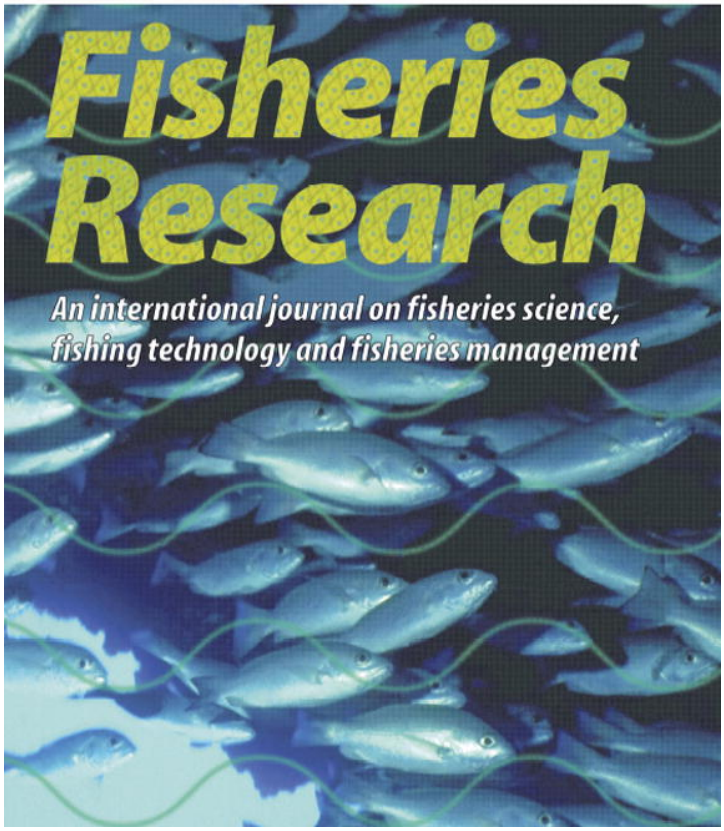
Provided for non-commercial research and educational use only.
Not for reproduction or distribution or commercial use.

Volume 84, issue 1, March 2007 ISSN 0165-7836

Special Issue
Whale Sharks: Science, Conservation and Management
Proceedings of the First International Whale Shark Conference



This article was originally published in a journal published by Elsevier, and the attached copy is provided by Elsevier for the author's benefit and for the benefit of the author's institution, for non-commercial research and educational use including without limitation use in instruction at your institution, sending it to specific colleagues that you know, and providing a copy to your institution's administrator.

All other uses, reproduction and distribution, including without limitation commercial reprints, selling or licensing copies or access, or posting on open internet sites, your personal or institution's website or repository, are prohibited. For exceptions, permission may be sought for such use through Elsevier's permissions site at:

http://www.elsevier.com/locate/permissionusematerial

Available online at www.sciencedirect.com
ScienceDirect
Fisheries Research 84 (2007) 119–127
FISHERIES RESEARCH
www.elsevier.com/locate/fishres

Property rights-based management: Whale shark ecotourism in Bahia de los Angeles, Mexico☆

Natalie Rodríguez-Dowdell [a,*], Roberto Enríquez-Andrade [b], Nirari Cárdenas-Torres [c]

[a] *Dirección en Baja California del Área de Protección de Flora y Fauna, Islas del Golfo de California, Comisión Nacional de Áreas Naturales Protegidas, Avenida del Puerto No. 375, Local 25, Fraccionamiento Playas de Ensenada, C.P. 22800, Ensenada, Baja California, Mexico*
[b] *Facultad de Ciencias Marinas, Universidad Autónoma de Baja California, Km 103, Carretera Tijuana-Ensenada, Baja California, Mexico*
[c] *The Nature Conservancy-Mexico Program, Novena e Iturbide #896, Plaza Sta. Lucía, Local 15, Col. Obrera, C.P. 22830, Ensenada, Baja California, Mexico*

Abstract

Predictable and long-term whale shark (*Rhincodon typus*) aggregations can be observed in few locations around the world. In some places where this occurs the use of the species through ecotourism has become an important economic activity. Bahia de los Angeles, Mexico is an important habitat for whale sharks for up to 7 months per year. Based on their presence, ecotourism activities with the species have become more popular among the local community in recent years. Whale sharks and their habitat represent an important form of natural capital with high potential to produce economic value; however this has not translated in an improvement of the local communities' quality of life due to several limitations that the activity, resource and users confront. The most evident threat is free access, carrying with it a potential loss of economic benefits due to resource saturation and when external groups use the resource or tourists observe the species without having to hire local tour operators. It is recognized that property right regimes are fundamental because they define the rights and obligations for the use of natural resources and the rules by which these rights and obligations are implemented. The present study recommends the implementation of a strategy for the sustainable management of whale sharks based on property rights; taking into account both the characteristics of the resource and the social context where it is used. Through the opinion of a consultant panel comprised of representatives from federal, state and municipal governments, as well as academics, non-governmental organizations and local users of the resource, three different options are analysed – free access; a limited number of permits for local users; a concession of the area in favour of the group of local users – by means of four qualitative criteria (efficiency, equity, transaction costs and acceptance) and a quantitative criterion (duration), using multicriteria analysis. The evaluation concludes that the scenario which is the most efficient, equitable, with lower transaction costs and more acceptable is a concession of the area in favour of the group of local users.
© 2006 Elsevier B.V. All rights reserved.

Keywords: Whale shark; Equity; Transaction costs; Multicriteria analysis; Management

1. Introduction

Predictable and long-term whale shark (*Rhincodon typus*) aggregations can be observed only in few locations around the world. In some places where this occurs, the use of the species through ecotourism has become an important economic activity.

Bahia de Angeles, located in the oriental coast of Baja California, Mexico is considered one of the most biologically productive areas in the Gulf of California (Álvarez-Borrego, 1983). High productivity favours the presence of whale sharks from May to December of each year; although recent studies show that there is an important inter-annual variation in the abundance of the species and duration of the seasons (Enríquez-Andrade et al., 2003).

Based on the presence of the sharks, ecotourism activities have been offered for more than a decade and prompted the

☆ A preliminary form of this paper Asignación de Derechos de Propiedad. Caso de estudio: Tiburón ballena en Bahía de los Ángeles, Baja California (Rodríguez-Dowdell, 2004) was presented at the 10th Biennial Conference of the International Association for the Study of Common Property, The Commons in an Age of Global Transition: Challenges, Risks and Opportunities. IASCP: Oaxaca, México. And published in the Digital Library of the Commons edited by the University of Indiana, while the Abstract was published in the Final Program of the Conference.

* Corresponding author at: Avenida del Puerto No. 375, Local 25, Fraccionamiento Playas de Ensenada, C.P. 22800, Ensenada, Baja California, Mexico. Tel.: +52 646 176 01 90; fax: +52 646 176 01 90.
E-mail addresses: natsrd@hotmail.com (N. Rodríguez-Dowdell), enriquez@uabc.mx (R. Enríquez-Andrade), ncardenas@tnc.org (N. Cárdenas-Torres).

0165-7836/$ – see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.fishres.2006.11.020

Author's personal copy

implementation of the project "Conservation and Sustainable Use of whale sharks through ecotourism in Bahia de los Angeles, Baja California" by the Autonomous University of Baja California (UABC) in coordination with the Reserve of the Islands of the Gulf of California (RIGC), from the Natural Protected Areas National Commission, and a group of local tour operators through 2001 and 2002.

Amongst the results of the project, a local whale shark management program was elaborated (Rodríguez-Dowdell et al., 2003) including a Code of Conduct for human interaction with the whale sharks (Cárdenas-Torres et al., this volume). One of the strategies identified in the program proposal was that local tour operators obtained their permits for non-extractable use of the species, in order to obtain the right to use the whale sharks and comply with legislation.

The permit allocation led to a process for the elaboration of a nation wide Preliminary National Regulation for non-extractable use (observation and swimming activities) of whale sharks, although the process to elaborate this regulation was later postponed indefinitely in 2004 (Rodríguez-Dowdell, 2004). Although the reasons for its postponement are not clear, it might be due to a regulatory moratorium that entered into effect in May of 2004. The moratorium establishes that the issuing of new regulations is to be suspended (Diario Oficial de la Federación, 2004).

Even though whale shark ecotourism activities are regulated through the allocation of permits, on paper, it is evident that the activity is still reflecting a similar situation as the one described by Hardin (1968). This refers to the "Tragedy of the Commons", where the activity is done basically without restrictions, in great part due to lack of inspection and surveillance.

As it has occurred in other places around the world, whale shark ecotourism at Bahia de los Angeles is perceived as an opportunity to promote the development of the local community. However, this important form of natural capital has not contributed to improve the local communities' quality of life due to several limitations that the activity, the resource and its users confront.

The most evident threat is free access. Free access describes a situation where there are no restrictions on the number of individuals that can use a resource. Basically it is a scheme of undefined property rights over the resource (Devlin and Grafton, 1998). It can be defined as "free for all" where people can exploit a resource at will, which is the reason why this scheme results in the exploitation of natural resources; a case where "everybody's access is nobody's property" (Bromley, 1989). In Bahia de los Angeles the number of tour operators interested in offering observation and swimming activities with the species is growing without control and is a divided group that does not work coordinately. A related threat is lack of habitat protection, which makes the area vulnerable to transformation.

Free access has the following effects: (1) the quality of the service provided by a saturable common-property resource diminishes as new users eventually exceed carrying capacity; (2) as the resource tends to saturate, it attracts redundant factors of production (labour, vessels and others) increasing opportunity costs; (3) offer can exceed demand, which in turn has a direct impact on market prices. Also (4) there is a potential loss of economic benefits when external groups use the resource or tourists observe the species without hiring local tour operators. These factors function as perverse incentives promoting conduct in certain individuals, which goes against the conservation of the resource (Toledo-Ocampo, 1996).

According to Devlin and Grafton (1998) property rights can be defined in terms of the owner(s) or user(s) and the relation they have with a certain good. They can basically be considered, as the rights people have to use resources. Property right regimes consist of *property rights*, titles that define rights and obligations within the use of natural resources, and *property rules*, the rules under which those rights and obligations are implemented (Bromley, 1991).

Recent scientific evidence suggests that a well specified property right regime is a necessary, but not sufficient, condition for proper natural resource husbandry. The property right must also be congruent with its ecological and social context. The ecological context refers to the structure of the ecosystem where humans live and work, as well as the particular properties of such ecosystems. The social context involves the dimensions of the human relation with the resources, including social or institutional arrangements, cultural practices and economic uses (Hanna and Munasinghe, 1995).

For the design and implementation of property rights in the use of natural resources, it is necessary to have a clear knowledge of the characteristics of the right. This includes facets such as exclusivity (to what level we can prevent other individuals, both on the physical and legal aspects, from using the resource), transferability (can the right be transferred through a contract), divisibility (can the use of the resource be divided), flexibility (can the right accommodate to changes in the good or circumstances of the user), duration (how long can an individual hold a right), and quality of title (certainty of the right from a legal point of view). Overlaying all these characteristics is enforceability, which refers to the mechanisms that will insure the validity of the property right (Devlin and Grafton, 1998; Enríquez-Andrade, 2002).

Another factor that must be known is the characteristics of the resource over which the right is given. According to these characteristics (the economic properties of the natural resource) a resource can be defined in terms of its rivality (how the use by one user affects another), exclusivity, and whether it is congestible or not. A resource is congestible when after passing a certain level of usage, any increment in the number of users will reduce the benefits that exist for the present ones. Combinations of the previous characteristics define a resource as public, private or as a common-pool (or common-property) resource. It is also important to know the economic agents associated to the resource. These are divided into three major groups, the producer (provides a good or service and obtains an economical benefit from the resource), the consumer (has a certain willingness to pay for the good or service) and the regulator (regulates the transactions between consumers and producers regarding a good or service with the purpose of increasing social wellbeing).

The present study evaluates three property rights-based management options and how the different dimensions of such rights affect effective management practices for whale shark

Author's personal copy

ecotourism in Bahia de los Angeles, taking into consideration both the characteristics of the resource and the social context where it is used.

2. Methods

Bahia de los Angeles is located in the oriental coast of Baja California at 29°00′N and 113°50′W in the municipality of Ensenada, Baja California, Mexico (Fig. 1). It is an open bay to the Gulf of California, with wide communication to the Canal de Ballenas (Whales Channel). The dimensions of the bay are 16 km × 6.4 km, and it has a NW-SE orientation, similar to the Gulf of California.

Robson's methodology (1993) for case studies was applied, specifically that which subscribes a series of individual cases. It is a study of a small number of individuals that share certain characteristics, these individuals are the local users of the resource which will be referred from now on as tour operators.

As a first step a framework was elaborated, where the dimensions, variables and relations of the case study were established. Resource characteristics were defined through field observation and bibliographical research; while the social context was determined by field observation and through identification of the tour operators. Once these were defined a survey was designed and implemented.

Later, through the opinion of a consultant panel composed of representatives from federal, state, and municipal government, academics, non-governmental organizations and local tour operators, three different management structures were analysed using multicriteria analysis (Nijkamp et al., 1990) (Table 1).

The options proposed were selected considering a range which differs on the characteristics of exclusivity, transferability, divisibility, flexibility, duration and quality of title (i.e. free access is non-exclusive, while the concession and permits are exclusive but not transferable).

To evaluate the options, four qualitative criteria and one quantitative criterion (Table 2) were used.

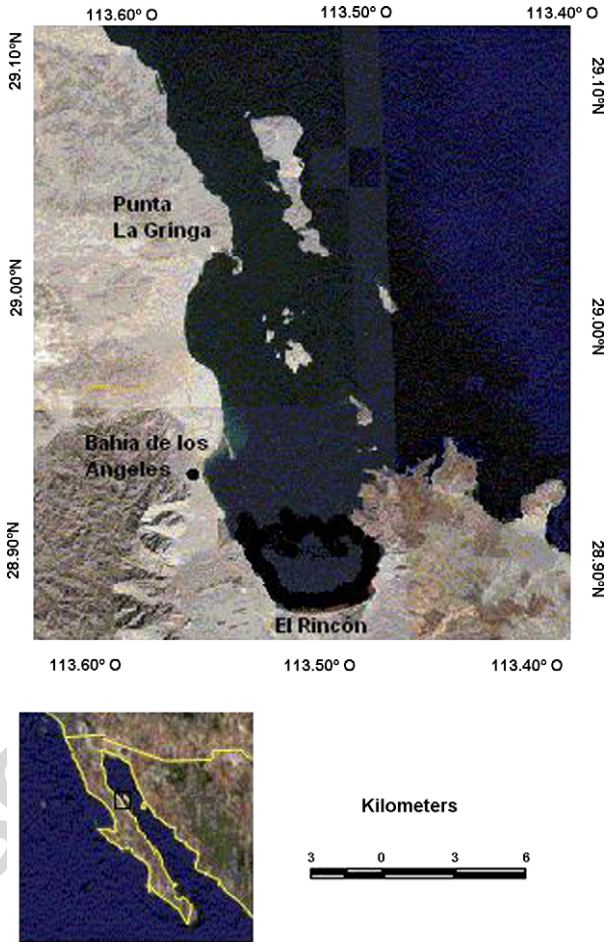


Fig. 1. Map of Bahia de los Angeles, Baja California, México.

The duration of each scenario was proposed considering the following: (1) free access, no period as it basically entails no regulation; (2) permits for non-extractable use of the species are granted only for one season and have to be renewed each year; (3) the maximum duration of concessions considered by

Table 1
Management scenarios for the use of whale sharks in ecotourism

Scenario	Proposal
Free access	This option was proposed as follows: anybody who wishes can observe and swim with the whale sharks. There is no property right associated to the resource
Limited number of permits	Defined as the authorisation allocated by the Environmental and Natural Resource Secretariat to individuals for non-extractable use of whale sharks The scenario proposed was as follows: a limited number of permits issued for local tour operators allowing them to offer whale shark observation tours, with duration of one season This also allowed tourists who arrive at Bahia de los Angeles and that take their own vessels to observe the species without hiring a tour operator, as long as they do not make a commercial activity from the resource This scenario differs from the present situation, as there would be a limited and predetermined number of permits
Concession	Defined as the authorisation for the group of local tour operators that gives them the right over the local area of occurrence of the species for a period of 50 years The scenario was proposed as follows: the concession of the area of whale shark sightings in Bahia de los Angeles in favour of the group of local tour operators, for a period of 50 years, specifically for the whale shark observation season and the whale shark ecotourism activity This option prohibits tourists using their own vessels; in order for them to observe the whale sharks they must hire the services of one of the local tour operators

Author's personal

Table 2
Qualitative and quantitative criteria used for evaluation

Criteria	Explanation
Qualitative	
Efficiency	The level of benefit that would be obtained by applying the scenario; i.e. how optimal it is in terms of resource use
Equity	How equitable is the distribution of the benefits to the local tour operators
Transaction costs	The cost to implement the scenario. The administration and management associated costs are considered, such as inspection and surveillance and legal aspects associated to allocation of permits and/or concession
Acceptance	The willingness by the sector (federal, state, municipal government, academics, non-governmental organizations and local tour operators—consultant panel) to implement the scenario
Quantitative	
Duration	Defined as the time scale for each scenario. This criterion was set as follows Free access: 0 (no period) Permits: 1 year Concession: 50 years

law for other activities, such as aquaculture, is 50 years. It is important to clarify that at present a concession as the one proposed is not permitted by law, as the non-extractable use of whale sharks is regulated by the General Wildlife Law and only through the allocation of permits. However, it does not preclude the fact that in the future the concession could be considered as an adequate management scenario; hence the importance of evaluating it.

The consultant panel graded the qualitative criteria for each management scenario according to a determined scale (Table 3).

Once the consultant panel graded the qualitative criteria for the different options they were asked to weigh the criteria (1–5) according to the order of importance.

The qualitative results were combined with the quantitative criteria (its values were predetermined to be: 0, 1 and 50) for each scenario. Results from this matrix were analysed by the method described by Voogd (1982). This consists of systematically comparing, separately, the qualitative and quantitative values between different options, and integrating the results in a final evaluation matrix, adding the results of the different comparisons per scenario as is shown in Fig. 2.

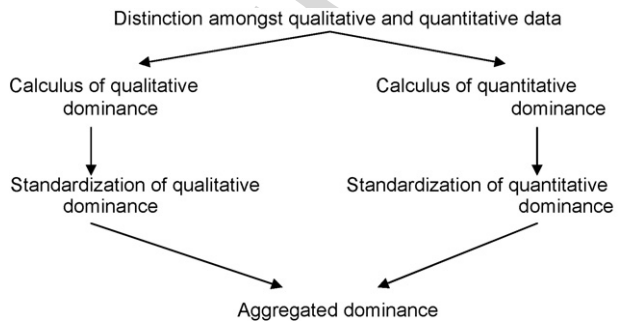


Fig. 2. Data treatment.

Table 3
Scale for evaluation of the qualitative criteria

Criteria	Scale
Efficiency	
The scenario is more efficient: it will promote more benefits derived from the use of the resource	1–5
The scenario will not have an effect on the efficiency: the benefits derived from the use of the resource will not be enhanced or will be diminished	0
The scenario is less efficient: less benefits will be derived from the use of the resource	−1 to −5
Equity	
The scenario is more equitable: the distribution of the benefits derived from the use of the resource will be shared more evenly between local tour operators	1–5
There will be no effect on the equity: the local tour operators will not be benefited or affected	0
The scenario will be less equitable: the distribution of the benefits derived from the use of the resource will be less equitable for local tour operators	−1 to −5
Transaction costs	
The scenario will have less transaction costs to be implemented	1–5
The scenario will have no effect on the costs	0
The scenario will have higher costs to be implemented	−1 to −5
Acceptance	
The scenario will be more accepted by your sector if implemented	1–5
The scenario will have no effect on acceptance	0
The scenario will be less accepted by your sector if implemented	−1 to −5

3. Results

3.1. Economic properties of the resource

Whale shark aggregations in Bahia de los Angeles were found to be a "non-exclusive" resource, because it is difficult to stop an individual who does not have a right over the resource from using it. They are also a "non-rival" resource, that is the use of the resource by one individual does not affect the use by another; although in time they could become "congestible", as described earlier. Finally it was found to be fugitive, i.e. subject to large migrations.

3.2. Economic agents associated to the resource

Consumers. Tourists who are willing to pay for eco tourist activities with whale sharks; mainly tourists from California, United States, and in a lower percentage from Mexico, Canada and Europe (Enríquez-Andrade et al., 2003).

Producers. Local tour operators who provide the service; this section is further described in section IV.3

Regulators. The body that has the authority to regulate the use of whale sharks. In this case the Environmental and Natural Resource Secretariat of the Federal Government (Diario Oficial de la Federación, 1976) through its various Administrative Units (Diario Oficial de la Federación, 2003). The General Wildlife Directorate has the responsibility to issue permits for the non-extractable use of whale sharks. As whale sharks are

Author's personal copy

listed as a threatened species in the NOM-059-SEMARNAT-2001 (Secretaría de Medio Ambiente y Recursos Naturales, 2002), inspection and surveillance is the responsibility of the Federal Environmental Protection Agency (Diario Oficial de la Federación, 2003).

3.3. Survey of local service providers

It was found that the local service providers could be broadly divided into two groups, those who are classified as full time tour operators (a total of 12 people) and those who are classified as prospective tour operators (a total of 11 people). The provision of tourist services is the primary activity of the first group while fishermen who have recently started tourist activities mainly comprise the second group.

The period of time the 23 people have been offering whale shark tours varies significantly, from 1 to 14 years (the most experienced tour operator). 34.78% have been offering the activity for four years; while 21.73% only started their activities during the 2003 season, mainly due to the great interest whale sharks have generated within the local community.

Besides whale shark observation the service providers also offer other related tourist activities such as observation in general of fauna, sport fishing, visits to the islands (a natural protected area), rental of equipment for snorkelling and providing accommodation services. Observation of fauna is the most important because the entire group offers this service, followed by sport fishing (82%) and visits to the islands (73%).

3.3.1. Level of organization

The great majority of service providers work by themselves; only 35% of the group has a family operated business comprising two people. It is notable that even though the group classified as full time tour operators have individual operations, they have managed to consolidate the position of their operations through promotion, contact with clients, and even have repeat clients from year to year, both for whale shark related activities and other services.

Of the service providers 61% are part of the local Ejido[1] (Ejido Ganadero, Turístico y Pétreo Tierra y Libertad), while 39% are not represented. Also, 74% are part of the Asociación de Pesca Deportiva y Ecoturismo de Bahía de los Angeles, A.C., a local organization constituted in December of 2003 to enhance the members operation in tourism activities.

3.3.2. Knowledge of the species

An important percentage of the group (53%) considers having a good knowledge of whale sharks; 43% think they have average knowledge of the species, while only 4% considers their knowledge to be excellent. These results are directly related to the time each tour operator has been offering whale shark activities.

3.3.3. Groups perception on whale shark ecotourism development

The threats the service providers considered as the most important were in the first place the lack of organization amongst themselves. This was followed by injuries caused to the animals by tourists and by a small part of the service providers who do not follow the Code of Conduct (established by Cárdenas-Torres et al., this volume) or that travel at high speed in the observation area. In third and fourth order are the deployment of fishing nets and unplanned tourism developments, associated to the Nautical Stairway project (promoted by the National Fund for Tourism, the project seeks to develop a marina within the area) with the possible consequences such, as pollution and an increase in vessel traffic. They also considered that lack of surveillance represents an important threat as well as the many requirements in order to obtain their permits, and lastly the lack of tourists that want to pay an exclusive price for whale shark observation.

In relation to free access they considered that the principal effect it has is loss of economic benefits, because tourists that visit the bay and take their own vessels do not have the obligation or interest to hire local tour operators to make the trip or act as guides in their own vessels. As a second scenario they considered that tourists, according to their own words "do whatever they want" and do not respect the Code of Conduct negotiated (Cárdenas-Torres et al., this volume) and met by part of the group, to minimize impacts on the resource. The survey of the service providers indicated their perception that as a consequence of free access the quality of the service and value of the resource decreases because several service providers are willing to charge a lower price in order to have the opportunity to make a sale.

In response to the role the authorities should play for the beneficial development of the activity, the majority regarded inspection and surveillance to be of paramount importance, both with respect to Code of Conduct compliance and to ensure that those who offer the activity are only those who are authorised. As such they view the presence of these authorities in the vicinity as indispensable. As a second important point they considered necessary to obtain support in the administrative requirements for regulating their vessels.[2] The service providers considered that the authorities should limit access and make it exclusive for local tour operators, insuring that tourists who bring their own vessels to the bay hire a local tour operator; that the authorities should help in promoting the activity with emphasis on international markets.

3.4. Scenario evaluation by the consultant panel

Results from the consultant panel are presented in Table 4. For confidentiality reasons and by previous arrangement with the consultant panel, their names and the institutions they represent have been omitted from the table.

[1] Ejido. Form of community-based tenure system recognized by Law.

[2] The closest Harbors Office where procedures can be completed is located in Ensenada (more than 600 km away from Bahía de los Angeles).

Author's personal copy

Table 4
Results from the consultant panel

	Background of expert consulted										
	Users		NGO's		Academics		Federal government		State government		Municipal government
	U1	U2	O1	O2	A1	A2	F1	F2	E1	E2	M1
Free access											
Efficiency	−5	−5	−5	−5	−5	−5	−3	−5	−3	−5	−5
Equity	3	−5	5	−5	−5	3	−4	−5	−2	−1	−5
Transaction costs	5	0	5	3	0	0	5	5	0	0	0
Acceptance	0	−5	−5	−5	−3	−5	−2	−5	−1	−1	0
Limited number of permits											
Efficiency	3	3	5	0	3	3	2	5	2	3	4
Equity	0	3	−3	−2	3	2	3	3	1	1	2
Transaction costs	−1	−5	−2	−1	−2	−4	−4	5	−2	−3	4
Acceptance	5	3	5	−2	0	3	4	5	0	3	3
Concession											
Efficiency	5	5	2	5	5	1	5	3	4	5	5
Equity	−3	5	−3	5	5	−1	2	−1	3	5	4
Transaction costs	−5	3	−5	2	2	1	−2	−5	−3	3	−4
Acceptance	5	5	4	5	0	1	2	0	1	4	4

During the consultation, besides grading the different options each member gave their opinion as to why they considered one to be better than the others. The following is a summary of the opinions presented:

- *Efficiency*. Seventy-three percent of the panel considered that the concession would be the most efficient scenario; only 27% considered that it could have negative implications for efficiency, the greatest risk being monopolization of the activity and the resource by the operators' group. These consultants believed that the tourists could take exception to having to hire a local tour operator to observe whale sharks, which could ultimately discourage them from visiting the locality, which is the reason why they prefer the permit scenario. The entire consultant panel, without exception, considered that free access is inefficient because it limits the economic benefits that could be generated through optimal regulation of the activity.
- *Equity*. Fifty-four percent of the panel considered the concession as the most equitable scenario for locals, because it could enable the group (through exclusivity) to develop whale shark ecotourism in a coordinated manner integrally within the community ensuring a fairer distribution of benefits. This part of the panel considered that the problem presented by the other options might lead to the displacement of locals by foreign operators who have greater resources, which would inevitably translate into inequity from the locals' perspective. Twenty-eight percent of the panel considered free access as the most equitable scenario, because it allows any person to offer a whale shark tour, even though they may not be authorised. The rest of the panel considered that permits could be equitable in terms that every year any local tour operator could aspire to obtain a permit, thus taking a share of the economic benefits, even though this may be small.
- *Transaction costs*. Being free for all, free access was considered by 46% of the panel as the scenario with fewest costs, because they perceived it would basically present no cost for administration and/or management of the resource or activity, whatever the consequences for it. Eighteen percent of the panel considered permits to present fewer costs and 36% of the panel considered that the concession, with time, could become the scenario with least cost mainly because inspection and surveillance would rely on the same tour operators that would be motivated to take care of the resource, and intermediate procedures (permits year per year) would be avoided.
- *Acceptance*. The entire panel had a negative opinion of free access, because it is viewed as the least favourable scenario for the protection and conservation of the resource. Thirty-six percent considered permits to be the most acceptable option because it implies regulation of the activity, which they perceived as necessary for the protection of the resource. Sixty-four percent considered the concession as the most acceptable because it would ensure that the benefits generated by the activity would stay within the community and could in turn generate a fairer distribution of such benefits.

3.5. Multicriteria analysis

Results from the multicriteria analysis are presented in Table 5. It is important to consider that the results presented are ordinal, showing only the order of preference of the options. According to the criteria used for the evaluation and weights of such criteria, the scenario which resulted as the most appropriate for non-extractable use of whale sharks in Bahia de los

Table 5
Scenario evaluation results

Scenario	Dominance index
Free access	−0.129
Limited number of permits	0.015
Concession	0.114

Author's personal copy

Angeles, is a concession in favour of the group of local tour operators.

4. Discussion

Given the characteristics of the resource, it is necessary to provide an instrument that effectively regulates its use. If this is not provided a continued increase in the number of users, could have a negative impact on the conservation of the species in Bahia de los Angeles and its economic value. Its classification as a fugitive resource makes it necessary that protection measures are not only offered at the local level but include the different economic sectors that share its distribution, otherwise, decisions taken elsewhere could have a direct impact on a resource with a potential to generate important economic benefits for the group of local tour operators, the community and region.

In regards to the group of local tour operators, characterised as heterogeneous, because there is a distinct difference in the time they have been offering the activity as well as their investment in the service and knowledge of the species, support will be required for them to work in a coordinated manner. Even though there are several local institutions that a number of the tour operators belong to, none of these integrates the whole group.

Considering the options presented to the panel, the concession presents advantages that are important to highlight (Table 6). First of all the concession presents the highest level of exclusivity, which permits the possibility to exclude foreign operators and retain economical benefits and by so doing may result in a more efficient activity in economic terms. If the concession is given to the group of local tour operators, the distribution of the benefits generated by the activity will be more equitable within the group, minimizing the conflicts that at present exist between them.

Even though the whole group does not necessarily work together at present, the concession could generate a sense of "ownership" of the resource that could lead to collective decisions amongst the group for the management of the species, for a more efficient activity and would maximize benefits through cooperation.

The time frame or duration of the property right implies a long-term vision, which translates in a more secure investment for the group in the development of the activity and in so doing generates incentives for the care of the resource.

According to Baltzer (unpublished), the main idea of "ownership" of a resource is that when an individual or group "owns" a resource and can aspire to retain benefits from its use in the future, the individual or group will have the incentive to invest in terms of its protection, restricted use and management. This in turn will enable for the functions of a property right to be met: (1) limit use, (2) coordinate users and (3) respond to environmental dynamic conditions. A basic question that must be addressed when designing property right regimes over a resource is which scenario generates the best incentives for a responsible use of the resource.

It is considered that the concession could lead to participation through collective decisions within the group of local tour operators, which would facilitate the establishment of a local management institution that would more easily participate with different stakeholders.

As discussed earlier a characteristic that overlays all property right dimensions is enforceability; the incentives presented by the concession would facilitate the implementation of necessary mechanisms to enforce rights and obligations on the local level, through collective surveillance and self-regulation. This in it self would lower transaction costs associated with the management of the resource. Such self-regulation would be more productive in terms of the protection of the resource compared to an administrative regulation.

Even though opinions obtained from the panel were varied, in great part because they depend on value judgments directly related to their experience and preferences; the entire panel considered that the time scale is a very important factor, and as a panellist said "if the scenario selected is equitable today and has certainty for the future, conservation of whale sharks for future generations can be expected".

Table 6
Dimensions of the property rights in terms of the options evaluated

	Concession	Permits
Exclusivity	From a legal point of view and as the option is presented, this is exclusive. In practical terms its implementation would be facilitated on the local scale	From a legal point of view and as the option is presented, it is less exclusive. Exclusivity only applies to local users who are not authorised. In practical terms its implementation is more difficult; it would rely on inspection and surveillance by the competent institution, which is not in the community
Transferability	It is not transferable; according to legislation concessions do not generate rights such as property and dominium. This will be limited by the dispositions dictated by the State and which the user must comply to	They are not transferable
Divisibility	It is divisible	They are not divisible
Flexibility	It is not flexible, concession terms must be met integrally by the user	They are not flexible; the permit integrates the terms of use
Duration	It lasts longer; law specifies that concessions can last from 6 months to 50 years	It lasts for one season
Quality of the title	The concession title would dictate the terms and restrictions	The permit given incorporates the rights and obligations it generates

Author's personal copy

5. Conclusion and recommendations

The present analysis draws attention to important aspects of whale shark ecotourism management, how this was initiated in Bahia de los Angeles promoted by the tour operators, as well as the challenges still ahead to ensure resource conservation, a task that involves all.

At present significant advances have been made in terms of conservation of whale sharks in Mexico, the allocation of the permits for non-extractable use of the species can be highlighted as part of the achievements. As they reflect the efforts of the General Wildlife Directorate to regulate an activity that is fast growing.

In spite of the advances, these measures have been insufficient to regulate the activity. There is no specified limit to the number of permits that can be granted each season, that considers either the carrying capacity or a precautionary approach. Furthermore, the permits are only functioning as an administrative instrument. This results in great part, from the difficulty the State and the Institutions which have the mandate to regulate the activity, to offer an efficient *in situ* management. At the same time, the incentives generated by the permits are not sufficient to promote coordination amongst the entire group of local tour operators.

It is necessary to promote the establishment of a Whale Shark Local Committee, hereafter simply referred to as the Committee, that integrates all the individuals and that has clear goals and objectives and is lead by a member of the group of tour operators. The Committee could serve as a forum for discussion and consensus to insure the proper use of the resource (in terms of benefits to the community and minimized impact to whale sharks) and identify needs for development of the activity. In order for this to be viable the Committee would need to be comprised by each individual member (local tour operators) with equal representation (voting rights) and representatives of authorities (those relevant to management such as the General Wildlife Directorate, the Environmental Protection Agency and the RIGC), non-governmental organizations and research institutions. These institutions could provide input and identify issues that could be addressed by one specific institution to help the group of tour operators.

There is already a research institution (UABC) and a non-governmental organization (Pronatura) with active work in Bahia de los Angeles. The UABC was involved in the whale shark conservation project and, its continued involvement has permitted research on whale sharks to be an ongoing activity. Pronatura, which works for the conservation of natural resources and habitats in Mexico, has provided important assistance as they supported members of the community to establish the Asociación de Pesca Deportiva y Ecoturismo de Bahía de los Angeles, A.C. Therefore, it would be beneficial for both the UABC and Pronatura to be part of the Committee.

It is also recommended that municipal, state and/or federal programs support individuals to enhance their capacities as a group in order to insure that whale shark ecotourism is efficient in economic terms and at the same time the benefit distribution is more equitable. It is important to increase the competence level, so whale shark ecotourism in Bahia de los Angeles, can be offered with a quality comparable to places such as Ningaloo Marine Park, so that international ecotourism markets are an option.

Fostering stewardship for the resource by local tour operators, and securing the economic benefits derived from the activity within the community, are necessary elements for conservation of whale sharks and management of whale shark ecotourism. Results from the research suggest that granting the concession for the group of local tour operators, is the best management scenario.

The challenge within the design of property rights is that they must meet social objectives in economical, equitable and ecological terms. The results of this analysis indicate that the scenario that is the most efficient, equitable, with lower transaction costs and is more acceptable is the concession of the area for the group of local tour operators.

Author's personal copy

Acknowledgements

The authors would like to acknowledge the local tour operators from Bahia de los Angeles, Baja California, specially Abraham Vazquez Haikin, because it was due to their vision and initiative that whale shark conservation efforts started in Bahia de los Angeles. It is thanks to their everyday efforts that special care is given to whale sharks during their stay at the bay and we keep on learning more about this charismatic and mysterious creature. Undoubtedly their continued work and support is imperative to insure their conservation for future generations. The authors would also like to thank all the personnel from the Baja California Direction of the Reserve of the Islands of the Gulf of California for their participation in different stages of research. Research has been possible thanks to financing received at different stages by the Mexican Fund for the Conservation of Nature and the Pew Charitable Trusts. The authors would like to thank the three scholars for their invaluable contributions to improve this article. Special thanks to Tennille Irvine for coordinating the process of elaboration, revision and article editing, and following up until the positive conclusion. In addition, the authors would like to thank the organizers of the International Whale shark Conference, specially John Keesing and Lucy Kay, and support received by different institutions to attend.

References

Álvarez-Borrego, S., 1983. Gulf of California. In: Ketchum, C.B.H. (Ed.), Estuaries and Enclosed Seas. Elsevier, Amsterdam, pp. 427–449.

Bromley, D.W., 1989. Property relations and economic development: the other land reform. World Dev. 17, 867–877.

Bromley, D.W., 1991. Environmental and Economy: Property Rights and Public Policy. Basil Blackwell, Oxford.

Cárdenas-Torres, N., Enríquez-Andrade, R., Rodríguez-Dowdell, N., this volume. Community-based management through ecotourism in Bahia de los Angeles, Mexico.

Devlin, R.A., Grafton, R.Q., 1998. Economic Rights and Environmental Wrongs-Property Rights for the Common Good. Edward Elgar Publishing Limited.

Diario Oficial de la Federación, 2003. Reglamento Interior de la Secretaría de Medio Ambiente y Recursos Naturales. México, D.F.

Diario Oficial de la Federación, 2004. ACUERDO por el que se fijan los lineamientos mediante los cuales se establece una moratoria regulatioria. México, D.F.

Diario Oficial de la Federación, 1976. Ley Orgánica de la Administración Pública Federal. México, D.F.

Enríquez-Andrade, R., 2002. Apuntes de Economía Ambiental: Introducción al Análisis Económico del Medio Ambiente y los Recursos Naturales. Versión 2.0. Facultad de Ciencias Marinas. Universidad Autónoma de Baja California, Baja California.

Enríquez-Andrade, R., Rodríguez-Dowdell, N., Zavala-González, A., Cárdenas-Torres, N., Vázquez-Haikin, A., Godínez-Reyes, C., 2003. Informe Técnico del proyecto "Conservación y Aprovechamiento Sustentable del Tiburón ballena a través del ecoturismo en Bahía de los Ángeles, Baja California. Facultad de Ciencias Marinas, Universidad Autónoma de Baja California. Dirección Regional en Baja California del Área de Protección de Flora y Fauna Islas del Golfo de California.

Hanna, S., Munasinghe, M. (Eds.), 1995. Property Rights in a Social and Ecological Context. Case Studies and Design Applications. Beijer International Institute of Ecological Economics and The World Bank.

Hardin, G., 1968. The tragedy of the commons. Science 162, 1244.

Nijkamp, P., Rietveld, P., Voogd, P.Y.H., 1990. Multicriteria Evaluation in Physical Planning. North Holland, Amsterdam, 219 pp.

Robson, C., 1993. Real World Research. A Resource for Social Scientists and Practitioner–Researchers. Publishers Ltd., Cambridge.

Rodríguez-Dowdell, N., Enríquez-Andrade, R., Cárdenas-Torres, N., Zavala-González, A., Vázquez-Haikin y, A., Godínez-Reyes, C., 2003. Propuesta de Programa de Manejo de Tiburón ballena (*Rhincodon typus*) con referencia específica a Bahía de los Ángeles, Baja California. Facultad de Ciencias Marinas, Universidad Autónoma de Baja California. Dirección Regional en Baja California del Área de Protección de Flora y Fauna – Islas del Golfo de California.

Rodríguez-Dowdell, N., 2004. Asignación de Derechos de Propiedad. Caso de estudio: Tiburón ballena en Bahía de los Ángeles, Baja California. Tesina de la Especialidad en Administración de Recursos Marinos. Facultad de Ciencias Marinas, Universidad Autónoma de Baja California, Baja California.

Secretaría de Medio Ambiente y Recursos Naturales, 2002. Norma Oficial Mexicana NOM-059-ECOL-2001. Protección ambiental – Especies nativas de México de flora y fauna silvestres – Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio – Lista de especies en riesgo. Publicada en el Diario Oficial de la Federación, Miércoles.

Toledo-Ocampo, A., 1996. Apuntes del Seminario de Economía Ambiental. La Valuación Económica de la Biodiversidad: Alcances y Limitaciones. Universidad Autónoma Metropolitana-Iztapalapa.

Voogd, H., 1982. Multicriteria evaluation with mixed qualitative and quantitative data. Environ. Plan. B 9, 221–236.

Author's personal copy