Shark-watching ecotourism in the Pacific islands: A move towards "payments for ecosystem services"?

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Introduction

Ecotourism based on observing iconic animal species in their natural habitats has become increasingly popular around the world and the Pacific Islands are no exception to this trend. Among these iconic species, sharks hold a special place as an attraction for tourists, including tourists who are not divers. One of the characteristics of this activity is the need for artificial feeding to ensure that there are enough animals present in a specific spot to be observed. So, while shark watching undeniably provides significant levels of income to local economies, it does, however, raise a certain number of problems in terms of its impact on the ecosystem, human safety and even a legitimate distribution of the dividends it generates (Clua et al. 2011). Another advantage of this activity is that it strengthens sharks' economic value in the eyes of decision-makers at a time when these animals are generally being overfished throughout the world (Clarke et al. 2006), in spite of scientific warnings about the need to preserve these super-predators within their marine ecosystems. Against a backdrop in which environmental arguments have shown their limits over the past few decades in terms of providing any real protection, an economic approach appears to be both complementary and necessary to ensure the sustainable development of shark populations in the South Pacific (Vianna et al. 2012). The purpose of this article is to present the general outlines of such an economic approach, highlighting ecotourism as a virtuous use of sharks that makes it possible to generate income while maintaining them in their ecosystem. Nevertheless, this approach is not totally virtuous unless it respects the three fundamental aspects of sustainable development: 1) environmental, 2) social, and 3) economic. This goal will only be reached through the implementation of "payments for ecosystem services" as we will attempt to demonstrate.

Basis of an economic approach to sharks

It was undoubtedly the article by Constanza et al. (1997) in the journal *Nature* in the late 1990s that embodied the idea that the planet's ecosystems can be assigned an economic value, especially in terms of the ecosystem services they provide to humans (see Box 1). This article defended the idea that every ecosystem can be divided up into its various components and services, each of whose value can be estimated on the basis of the data provided by the many different studies that describe and quantify biological functions, before shifting over to the economic domain. These values, divided on the basis of "use values" and "non-use values", range from the most tangible such as the price that can be gained from selling all or part of a natural asset to the most abstract such as the value attributed to the continued existence of that asset for the enjoyment of future generations (heritage or bequest value). The cumulative sum of all those values leads to the concept of "total economic value" (TEV), which obviously can be applied to sharks (Fig. 1). This TEV concept is far from perfect conceptually (see Box 2), but it has the merit of making it possible to grasp the diverse range of values that can be attached to a natural asset. That is, how to differentiate from among the direct use values, those that are "consumptive" and those that are not. Consumptive direct-use values are mainly based on fishing, which provides a profit from shark catches by selling products such as their meat, but more particularly their fins, which gives rise to a very profitable business. However, this use is consumptive because it contributes to the disappearance of sharks from their habitat with some well-known adverse effects, particularly through cascading effects on ecosystems (Myers et al. 2007). Such uses, therefore, appear less sustainable than non-consumptive direct uses, which keep the animals in their ecosystems. The best example of a non-consumptive direct-use value is nature tourism or ecotourism (Fig. 1).

Economic value of shark-watching ecotourism

Shark ecotourism first developed in the late 20th century but mainly involved whale sharks, *Rhincodon typus*, a plankton-eating animal that is more like whales in ecology and behaviour than carnivorous sharks. Economic analyses of the dividends drawn from observing this animal were done in Australia, which is still the top site in the world for this industry, which began in 1989. In 2006, each tourist in the Ningaloo Reef region

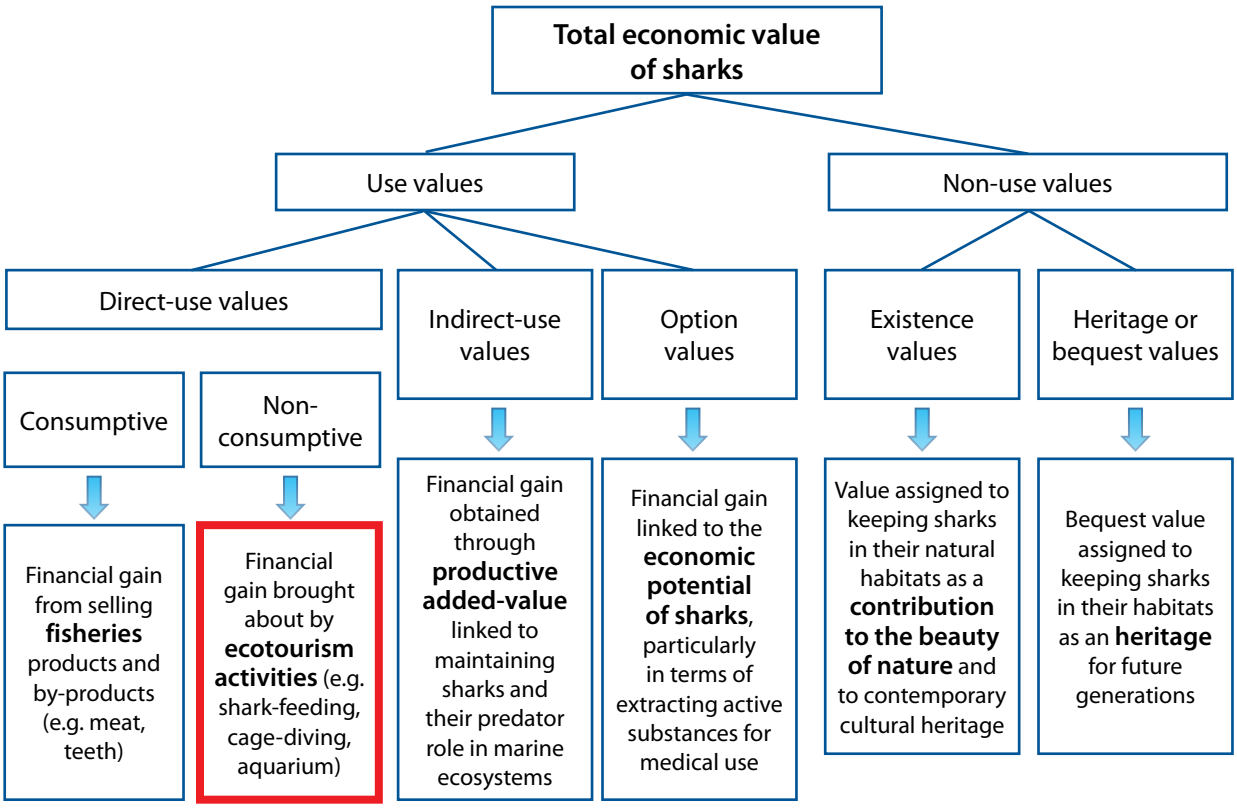

Figure 1. Chart of the total economic value of sharks. This chart gradually moves from the most concrete values on the left to the most abstract ones on the right.

of Western Australia spent about USD 758 per shark-watching trip and the cumulative annual total for all tourists was about USD 5 million (Catlin et al. 2009). Diving trips to spot carnivorous sharks also began in New Caledonia in the 1990s. Artificial feeding there focused on grey sharks (*Carcharhinus amblyrhynchos*) in Boulari Pass, just outside Noumea. However, no data have been published on the economic impact of this activity (which came to an end in the early 2000s after several accidental bites), without the authorities having to take any action. It was at that time that shark feeding began in Fiji on the island of Beqa (south of Viti Levu), to observe bulldog sharks (*Carcharhinus leucas*) (Brunnschweiler 2009), an activity that continues today. The eastern Pacific, particularly French Polynesia, also witnessed the development of this activity at the end of the last century. Based on a more than five-year study on a cluster of sicklefin lemon sharks (*Negaprion acuridens*) on the island of Moorea, it was shown that a "resident" lemon shark " (which serves as the basis for the quality of the ecotourism service sold) yields an average annual economic benefit of USD 370,000 (Fig. 2) and that the 30 or so sicklefin lemon sharks involved in shark-diving tourism brought in about USD 5.4 million to the island of Moorea. The study concluded that "when a live shark is involved in ecotourism, it has an intrinsic higher value than a shark that is caught" (Clua et al. 2011). More recently, the same type of study, designed to demonstrate that keeping sharks alive brings much more into local economies than fishing does, was carried out in Palau and concluded that shark-based ecotourism generated USD 18 million per year, contributing 8% of the country's gross domestic product, particularly through an annual payroll to operators in Palau of USD 1.2 million (Vianna et al. 2012). Some authors even attempted

Box 1: What is an ecosystem service?

The most commonly accepted definition of "ecosystem" or "environmental services" is the one given in the Millennium Ecosystem Assessment (MEA 2005), which stated that these are the benefits people obtain from ecosystems without having to act to get them. "Services" have to be distinguished from the "ecological functions" that produce them: ecological functions are the natural functioning and maintenance processes of ecosystems, whereas services are the result of those functions. Such services are, for example, producing oxygen in the air; naturally purifying water; or the biomass that feeds domesticated, fished or hunted animals.

Box 2: Is the "cost–benefit analysis" approach more effective and illustrative than "total economic value" (TEV)?

The TEV concept is often rightfully contested by certain environmental economists as, while it is fully justified to assign an absolute "monetary" value to very concrete aspects such as the price of products from fisheries or those inherent to ecotourism (set by existing markets), this is a much less plausible approach for the much more subjective dimensions related to culture or heritage. Caution needs to be taken in assessing such values because the use of the contingent valuation approach (or of "willingness to pay"), consists of asking people how much they would be ready to spend in order to maintain a certain species in its natural habitat. This approach is less open to criticism when a relative line of reasoning is used by asking people to list certain natural assets in their order of importance (joint analysis method). In any event, the economic cost–benefit analysis does have many advantages with regards to such approaches, which are based on human behaviour and, therefore, subject to bias. It consists of calculating the economic differential that exists between the cost of investing in a conservation or economic development activity and the economic benefits that can be drawn from that activity. So whatever the absolute value of the asset that this method is applied to (which may be of questionable accuracy), the economic differential between investments and benefits remains much more precise and legitimate conceptually, even if it does add a measure of incertitude linked, for example, to the discount rate. A concrete example of this approach is based on calculations done in Kiribati that showed that the economic value of sharks in terms of the increase in reef fisheries productivity, even without being combined with other existence or option values (related to ecotourism), was more advantageous than the current benefits provided by finning (fishing method consisting of simply removing sharks' fins before releasing them into the wild without any hope of survival) (Walsh and McCormick 2009)

to calculate the overall non-consumptive direct-use value for sharks worldwide by identifying as many existing operations as possible across the planet. An initial summary identified 376 ecotourism operations at 83 different sites in eight large geographic regions. In one case study, this analysis also showed that sharks' non-consumptive use values were higher than their consumptive use values (Galagher and Hammerschlag 2011). Finally, a more recent analysis evaluated the annual number of tourists who pay to watch sharks at about 590,000, a budget of more than USD 314 million. This budget is currently less than the USD 630 million that shark fisheries bring in but we have to consider the fact that shark catches are declining due to overfishing and if the upward trend for ecotourism continues, the number of shark watchers could double over the next 20 years and the annual budget could exceed USD 780 million (Cisneros-Montemayor et al. 2013). So the economic value of shark ecotourism is already significant around the world and it is rising rapidly. The South Pacific is no exception to this trend and, in that regard, is well placed for setting up sustainable development mechanisms for sharks by recovering part of the flow of revenues generated by tourism.

Figure 2. According to Clua et al. (2011), during its 20-year lifespan, a French Polynesian sicklefin lemon shark involved in ecotourism activities can bring about USD 2.64 million into the local economy (image: E. Clua).

Need to implement "payments for ecosystem services"

As we have just seen, we should accept the fact that nature, through all the ecosystems around the planet, provides "services" to humans. We have also shown that sharks contribute to that phenomenon, particularly through fisheries or ecotourism, and that the latter activity generates considerable revenue, which is vital for certain Pacific Island economies. Such income is even more important because at the present time, these services are provided free of cost to humans. This comment obviously also applies to fisheries. Everything would be perfect if nature had an unfailing ability to provide this service or, at least, to ensure that the service is ongoing and consistent. But such is not the case for sharks because human activities impair the service. This is obvious with fisheries, which, due to their uncontrolled nature, have a negative impact of shark populations' ability to regenerate, going so far as to threaten the survival of certain species (Field et al. 2009). It is less obvious with ecotourism but the risks of abuse likely to alter balances within the ecosystem do exist. The main threats are changes to the animals' biology, with a risk of them becoming accustomed to unhealthy food (keeping them from varying their diets), increased parasitic infections (linked to the concentration of animals in a limited space), and increased interbreeding (linked to an increased attachment to feeding sites and changes in natural movement). On a broader scale and in relation to the animals becoming used to staying a single spot, it can also be assumed that they will no longer be present in other parts of the ecosystem to play their role of predators (Clua et al. 2010). From a fully pragmatic, economic perspective, it does, then, seem worthwhile to set up financial mechanisms to make it possible to re-inject part of the dividends from ecotourism into maintaining or even restoring the ecosystem service this activity is based on. This is the "payment for ecosystem services" (PES) principle. The resulting funding, in the form of payments by beneficiaries (service providers and users) of ecotourism activities, which would not undermine their profitability, could serve to support various actions to promote the sustainable development of shark ecotourism.

Possible uses of "payments for ecosystem services"

The three pillars of sustainable development are economic, environmental and social concerns, which continually interact. With regards to shark ecotourism, the economic aspect is well developed, as we have shown. In contrast, in general no significant attention is currently being paid to the environmental and social aspects. For the environment, part of the funds recovered by public authorities should be reinvested in two areas. The first is scientific support for shark-feeding operations to ensure that such operations are harmless for the animals and

Figure 3. A Solomon Islands fisher with a shark whose dorsal fin and the bottom half of the tail fin he has just removed to meet the demands of the Asian market for such products (image: E. Clua).

the environment as well as for people in terms of safety (managing the risk of accidental bites, which have a very negative impact on the activity as they frighten off potential customers). Such scientific monitoring would make it possible to reduce such incidences by making recommendations about activity management in real time (e.g. a halt in feedings during key periods of the year when breeding competition, combined with competition for access to food, creates a temporary increase in the aggressiveness of certain animals (Clua et al. 2010). The second area concerns implementing shark protection and conservation measures, particularly through mechanisms such as marine protected areas. This is the case in Palau and in French Polynesia, where enough sanctuaries to protect sharks exist but where the resources to ensure effective surveillance are inadequate and could be strengthened through PES. For the "social" aspect, consideration must be given to the fact that when the government decides to protect sharks, particularly by promoting development through ecotourism, this is often done to the detriment of fishers, who lose a food or trade resource (Fig. 3). So, it would be good for part of the PES to be used to compensate the efforts made to no longer fish for sharks; for example, through actions to promote sustainable fisheries techniques that would benefit the fishers involved, such as deploying fish aggregation devices not too far from the coast. If their legitimacy and effectiveness needs to be shown, such compensatory mechanisms already exist, without being called "payments for ecosystem services" although they are based on the same principle (see Box 3 for an example in Fiji). Concentrating reinvestment efforts on

Box 3: Shark feeding at Beqa, Fiji: An early model of "payments for ecosystem services"?

An ecotourism operation was developed in the early 2000s on the island of Beqa in Fiji, located south of Viti Levu, based on scuba diving to observe bulldog sharks, *Carcharhinus leucas*, fed by the leader of the dive group. In addition to the profits made by the two dive clubs who hire local staff, each of the five villages involved in creating the marine reserve where the spotting dives are made receive an annual budget of about USD 60,000 to be used as they see fit (Brunnschweiler 2009). In particular, these payments help compensate the efforts of village fishers to respect the reserve and not to fish for sharks outside the reserve. Even if this mechanism is not presented as a PES, it adheres completely with its principles and has proven its effectiveness over a period of more than 20 years in the clearly social and potentially environmental domains (image: E. Clua).

environmental and social aspects does not mean that efforts cannot also be made in the "economic" area. It would be possible, for example, and as part of a spiral, for public authorities to use a portion of the PES to promote the country's tourism industry internationally, so as to better sell the "shark ecotourism" destination and lead to higher PES. The existence of mechanisms such as those just described, based on the sustainable development concept, would most probably also prove to be great marketing tools for tourists who are increasingly leaning towards sustainable green tourism.

Conclusion

We hope that we have shown that all of the necessary ingredients to implement PES in the shark ecotourism sector exist, particularly at the legal and judicial levels, in the Pacific, which has recently become a world leader in shark conservation (Techera 2012). Setting up PES in this region would be a first worldwide. Still, while this principle is clear and legitimate, certain legal and institutional hindrances need to be removed. That would require the involvement of those with authority in those areas, who will have to work side-by-side with marine biologists, economists and other social anthropologists, using an extremely cross-cutting and multi-disciplinary approach.

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