

ECONOMIC IMPORTANCE OF CONSERVING WHALE SHARKS



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Executive Summary

Determining the economic value of a species is of great importance in gaining support for protection of that species. Whale sharks are no exception. This species is at risk in its natural environment and has previously been the subject of intensive fishing practices. Whale sharks are currently listed as ‘vulnerable to extinction’ under the World Conservation Union’s (IUCN) ‘Red List of Threatened Species’. They also became listed on Appendix II of the *Convention on International Trade in Endangered Species* (CITES), which requires that international trade in products from this species is carefully regulated to assist in halting the decline in whale shark numbers. This listing however does not extend to the monitoring of domestic trade in whale sharks and their products.

Up to 1000 whale sharks were taken annually in the Indian fishery at the end of the last century before this practice was banned in 2001. Taiwan, the largest consumer of whale shark meat, put an end to the last large scale and legal whale shark fishing industry in 2007. However, despite recent bans on hunting, the recovery rate for whale sharks is likely very slow. This is further compounded by illegal, unregulated and unreported hunting – in addition to legal / opportunistic captures in various countries.

The increased uptake of well-managed ecotourism has the ability to be an economic and ecologically sustainable alternative to killing whale sharks. The economic gain from hunting is minimal when compared to the potential income generated from whale shark ecotourism. In Australia, the conservative value for each living whale shark is calculated at UA\$282,000 per shark.

Acquiring the economic value of a species can be a crucial step towards gaining legitimacy for the protection for that species. The current unsustainable fishing pressures placed on sharks (subclass *Elasmobranchii*) makes them one of the more urgent taxa requiring greater levels of protection and conservation. As an example, a study published in *Science* in 2007 (see Myers *et al.* 2007) indicated that between 1970-2005 along the east coast of the USA, the number of large sharks have declined dramatically, including scalloped hammerhead and tiger sharks that may have declined by more than 97%. In addition, bull, dusky and smooth hammerhead shark numbers have dropped by as much as 99%. WildAid (2004) report that shark finning, the practice of removing a shark's fin and discarding the rest of the body, has risen 400% over the last decade and a half. It is estimated that 'finning' claims between 26-73 million sharks annually (Clarke 2006). The median of this range of estimates (*i.e.* 38 million sharks) translates into an estimated 1.7 million metric tons of dead sharks (Raloff 2006).

Whale sharks (*Rhincodon typus*) are also at risk and have been the subject of intensive fishing practices to date. They are in fact the largest fish in the sea (Last and Stevens 1994), although their exact maximum length and weight is uncertain. Conservative estimates place them at 12 metres long and weighing 10 tonnes (Compagno 2001), while Chen, Liu and Joung (1997) report a specimen from Taiwan reaching 20 metres and weighing 34 tonnes. They are a highly migratory species with a cosmopolitan distribution and they can be found in all tropical and warm-temperate seas (Colman 1997) (see Figure 1).

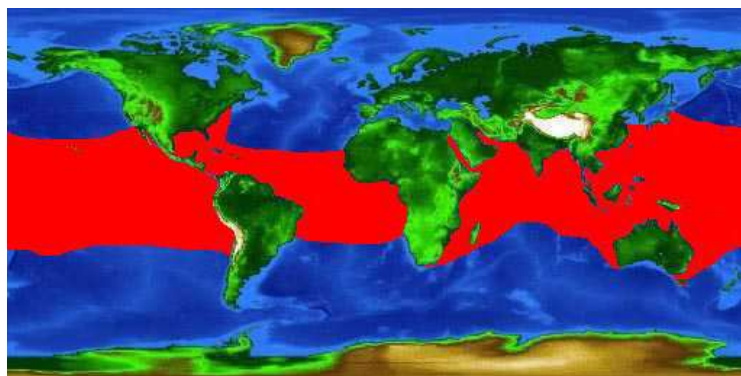


Figure 1: Global distribution of whale sharks (indicated in red)

One of only three filter-feeding sharks (Last and Stevens 1994), individuals of the species be regularly found aggregating at specific localities during certain months of the year, usually in areas associated with large ‘food pulses’ (Norman, 1999). It is because of their wide distribution (see Table 1), highly migratory nature and their dependence on healthy oceans to sustain their huge appetite that this species can be considered a ‘flagship species’ for the health of the marine environment. Despite a greater focus in research over the past decade however, the biology and ecology of whale sharks remains an enigma, with still much to learn to assist efforts aimed at conserving the species (Norman 2004).

Table 1: Whale shark Range States (Anon, 2002)

Argentina	Eritrea	Nicaragua
Australia	Ethiopia	Nigeria
Bahamas	Federated States of Micronesia	Northern Marianas Islands
Bahrain	Fiji	Oman
Bangladesh	France (New Caledonia,	Pakistan
Barbados	Reunion, French Polynesia	Palau
Belau	and other South Pacific	Panama
Belize	possessions; Clipperton	Papua New Guinea
Benin	Island; Guadeloupe,	Peru
Brazil	Martinique and other	Philippines
Brunei Darussalam	Caribbean possessions)	Portugal (Madeira, Azores)
Cambodia	Israel	Solomon Islands
Cameroon	Ivory Coast	Somalia
Cap Verd Republic	Jamaica	South Africa
Chile	Japan	South Yemen
China	Jordan	Spain (Canary Islands)
Colombia	Kenya	Sri Lanka St. Kitts-Nevis
Comoros	Kiribati	St. Lucia
Congo	Korea	St. Vincent and the Grenadines
Costa Rica	Kuwait	Sudan
Cote d'Ivoire	Liberia	Surinam
Cuba	Madagascar	Swaziland
Democratic Republic of the Congo	Malaysia	Tanzania
Djibouti	Maldives	Thailand
Dominica	Marshall Islands	The Gambia
Dominican Republic	Mauritania	Togo
East Timor	Mauritius	Tokelau
Ecuador	Mexico	Tonga
Egypt	Morocco	Trinidad and Tobago
El Salvador	Mozambique	Tuvalu
Equatorial Guinea	Myanmar	United Arab Emirates
French Guiana	Namibia	United Kingdom (St. Helena, Ascension, Bermuda, Virgin Islands, Anguilla, Turks and Caicos, Monserrat and other Caribbean and Pacific possessions)
Gabon	Nauru	United Republic of Tanzania
Ghana	Netherlands (Netherlands Antilles, Curacaçao and other Caribbean possessions)	Uruguay
Grenada	New Zealand (including South Pacific possessions)	USA
Guatemala	Macau	Vanuatu
Guinea	Qatar	Venezuela
Guinea Bissau	S. Tome and Principe	Vietnam
Guyana	Saudi Arabia	Western Samoa
Haiti	Senegal	Yemen
Honduras	Seychelles	
India	Sierra Leone	
Indonesia	Singapore	
Iran		
Iraq		

Despite being the focus of several fishing operations, whale sharks are becoming increasingly appreciated for their conservation value. They have been on the World Conservation Union's *Red List of Threatened Species* since 1990 and are currently classified as 'vulnerable to extinction'. This indicates that the estimated and projected reduction is between 50 and 20% of the population over a ten-year or three-generation period, whichever is the longer (Norman 2000). In 1999, the whale shark was listed on Appendix II of the *Convention on Migratory Species (CMS)*. This relates to migratory species that need or would significantly benefit from the implementation of international cooperative agreements for its conservation and management are listed in Appendix II of the Convention. In addition, whale sharks became listed in 2002 under the *Convention on International Trade of Endangered Species (CITES)* Appendix II, meaning that there are international trade limitations for product from this species for a nation that is a signatory to the convention. Appendix II is reserved for species that are not currently facing extinction but have the potential to be in the future if trade is not controlled. In addition, whale sharks are protected species in many nations' waters. However, given their migratory behaviour (Colman 1997, Eckert and Stewart 2001), without global protection from all relevant nations these conventions offer only partial protection. And it must be realized that the CITES listing only monitors/restricts international trade in whale sharks and does not influence domestic trade in product from this threatened species. Importantly, protection is only useful if monitoring and compliance is adequate.

In Taiwan, the whale shark is largely caught for its meat and is known locally as 'tofu shark' due to its apparent texture and taste. The market value for whale shark meat in Taiwan, which accounts for around 45 percentage of the body weight of a whale shark, was given as approximately US\$11.80/kg (Chen and Phipps 2002).

Taiwan, the largest consumer of whale shark meat, put an end to the last large scale and legal whale shark fishing industry in 2007. Over the last several years Taiwan has been reducing their quota in anticipation of this ban, with 30 permitted taken in 2007 down from 60 in the previous year. Prior to this planned reduction, figures on catches in Taiwan from 1997 to 2001 reveal that the number of sharks caught had dropped considerably

from 272 to 113 (Chen and Phipps 2002). However, Chen and Phipps (2002) state this could also be due to discrepancies in the reporting of catches, as opposed to a reduction in the number of sharks. In support of the latter hypothesis, all sharks landed in 2001 were relatively small, the largest being only seven metres in length, an outcome which may have been influenced by over fishing. Furthermore, there is evidence that other whale shark fisheries also experienced a reduction in catches despite increased effort and greater demand for whale sharks (Watts 2001).

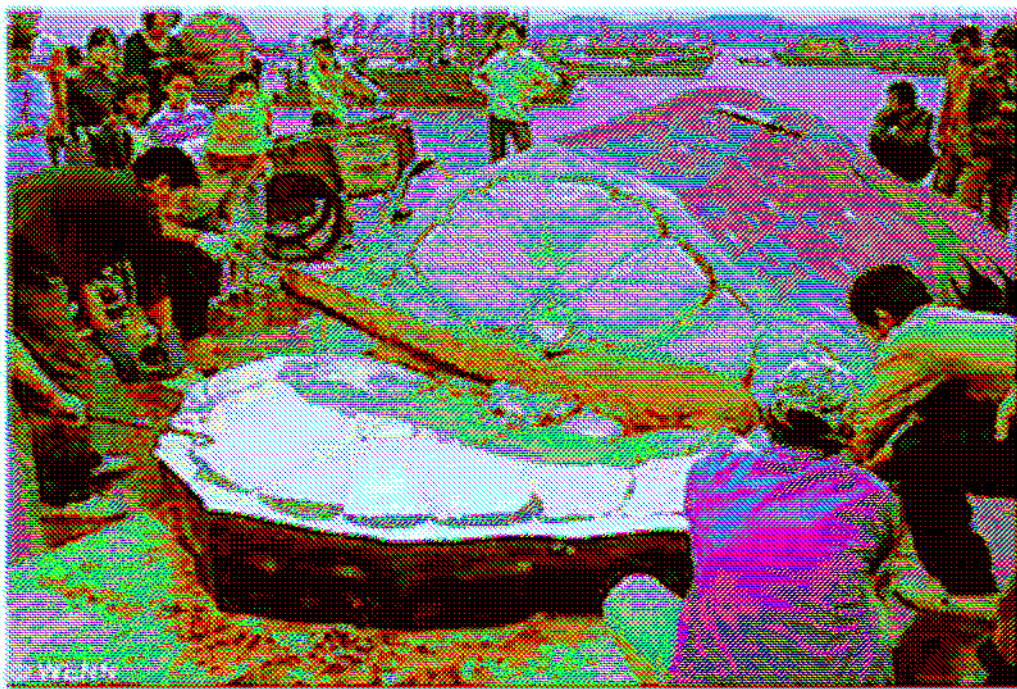


Figure 2: A crowd watches as the fishermen cut the giant whale shark into pieces in China
(source: Daily Mail online:

http://www.dailymail.co.uk/pages/live/articles/news/worldnews.html?in_article_id=443987&in_page_id=1811)

In addition, there is also evidence that Taiwan is not the only market for whale shark meat. Alava (2002) purports that Japan, Singapore, and Hong Kong also import whale shark meat to varying degrees. There are also reports of whale shark meat being sent to Europe, with one 2000kg shipment sent from Taiwan to Spain in 2003 (Clark 2004). Furthermore, recent anecdotal reports suggest that China is another addition to this list. This is consistent with Clark's (2004) findings that general frozen shark meat imports to China have increased 10 fold since 1998.

Although whale shark meat constitutes its greatest product by weight, whale shark fins are known to be highly valuable and another considerable export. A report detailing the characteristics of shark fin trade in mainland China and Hong Kong concluded that the effectiveness of the regulation of global trade in shark fin is highly dependant on success in these regions (Clark 2004). Hong Kong has traditionally, and still largely is, the major importer of shark fins, including whale shark, accounting for around 50 percentage of global trade (Clark 2004). Due to the greater economic liberation of mainland China, there is also now greater trade in sharks fins present in mainland China that is independent of Hong Kong (Clark 2004). Given their large size, single whale shark fins obtain high prices and are known to be worth up to US\$57,000 (Clark 2004).

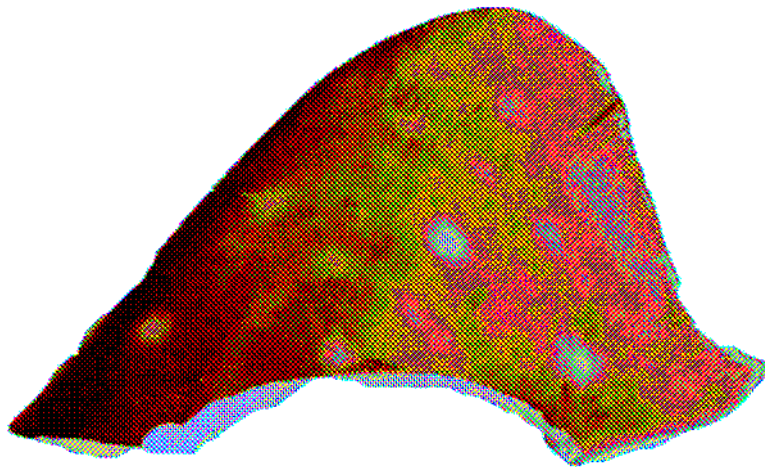


Figure 3: Whale shark – 1st dorsal fin (copyright: Brad Norman)

The economic incentive for fishing whale sharks is likely a function of their value for consumption, more so than for any traditional or cultural purpose. There have been exuberant claims on the prices of shark fin soup in restaurants and the prices paid per kilogram for shark meat, equivalent to tens of thousands of dollars for a single shark (Chen and Phipps 2002; Clark 2004). What needs to be considered, besides the obvious conservation concerns, is that the recorded prices paid to fisherman (landed) are meager in comparison to recorded prices paid in restaurants. In India, fishermen were paid less than US\$4000 per shark and Taiwanese fishermen were receiving as low as US\$0.10 per

kilogram (Watts 2001). A recent catch recorded from China sported that an eight metre whale shark was sold for only US\$3000 (Crienglish 2007) (see Figure 4). This clearly highlights that there is minimal economic benefit on a regional/local scale from whale shark fishing, as the high prices are realized elsewhere.



Figure 4: Whale shark caught in China for sale at market
(source CRIenglish.com: <http://english.cri.cn/3100/2007/09/17/1321@274920.htm>)

Despite the relatively recent cessation of the major ‘legal’ whale shark fisheries throughout the world, the likely very slow recovery rate of whale sharks makes it possible that the large number taken in previous fishing operations will have long term ramifications (Pravin 2000). To put this into context, while the Indian fishery was at the peak of its output, approximately 1000 sharks were taken annually (Pravin 2000), and this catch is around five times the most up to date estimates of the whale shark population returning to Ningaloo Marine Park (Norman *et al.* in prep), an area that has a lucrative whale shark tourism industry and known as one of the best locations in the world to find whale sharks (Norman 1999). Furthermore, recent genetic testing of whale sharks has confirmed, what was only assumed until now, that there is a high level of interbreeding between the various regional populations (Castro, Stewart, Wilson, *et al* 2007 cited in

Bradshaw 2007). As a result, besides decreasing yields experienced by localised whale shark fisheries (Watts 2001), there is additional evidence that whale shark numbers at particular locations may have been negatively influenced by activities elsewhere. For instance in Phuket, Thailand, a destination where whale sharks were listed by divers as third most important reason for visiting the region (Bennett, Dearden, and Rollins 2003), Theberge and Dearden (2006) found that there had been a 98% drop in sightings of whale sharks from 1998-2001.

But while efforts continue to bring a worldwide ban to unsustainable whale shark fishing, India has shown remarkable success in implementation of the ban – largely the result of a strong cultural influence demanding the protection of whale sharks. This was largely initiated through the efforts of the Wildlife Trust of India and local spiritual leader Morari Bapu, who advocated the importance of conserving whale sharks: suggesting that whale sharks coming to the waters of Gujarat, India are analogous to a pregnant daughter returning to her father for protection (with a street play outlining this message performing at ports along the Gujarat coast). As an example of the influence of this action, fishermen cut free seven whale sharks trapped in fishing nets off the Veraval coast (India) between October 7-9, 2007 (Bukhari 2007). However, some other countries have an opposing incentive to continue consumption of whale sharks, especially in East Asian countries where the demand for shark fin soup can still be high. In such countries, even if/when protection is implemented, questions must be asked, including: how effective is it? What is the level of compliance? Has CITES listing resulted in improved reporting of whale shark trade? Are the incentives in place strong enough the worth of e.g. nationwide bans on the kill and consumption of whale sharks? And will a ban in one country effectively only shift pressure on whale sharks from one region to another? These questions require immediate investigation.

And in addition to the ‘legal’ intensive fishing industries conducted in the past, data presented in Table 2, while by no means exhaustive, demonstrates that there have been other more recent opportunistic catches at various locations around the world. These reports however should be viewed as very conservative, since history shows that when

the legitimate whale shark fisheries were experiencing decreased yields whale sharks were being sourced elsewhere to meet demand (Watts 2001). Chen and Phipps (2002) estimated that up to 40% of fishing yield in some Taiwanese regions (which included whale sharks) is traded to China in the open seas and consequently not recorded or logged as official catch. Conversely, of the meat for sale in Taiwan it is purported that over half is not sourced locally in Taiwanese waters (Chen and Phipps 2002). Not surprisingly, there were large discrepancies found between reported catches and imports in Taiwan, and total content of whale shark meat available for sale (Chen and Phipps 2002). And these figures do not include the probable illegal, unregulated and unreported catch of whale sharks in many regions where monitoring and compliance is effectively non-existent. The level of pressure on whale sharks in these areas must be established as a priority.

Table 2: News reports of whale shark catches and strandings between 2006-2007

Date	Illegal and Opportunistic Landings and Strandings of Whale Sharks	Area/Region	Comments
Nov-07	5.5m whale found dead floating in shallow waters	Batangas, Philippines	It is claimed by locals that they landed two whale sharks earlier in the year
Sept-07	8m male caught	Fujian province, China	
Sept-07	8m female caught	Fujian province, China	
Aug-07	6m whale shark found dead in fishing net	Sabah, Malaysia	A similar incident occurred in 2006, however that whale shark has since died in captivity
Aug-07	5.2m female whale shark caught in fishing nets was transferred to aquarium	Yomitan Village, Japan	
Jul-07	Three whale shark kept in fishing cages for tourism purposes	Torri Beach, Japan	
Jun-07	6m whale shark caught	Zhejiang province, China	Second whale shark to die in less than 6 months
Jun-07	whale sharks die in captivity	Georgia, United States	
Jun-07	8m whale shark found dead in water, cause of death unknown	Florida, United States	Second whale shark to die in less than 6 months
Jun-07	Two small whale sharks captured in Taiwan and sold to the Georgia Aquarium	Georgia, United States	
May-07	Whale shark dies in captivity	Japan	Second whale shark to die in less than 6 months
Mar-07	6.2m whale shark accidentally caught in fishing net dies	Cambodia, near Thai border	
Mar-07	10m large whale shark caught	China	Second whale shark to die in less than 6 months
Feb-07	5m male found stranded	South Africa	
Jan-07	whale shark dies in captivity	Georgia, United States	Second whale shark to die in less than 6 months
Dec-06	5m whale shark caught	Kerala, India	
Nov-06	6m whale shark caught by fishermen in South China Sea	Hainan, China	After recovering from damage caused from net and harpoons, whale shark was transported to Guangzhou Aquarium, Guangdong Province in Sept. 2007
Nov-06	4.5 whale shark found stranded	St Lucia, South Africa	
Sep-06	6.5m female caught	Philippines	
Jul-06	2m whale shark caught in net butchered	Cagayan, Philippines	After recovering from damage caused from net and harpoons, whale shark was transported to Guangzhou Aquarium, Guangdong Province in Sept. 2007
May-06	8m whale found dead with bullet wounds to the head	Batangas, Philippines	
Apr-06	10m whale shark beached	Israel, Mediterranean Sea	
Feb-06	8m shark caught	Zhuhai, China	Cause of death believed to be ingestion of sewage 3000kg shark sold for US\$0.50/kg

An alternative more environmentally responsible economic use of whale sharks is gaining increased momentum. Whale shark tourism first started in the late 1980s at Ningaloo Reef in Western Australia (Colman 1997b), and has since proliferated to at least 20 other locations around the world, including Seychelles; several locations in Mexico, Philippines; Maldives; Belize; Honduras; Mozambique; Kenya; and Djibouti (Norman unpub. data). It is estimated that up to 100,000 people participate in whale shark tourism activities around the world annually, paying up to US\$350 for a single encounter, in turn generating millions of dollars for local economies (Catlin unpub. data). Furthermore, some of these tourism industries have developed at the expense of consumptive uses.

For instance, whale sharks were legally hunted in the Philippines until protection was introduced in 1998. Whale shark ecotourism soon developed in Donsol, Sorsogon with great success and was subsequently listed as 'Asia's Best Animal Encounter' by Time Asia (Perry 2004). The whale sharks' appearance in Donsol has continued to be a benefit to the local economy. Early records show 800 visitors to Donsol in 1998 with a total income of US\$10500, generated from registration fees and boat rentals. The number of visitors increased to approximately 7200 in 2005, generating an estimated income of US\$208,000. Arevalo (2006) notes that revenues derived from tourism efforts (related to whale sharks) resulted in Donsol being elevated from a fifth class municipality (annual income of US\$162000 to a fourth class US\$301,000-486,000). This resulted in a shift from Rank 76 in the poverty line amongst the poorest municipalities of the region to a rank of 17 (Arevalo 2006). In addition, since 2002 more than 300 jobs have been created and in excess of 200 fishermen have gained seasonal employment as a result of whale shark ecotourism.

As stated by Topelo and Dearden (2005) "Knowledge of the economic value of shark watching can be used to gain public support for the protection of sharks through the establishment of marine reserves and/or restrictions placed on the fishing industry.". To fully appreciate the economic value of a species to tourism, it can be helpful to calculate the economic worth of an individual animal, as was done by Anderson and Ahmed (1993) who recorded an annual value of US\$33,500 for each grey reef shark (*Carcharhinus*

amblyrhyncos) to tourism in the Maldives. However, quantifying the value of a whale shark to tourism is not as easy as calculating the amount paid per a kilo for an animal. Nonetheless, there have been several reliable studies conducted in recent years based on the worth of a whole tourism industry (see Table 3). As an example, it was found that at Ningaloo between AU\$3.2 and 6.2 million would be lost to the local economy if the whale sharks were not present (Catlin unpub. data). In another study, whale shark tourism was valued at US\$3.08 million to the Seychelles. Furthermore the economic significance of these economic contributions is compounded by the fact that apart from the whale shark industry at Ningaloo Reef, the majority of these industries take place in developing nations and generate their income in a short period of time (given the seasonal nature of the whale sharks' presence).

Table 3: The economic values and number of whale sharks at four destinations

Location	Estimated worth	Method	Number of sharks
Western Australia	AU\$3.2-6.2 million	Direct expenditure	Minimum 400
Seychelles	US\$3.08 million	Travel Cost Method	Approx. 150-200
Philippines	US\$208, 000	Unknown	Minimum 129
Belize	US\$1.32 million	Unknown	Minimum 106

In order to extrapolate the value for individual whale sharks, we require not only knowledge of the value of the industry but also the number of whale sharks being exploited. Chen and Phipps (2002) argue that a simple comparison between the individual value of a shark to tourism versus its worth to fishing does not do justice to the flow-on effects associated with fisheries, such as wholesaling and market value. While there may be economic flow-on benefit from fishing whale sharks, this is not unique to this industry and it is also true for tourism-related activities, which have the potential to generate a large flow-on given it is an export industry. Furthermore, Chen and Phipps (2002) ignore the fact that whale sharks are known to have great longevity (up to 60 years) (Pauly 2002), and have been found to visit the same location in consecutive years or

alternatively remain there all year round (Norman unpub. data). Therefore, unlike fishing industries that receive only the one-off income from a dead shark, tourism has the potential to acquire economic benefits from a single shark for several decades.

Given that Ningaloo Reef is the oldest and most researched destination for whale shark ecotourism (Colman 1997b), it serves best as a case study for estimating the individual value of a whale shark. The calculation involves taking the middle estimates for the value of the industry. This figure is then divided by the number of sharks and multiplied by the generational gap: whale sharks are believed to have a generation period of approximately 24 years (Watts 2001).

In Australia at Ningaloo Reef

$$\frac{\text{Value of the industry (AU\$4.7million)}}{\text{Number of sharks (400)}} \times 24 \text{ years} = \text{AU\$282,000 per shark}$$

It should be noted however that this calculation does not take into account the fact that a whale shark could visit more than one destination and consequently its worth could be double or triple this single value (because of the value to other whale shark destinations). Support for this has already been forthcoming from researchers using the *ECOCEAN Whale Shark Photo-identification Library* in Belize, Honduras and Mexico with confirmation that some of the same whale sharks visit all three locations (see www.whaleshark.org).

A similar approach to establish the individual worth of a live whale shark to tourism was made by Graham (2004) for whale sharks in Belize. Her calculation resulted in a much greater value of \$US 2,094,340 per shark by using the average age of sharks, rather than the generation gap, as the multiple. Although the calculation used in the current paper is more conservative in nature, it was chosen for a variety of reasons. Firstly, without knowing the intricacies of whale shark migration it would be speculative to assume that the every whale shark returns to the same location each year. Moreover, whale sharks are

not known to frequent any tourist location regularly when they are juveniles, therefore including their juvenile years in this calculation would be misleading. The life history of whale sharks is largely unknown, although for the calculation used in this paper, the whale shark population at Ningaloo is regarded as stable. Therefore given this population size, it may be expected that a whale shark should be replaced on average every biological generation. Nevertheless, the more conservative figure produced by the calculation within the current paper is still relatively large in comparison to the revenue obtained through whale shark fishery activities.

It is clear that there are many destinations worldwide currently reaping the economic benefits derived from whale shark tourism, although the total potential for greater participation by stakeholders (and economic benefit) through new whale shark tourism destinations worldwide is unknown. And while locations such as India, which has high densities of sharks, is a potential addition to this list, there are likely many undiscovered 'hotspots' for this species. At Ningaloo, the 'original' whale shark tourism destination, the presence of whale sharks was widely unknown and undescribed until the 1980s when a concerted effort was made to locate and record their presence (Colman 1997b). With greater exploration of whale shark habitats, there is the potential to find and create additional whale shark tourism industries at previously unidentified locations for whale shark appearance.

In conclusion, whale sharks are an inherently important species to conservation of the natural environment. Not just because they are the largest fish in the sea and susceptible to over-fishing, but because of their ability to attract interest and act as a flagship species for the conservation of the greater natural environment. The evidence presented in this paper clearly indicates shows that the economic gain from the unsustainable practice of fishing whale sharks is minimal when compared to the potential income generated by using whale sharks as a sustainable tourism attraction. And while several of the larger scale legal whale shark fisheries have ceased, it is clear from the literature and anecdotal reports that there is still some demand for the export of both whale shark meat and fins. It

is therefore extremely important that efforts are maintained to halt any future developments in both the legal and illegal fishing of whale sharks as a priority.



Figure 5: Whale shark and ecotourist (copyright: Brad Norman)

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