regulations, were taken into account.

RESULTS

For the JRNP, 68 EGS were identified, 12 were evaluated for Scenario I and 17 for Scenario II (Table 1).

For Scenario I, the first fishery economic benefit calculated from finfishing was of 79.7 US yr^{-1} X 10^3. Second fishery economic benefit was the spiny lobster catch. This benefit was valuated in 8 500.0 US yr^{-1} X 10^3. Third fishery economic benefit was the spillover of high commercial value species. A benefit of 302.4 US yr^{-1} X 10^3 was obtained taking into account the price per kilogram of current fish exports.

In the case of non - fishery economic benefits, SCUBA diving tourism and catch and release sports fishing were identified. The incomes from those activities yield a total of 635.8 US yr^{-1} X 10^3. For research environmental services, a value of 5.2 US yr^{-1} X 10^3 was obtained.

For the cultural economic benefit, which included the enhance aesthetic experiences and opportunities service and enhance conservation appreciation a value of total travel cost of 3 194.0 US yr^{-1} X 10^3 was obtained for the first one and for the second 30.0 US yr^{-1} X 10^3, 500 corresponding to fishing annual licenses (50 Cuban Convertible Pesos each one).

In the case of abiotic components, specifically for protection and refuge for species, benefits obtained were of 5 577.0 US yr^{-1} X 10^3. In the case of global climate regulation, specifically through carbon sequestration, benefits total 11 811.7 US yr^{-1} X 10^3. On the other hand, benefits of transformation, detoxification and sequestration of pollutants, were valuated in 90.4 US yr^{-1} X 10^3. At least, benefits derived from allow for suitable nutrient cycles were of 25 973.9 US yr^{-1} X 10^3.

The total value of ecosystem and population benefits, from the environmental service of biological diversity maintenance, was of about 2 157.0 US yr^{-1} X 10^3.

For scenario I, the sum of economic benefits and non – economic benefits was of 12 747.1 US yr^{-1} X 10^3, and the sum of abiotic and biotic components of 42 610.0 US yr^{-1} X 10^3 (Table 2).

In the case of Scenario II, fishery economic benefits coincide with benefits of Scenario I. The total for Finfishing benefit was of 17.2 US yr^{-1} X 10^3. For spiny lobster fishery, the amount was of 10 000.0 US yr^{-1} X 10^3. In the case of the third fishery economic benefit, spillover of species with high commercial value, calculation was made using figures from Scenario I and the future spillover increase under protection conditions of the area was added. Value obtained was of 391.7 US yr^{-1} X 10^3.

For the non – fishery economic benefit was identified SCUBA diving tourism and catch and release sport fishing. Value was the same as in Scenario I, 635.8 US yr^{-1} X 10^3.

For the non – economic benefits of education and research, the environmental service of the former and the opportunity for PhD and Master dissertations and other investigations were taken into account. Currently, arrangements with foreign universities are in progress. Incomes calculated for this activity were around 43.8 US yr^{-1} X 10^3.

The amount corresponding to the investigation environmental service was estimated taken into account two research projects for the JRNP; and was of 610.0 US yr^{-1} X 10^3.

Benefits from enhance aesthetic experiences and opportunities services were of 5 125.5 US yr^{-1} X 10^3. The value regarding enhance conservation appreciation was the same as that of Scenario I.

Regarding abiotic components, benefits identified (mangroves as species refuge and protection, the regulation of global climate, specifically through carbon sequestration, allow for suitable nutrient cycles and transformation, detoxification and sequestration of pollutants), were the same as those of Scenario I, as well as for population and ecosystem benefits.

Benefits from biotic components services (protect keystone and dominant species, prevent lost of vulnerable species, prevent lost of rare species and protection of long – lived species) total 68.6 US yr^{-1} X 10^3.

For Scenario II, the sum of economic and non – economic benefits totals 16 854.0 US yr^{-1} X $10^3$and in the case of all the biotic and abiotic components, 42 678.6 US yr^{-1} X 10^3 (Table 3).

For conservation costs, following the classification by Dixon *et al*. (1993), and Pendletton (1995), they were divided into direct, indirect and opportunity costs. For Scenario I, these costs were of 629.8 US yr^{-1} X 10^3 (Table 4). For Scenario II (Table 5), conservation and opportunity costs were of 770.17 US yr^{-1} X 10^3.

Cash flow of Scenario I yielded a Net Present Value of 467.9 US yr^{-1} X 10^3 (Table 6), and Scenario II 501.6 US yr^{-1} X 10^3, (Table 7).

DISCUSSION

The 38 EGS identified for the JRNP strengthen the fact that environmental functions of ecosystems are very diverse; it could be said that infinite, because whenever we make an analysis of a natural resource it could have a new function or environmental service. The diversity of environmental functions strengthens the natural richness of the JRNP.

EGS of the highest market value or with enough information available were selected for both Scenarios, so that valuation methods could be applied. The number of benefits in a Scenario with conservation and management tools is higher. That is why conservation represents a desired scenario from the social and environmental points of view (de Groot, 2006).

For the assignment of value in both scenarios, methods and techniques proposed by other authors have been used, making the necessary adaptations to this study. Besides, we proposed several alternatives for estimating existence value services, which could be used in further studies.

The sum of biotic and abiotic components in Scenario I represents 77 % of the economic and non – economic benefits. These results strengthen the fact that no – use value of EGS exceeds use value. In the same way, figures obtained from Scenario II confirm this, because no – use value represents 72 % of the use value. It is important to say that the number of benefits identified or calculated in both categories is not the same. Nonetheless, differences between no – use value and use value are very high, as use value will never be higher than no – use value of EGS in any scenario. It is relevant that in Scenario II, use value exceeded in 4 106, 8 US yr^{-1} X 10^3 that of Scenario I. This means that direct benefits of the protected area could be higher, with protecting tools and appropriate management decisions.

In both scenarios, NPV is above cero, so financially speaking, both are feasible. Nonetheless, the difference of 33.8 US yr^{-1} X 10^6, between NPV of scenario II and Scenario I, indicates that under any circumstance, the establishment of a National Park in the Jardines de la Reina area is economically feasible, with all protection and conservation tools and the diversification of activities (tourism and research).

Results obtained are only a part of the Total Economic Value of Jardines de la Reina, because value was only assigned to relevant EGS.

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Table 1 Jardines de la Reina Environmental Goods and Services

TEV – Benefits from the Jardines de la Reina Marine Reserve						
Use Value				No Use Value		
Direct Use Value		Indirect Use Value		Option Value		Existence Value
Economic Benefits		Non - economics benefits		Abiotic Components		Biotic Components
Fishery	Non – fishery	Research and Educational	Cultural	Process	Populations and Ecosystems	Species
Finfishing	Tourism: Scuba Diving and Sports Fishing of catch and release	Educational Opportunities	Enhance aesthetic experiences and opportunities.	Protection against coastal erosion	Preserve natural communities Composition and functioning	Protect keystone and dominant species
Lobster catch	Trekking	Research	Interpretative Center	Protection and refuge for migratory Species and others	Ensure biodiversity protection	Prevent lost of Vulnerable species
Spillover of high economic value fish	Bird watch		Enhance conservation appreciation	Global Climate Regulation. Carbon sequestration	Pharmaceutical Potential	Sustain species presence and abundance
Raw Materials for medicines	Whale Sharks watch		Support cultural, religious and spirituals values	Avoid physical damage to habitats	Support communities life	Prevent lost of rare species
Raw Materials for souvenir and handicraft	Wildlife Photograph			Transformation, detoxification and sequestration of pollutants		Protection of long – lived species
Raw Materials for construction				Allow for suitable Nutrient cycles		Conservation of Ecosystems
Alive fishes and corals for aquarium				Sand Production		Educative and recreational Videos
				Exportation of Organic materials and plankton to pelagic food network		Protect genetic resources and biodiversity

Table 2. Scenario I. Current Benefits from Jardines de la Reina (in US yr^{-1} X 10^3)

TEV – Benefits from Jardines de la Reina						
Use Value				No Use Value		
Direct Use Value		Indirect Use Value		Option Value		Existence Value
Economics Benefits		Non - economics Benefits		Abiotic Components	Biotic Components	
Fishery	Non - Fishery	Research and Educational	Cultural	Process	Populations and Ecosystems	Species
I Finfishing	I Tourism: Scuba Diving and catch and release Sports Fishing	I Research	I Enhance aesthetic experiences and opportunities	I Protection and refuge for migratory and other Species	I Ensure biodiversity protection	
II Lobster catch			II Enhance conservation appreciation	II Global Climate Regulation. Carbon Sequestration		
III Spillover of high commercial value species				III Transformation, detoxification and sequestration of pollutants		
				IV Allow for suitable Nutrient cycles		
I 79,7	I 635,8	I 5,2	I 3194,0	I 2577,0	I 2157,0	
II 8500,0			II 30,0	II 11811,7		
III 302,4				III 90,4		
				IV 25973,9		
8882,1	**635,8**	**5,2**	**3224,0**	**40453,1**	**2157,0**	**-**
12747,1				**42610,0**		
55357,2						

Table 3. Scenario II. Jardines de la Reina Benefits after approval as a National Park with new management tools and accommodations. (US yr^{-1} X 10^{3})

TEV – Benefits from Jardines de la Reina						
Use Value				No Use Value		
Direct Use Value		Indirect Use Value		Option Value		Existence Value
Economics Benefits		Non - economics Benefits		Abiotic Components	Biotic Components	
Fishery	Non – fishery	Research and Educational	Cultural	Process	Populations and Ecosystems	Species
I Finfishing	I Tourism: Scuba Diving and Sport Fishing of catch and release	I Educational Opportunities	I Enhance aesthetic experiences and opportunities	I Protection and refuge for migratory Species and others	I Ensure biodiversity protection	I Protect keystone and dominant species
II Lobster catch		II Research	II Enhance conservation appreciation	II Global Clime Regulation. Carbon Sequestration		II Prevent lost of Vulnerable species
III Spillover of high commercial value species				III Transformation, detoxification and sequestration of pollutants		III Prevent lost of rare species
				IV Allow for suitable Nutrient cycles		IV Protection of long – lived species
I 17,2	I 635,8	I 43,8	I 5125,5	I 2577,0	I 2157,0	I 2,2
II 10000,0		II 610,0	II 30,0	II 11811,7		II 20,6
III 391,7				III 90,4		III 5,8
				IV 25973,9		IV 40,0
10408,9	**635,8**	**653,8**	**5155,5**	**40453,1**	**2157,0**	**68,6**
16854,0				**42678,6**		
59532,6						

Table 4. Conservation Cost for Scenario I. (US yr^{-1} X 10^3)

Costs for Scenario I	
Conservation Cost	**Figures/year**
Direct	
Scientific research	5.2
Tourism operation Costs	624.5
Total	629.8
Indirect	
Opportunity	
Overall Total	**629.8**

Table 5. Future Conservation Costs for Scenario II. (US yr^{-1} X 10^3)

Costs for Scenario II	
Conservation Cost	**Figures/year**
Direct	
Resource management	4.32
Resource Protection	11.47
Capacity building	3.48
Environmental education	3.12
Scientific research	6.84
Administration	40.58
Construction and maintenance	12.57
Cooperation and collaboration	0.74
Tourism operation Costs	624.54
Total	707.7
Indirect	
Opportunity	62.5
Overall Total	**770.17**
Tourism operation Investment (increase of accommodation capacities)	1 000.0
Research facility Investment (accommodation and laboratory for researchers and students)	347.8
Total Investments	**1 347.8**

Table 6. Cash Flow Scenario I.

Cash Flow for Scenario I with current benefits and costs (US yr^{-1} X 10^6)																
	Investment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Benefits		55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4	55,4
Costs		0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7
Net Cash Flow		54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7	54,7
Discount Factor		0,926	0,857	0,794	0,735	0,681	0,630	0,583	0,540	0,500	0,463	0,429	0,397	0,368	0,340	0,315
Discount Cash Flow		50,6	46,9	43,4	40,2	37,2	34,4	31,9	29,5	27,3	25,3	23,4	21,7	20,1	18,6	17,2
NAV		467,9														
Discount Rate		10%														

Table 7. Cash Flow Scenario II.

Cash Flow for Scenario II with benefits and costs from Jardines de la Reina after approval of the National Park with new management measures and accommodation facilities (US yr^{-1} X 10^6)																
	Investment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Benefits	-1,35	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5	59,5
Costs		0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Net Cash Flow	-1,3	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8	58,8
Discount Factor		0,926	0,857	0,794	0,735	0,681	0,630	0,583	0,540	0,500	0,463	0,429	0,397	0,368	0,340	0,315
Discount Cash Flow	-1,3	54,4	50,4	46,6	43,2	40,0	37,0	34,3	31,7	29,4	27,2	25,2	23,3	21,6	20,0	18,5
NAV		501,6														
Discount Rate		10%														