

Report to **PROJECT AWARE FOUNDATION**



**Whale Shark Research Project – India
Research - Conservation - Ocean Advocacy
Ecotourism Development**

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Shark Research Institute
P.O. Box 40
Princeton, New Jersey 08540
USA**

Submitted by
Arun & Alka Patil
Sundial Apartment, A.S. Road, Altinho,
Panjim, Goa , India. 403 001
Email : arun_patil55@hotmail.com
alkapatil12@yahoo.com

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Executive Summary

In India, whale sharks are now protected under Schedule 1 of the Wildlife Protection Act of 1972. Prior to the ban on hunting the sharks, fishermen along the coast of Gujarat had become dependant on whale sharks as an additional source of income. To ensure effectiveness of the ban, SRI is seeking an alternative source of income for these fishermen. The report examines the feasibility of establishing whale shark eco-tourism industry at the port of Diu, and identifies the need to generate reliable data regarding seasonality and locations of whale shark sightings as a requirement to establishing its commercial viability for local entrepreneurs.

**REPORT OF FEASIBILITY STUDY
BY THE SHARK RESEARCH INSTITUTE
30 March to 10 APRIL 2004**

BACKGROUND

The post-World War II boom in the economies of countries of the Pacific Rim created new wealth. A status symbol in Asian countries is consumption of dishes once reserved for the wealthy, such as shark fin soup. The demand for shark fins in the Asian market has depleted shark stocks throughout the world and many species are now facing extinction. For example, along the east coast of South Africa, whale sharks declined 83% from 1993 to 2001. In the Gulf of Mexico, the population of oceanic whitetip sharks is one percent of what it was 50 years ago. Sharks are apex predators (K-selected species) of the ocean ecosystem. Removal of sharks is causing profound and negative alterations to the ocean ecosystem.

In 1993, the Shark Research Institute (SRI) created a strategy that results in a win-win situation for both fishing communities and sharks. Through development of shark ecotourism, value is created for living sharks, and a sustainable, renewable revenue stream is generated for former fishers. Sharks are now being viewed as economic assets to be protected by an increasing number of countries throughout the world.

Traditionally, during the time of year whale sharks passed along the north Gujarat coast (a region called "Saurashtra"), local fishermen relied on their catches of pomfret. The fishermen netted the fish using wide-mesh nets that allowed juvenile fish to escape. By allowing the young fish to reach adulthood and breed, the fishery remained sustainable. Then, the foreign fleets moved into the area, using fine-mesh nets designed to catch juveniles as well as adults, and the fishery soon collapsed.

Faced with a loss of income, the Gujarat fishermen, were receptive to replacement of the pomfret fishery with a whale shark fishery. Whale sharks were seasonally abundant along the Saurashtra coast and individuals were occasionally taken for the oil contained in their livers, but whale shark flesh was not consumed in India and there was no market for whale shark products in the country.

When Asian markets became aware of the numbers of whale sharks along the Gujarat coast, they were quick to respond. What followed was an unprecedented slaughter of whale sharks along the entire Saurashtra coast. Considered a rare species (by 1986 there had been only 320 recorded sightings of the ocean giants in all of western scientific literature), some 1,000 whale sharks were slaughtered in a single season (2000) with Veraval as the processing center.

Of the 370 species of sharks, whale sharks are the most valuable to the ecotourism industry. Highly lucrative whale shark tourism industries have developed elsewhere in the world because the giant sharks are entirely

harmless to man and many appear to enjoy interacting with swimmers and divers. As had happened earlier in the Philippines, the whale shark population along the Saurashtra coast was being decimated, thereby reducing the likelihood enough would survive on which to build sustainable-use programs such as whale shark tourism. It was the same “scorched earth” mentality that characterizes the Asian markets’ rape of the seas elsewhere in the world.

2000

Executive Director of SRI, Marie Levine met with Mike Pandey of Riverbank Studios, representatives of the fishing industry, diving industry and marine conservation organizations (National Institute of Watersports and Reef Watch Marine Conservation) in India and a conservation strategy for whale sharks was developed.

2001

April : Grants from the PADI Foundation and Project AWARE Foundation allowed SRI to conduct a study of the whale shark trade at Veraval. During this study, SRI established that the port of Veraval in the state of Gujarat had become a major whale shark trading center with specialized whale shark meat processing factories feeding a flourishing whale shark product export industry. Data on whale shark landings at Veraval were presented in the SRI report.

June : Whale sharks were placed on Schedule 1 of the Wildlife Protection Act of 1972

July : A conference convened by the Central Government at Sansagir identified eco-tourism as the best alternative vocation for the fishers of Gujarat.

December : Schedule 1 of the Wildlife Protection Act of 1972 was amended to include only nine species of sharks and rays.

2002

February : The need for establishing an eco-tourism project for whale shark viewing as a tourism activity stems from the need to provide alternate means of livelihood to fishermen who were involved in the whale shark fishery prior to its ban. Using a grant from Project AWARE Foundation, SRI conducted an assessment of the post-ban scenario and the impact of the ban on the local population at Veraval. It was observed that the fishermen had grudgingly accepted the ban on killing of whale sharks. The size of the whale shark makes it difficult for the local fishermen to defy the ban and continue to land the whale sharks in a clandestine manner. The export traders appreciated this situation and adapted to business in other fish species. Even if a fisherman managed to land the whale shark at a deserted beach in the cover of the night, he was unlikely to get a good enough price for his catch to risk breaking the law.

The study also assessed the existing tourism infrastructure at Veraval, and found it lacking. Although the whale sharks have been reported all along the Saurashtra coast, none of the locations appeared to be suitable for whale shark tourism due to a total lack of tourism infrastructure. The Union Territory of Diu

located along the same coast appeared to be the most promising location for basing a whale shark viewing project. It was concluded shark-based tourism in the region was more likely to be successful if first established at Diu, and could serve as a template for development elsewhere along the Saurashtra coast.

November: India and the Philippines proposed the whale shark for an Appendix II listing at the Convention in Trade in Endangered Species (CITES), a United Nations Treaty Organization. The proposal was successful, receiving the required 2/3 majority vote of the member nations. The Appendix II listing prohibits all trade in whale shark products of member nations unless the nation can first demonstrate that such trade is not detrimental to survival of the species. Sufficient scientific data are available to establish that whale sharks may not be taken anywhere in the world without putting the entire population at risk.

2003

Due to international perception regarding scope of conflicts in Gujarat, SRI's efforts at fundraising for development of whale shark ecotourism were unsuccessful.

2004

April : A proposal was sent to SRI to conduct a feasibility study for establishment of a whale shark based eco-tourism project in order to determine what infrastructure was available and what additional data were needed to approach local entrepreneurs and potential investors. SRI secured funding for the study through Project AWARE Foundation. Results of the study (contained herein) identifies a need for additional data on seasonality of sightings in order to develop domestic and international markets.

THE EXPEDITION TEAM

The principle researchers are Commander Arun Patil and Alka Patil. The Patils conducted the earlier studies for Shark Research Institute along the Saurashtra coast. Commander Patil is also Director of India's National Institute of Water Sports. Mumbai-based NGO, Reef Watch Marine Conservation (RWMC), headed by Pralhad and Mitali Kakar have been doing extensive field work in the Saurashtra region to increase awareness in the coastal population about the need to protect the whale shark and agreed to join hands with SRI on this project. Sudarshan Rodrigues, RWMC's marine biologist, joined the study team. He brought with him a wealth of local contacts and knowledge of the ground situation about whale sharks in the coastal belt. We also contacted Mike Pandey whose pioneering film on the whale shark industry in Veraval, *Shores of Silence, Whale Sharks of India*, won the Green Globe Award at Cannes. Unfortunately, he was not able to join the team due to prior commitments.

OBJECTIVES OF THIS STUDY

The scope of this feasibility study was limited to the aspects related to establishment of a project based on whale shark viewing as a tourism activity. The following objectives were finalized for the study:

- 1) Does Diu have the requisite infrastructure to support this type of tourism, which may include domestic as well as foreign tourists?
- 2) Response of Local & Central authorities for the study and subsequent eco-tourism project and permissions.
- 3) Identify problem areas & prepare the ground for subsequent research initiatives of SRI related to satellite tagging of whale sharks off Diu.
- 4) Design the study to maximize data collection with regard to sightings of whale sharks: Optimum time of year for sightings, distance from shore, and numbers and sizes of whale sharks to be seen. Determine the availability of suitable sea-going boats and costs involved (Will it be easy or difficult to locate whale sharks with locally available talent and equipment). Determine the availability of aircraft or aerial surveys and support, find local sources of equipment and evaluate adequacy of expertise of local operators and their costs.
- 5) Commence creation of a database of whale shark sightings off Diu, which, hopefully, will be continued by subsequent researchers.
- 6) Investigate the possibility of involvement (financial and physical) of Indian / local entrepreneurs in whale shark tourism. Determine their needs and what how we can assist them in development of the industry.
- 7) Other aspects, which may come up during the feasibility study.

FIELD WORK

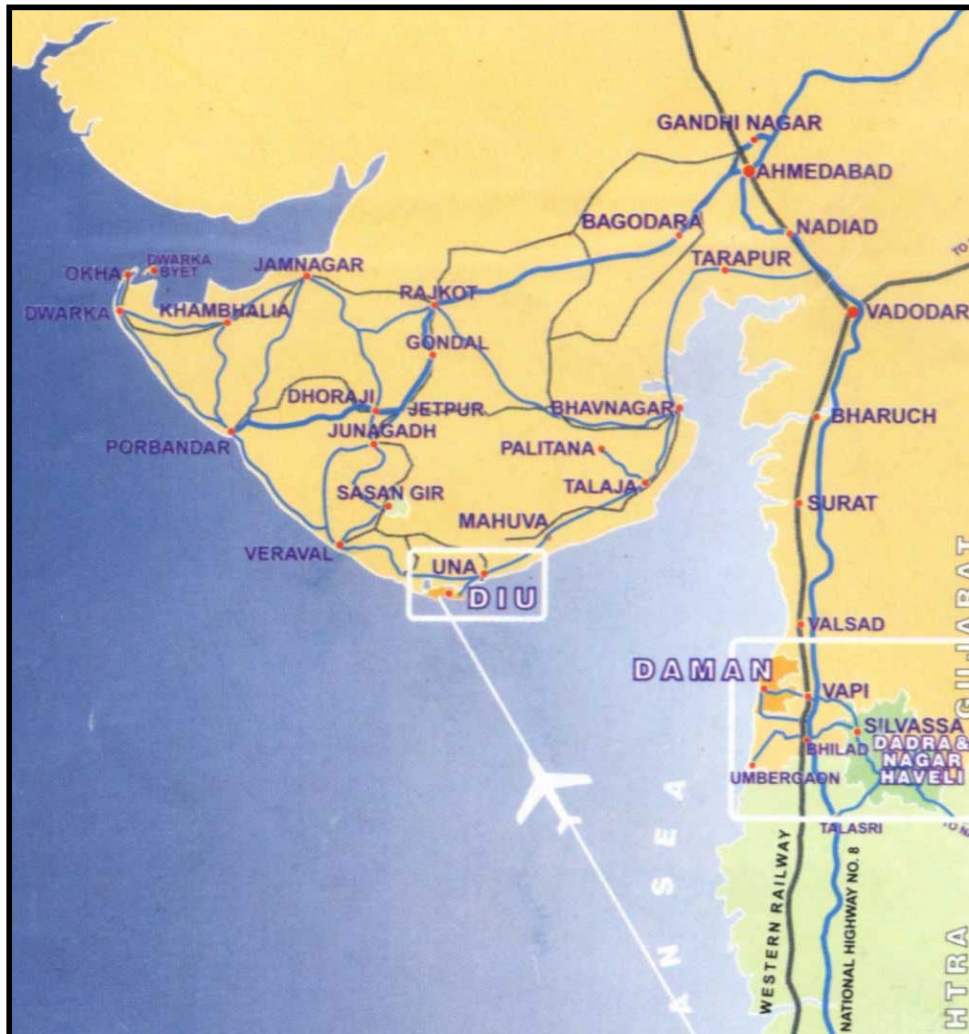
The fieldwork related to the feasibility study was divided into two distinct aspects:

- a) Suitability of Diu for basing a tourism project for international and up-market domestic tourists.
- b) Suitability of Diu for whale shark viewing as a domestic and international tourism activity.

a) Diu as a domestic and international tourist destination

- 1) Diu is a centrally administered region called “Union Territory of Daman and Diu”. The state laws of the Government of the surrounding state of Gujarat are not applicable to this region.

Location map of Diu



Geographical location of Diu is shown in the location map on the preceding page. For the international as well as upmarket domestic tourist, there is a direct flight from Mumbai to Diu by a private airline 'Jet Airways' with a flight time of one hour. There is a cheaper flight from Mumbai to the nearby town of Rajkot by Indian Airlines, which would involve a road journey of approximately four hours by taxi to reach Diu. There are no ships plying to this region from Mumbai. The connectivity by rail or road is not promising. The nearest major railhead is at Rajkot. Because of the geographical shape of the region, the road from Mumbai goes northwards up to Ahmedabad and then southwards to Diu via Rajkot and Veraval.

- 2) Diu is surrounded by the state of Gujarat which is the only major state in India with prohibition in force. However, Diu being a Union Territory, the Gujarat state prohibition law is not applicable in Diu.
- 3) The island of Diu has virtually no industry. It is a quiet place with clean beaches. It is a popular destination for the rich trading community of Gujarat. Therefore, there are a large number of hotels of one- to three-star categories, which could cater to the proposed whale shark tourism.
- 4) The Collector, who is based in Diu, is the senior-most official of the Union Territory administration. Being a small region, the administration is responsive to the tourism industry.
- 5) Like Goa, which is an internationally-known tourist destination, Diu was a Portuguese colony. Goa is slowly becoming crowded with tourists, whereas Diu remains a secluded and beautiful beach destination offering the same attractions as Goa, but without the commercialism and overcrowding.
- 6) Diu has a number of excursion spots within easy driving distance. Photographs of most of these spots are given in our previous report of February 2002. These excursions would provide an optional recreational activity for tourists when they take time off from whale shark viewing at sea (*Photographs 14 to 17*).
- 7) Most tourists prefer to hire two wheelers for moving around Diu (*Photograph 1*), but cars are also available for hire.
- 8) Saurashtra has a very unique culture, which would be a major attraction for a foreign tourist. For wildlife enthusiasts, the Gir Wildlife sanctuary, famous for the Asiatic Lion, is nearby. The Wild Ass and the Flamingos of the Kutchh desert are also special attractions of this region. The Somnath temple located 90 km away has been an ancient religious center of the Hindus for many centuries.

For international tourists landing at Mumbai, the afternoon flight to Diu would be a convenient connection eliminating an overnight stay in Mumbai.

We evaluated various hotels in and around Diu and found some of them to be of adequate standard for an international tourist. Kohinoor and Radhika resorts are specially recommended. For a budget tourist who would prefer a special ambiance rather than the three-star comforts of a resort, we recommend Resort Hoka at the Nagoa beach (*Photograph 2*).

b. Diu as a whale shark tourism destination

Researchers collected data on the whale shark landings at Veraval to assess the seriousness of the situation related to the survival of the whale sharks off the Gujarat coast. Year-wise occurrence of whale sharks in India was reported in the August 2000 issue of *Current Science*, summarizing the landings from 1888 to 1998. The March 1994 issue of *Indian Journal of Fisheries* gives data of landings of whale sharks at Veraval from 1988 to 1991. Ms. Fahmeeda Hanfee provided data on whale shark landings along the Indian coast in her report “*Trade in Whale Sharks off Gujarat Coast*” prepared for WWF India in January 2001. Our report of April 2001 included data on exports and exporters and provided updated data on whale shark landings at Veraval and other locations on the Gujarat coast.

All accumulated data were related to whale shark ‘landings’. There has been no documentation of the ‘sightings’ of whale sharks anywhere in India. The whale shark processing factories and export firms were located at Veraval and the fishermen towed their whale shark catches to this port irrespective of where the animals were actually caught. Hence the ‘landing’ data cannot be taken as representative of the whale shark ‘sightings’ off Veraval.

Since Veraval was ruled out as the whale shark tourism center for several reasons, we had to look for other locations in the Saurashtra region. The ports of Kodinar, Sutrapara, and Madhavpur could not be considered since they have no tourism infrastructure. We therefore decided to concentrate our fieldwork to the port of Diu.

c. Trawler Survey

The first step in doing any work in Diu is to obtain approval from the Collector. The next important person of the local administration related to our study was Mr. Sukar Anjani, fishing superintendent of Diu. We met him at his office in the heart of the town (*Photograph 3*). Initial inquiries made by him for hiring of trawler for the feasibility study proved unsuccessful since the trawler owners were comparing the cost of a successful trawling day at sea with the hiring charge that they could charge us. Mr. Anjani therefore contacted Mr. Ramjibhai, the headman of the Vanakbara fishing village. Over a cup of black tea in his office, we were able to negotiate a reasonable hire charges for a four-day survey (*Photograph 4*). The owner of the trawler “*Krishna Kumar*” was located and his willingness to hire his trawler was confirmed. We then verified that he had enough expertise of locating whale sharks at sea. He was then

briefed on the work of our study. He agreed that he would not be trawling on the days he will be working for us.

The trawler owner had to incorporate some modifications to his trawler for the study team. A tarpoline sheet was stretched across the fore deck for shade from the sun. Four plastic chairs were placed under it and lashed together, and to the deck. A rope ladder was prepared so that the team members could climb back on the trawler while at sea (*Photograph 5*). The trawler did not have navigation or communication equipment on board. The headman of the village agreed to loan a wireless set from his fleet of trawlers for the duration of the study. Fresh provisions were stocked up specially since one of the team members was vegetarian, whereas the normal diet of the crew at sea was fish and rice. The dining area was the rear deck, which also had a small wood fired stove (*Photographs 6 and 7*).

It was perhaps the first time that a woman was sailing on the trawler. The whole village had assembled to see us embarking along with our underwater camera and other snorkeling equipment. There was a traditional fishermen's ceremony of breaking coconut and lighting incense sticks before we set sail in the early hours of 5 April 2004 (*Photograph 8*).

Vanakbara harbour has a very shallow channel and leaving and entering harbour can only be done at highest tide. The importance of this fact became apparent only towards the end of the survey since it put severe restrictions on our entering and leaving the port. We had to anchor outside and wait for several hours for the tide on two occasions. This limitation could have been resolved by shifting the operations from Vanakbara harbour to the jetty near the fishing superintendent's office in the main town of Diu.

The fishermen who were earlier engaged in killing of whale sharks had developed their own techniques and thumb rules locating the whale sharks. These techniques therefore differed from each fishing village. The Vanakbara fishermen believed the 'barrel' fish (which is the local name for Whale Shark) came up to bask in the sun as the day got warmer and was usually found in what they called "Lal Pani" which translates as "Red water", (which may be indicative of the colour due to the krill on which the Whale Shark often feed). However, all of them seem to agree that the barrel fish is not seen very often as in previous years. We had to take this observation in correct perspective, since in the post ban period they were not setting out on dedicated Whale Shark hunting missions.

After about of about one hour of sailing on the first day, we tried out our equipment and camera (*Photograph 9*). The make-shift ladder seem to be adequate. The plastic chairs and the sunshade also seem to be serving their purpose quite well. We established contact with the port authorities on the wireless set and set out to find Whale Sharks.

On the first day we headed for the deeper waters, known as "Patla pani" by the fishermen (which translates as "clear water"). The trawler skippers' traditional shark hunting method was followed, which was to go to the point where the

clear water met the band of turbid water (“Lal Pani”) and then to follow this band of “Lal Pani”, which is where whale sharks are spotted. Two team members along with the two members of the crew sat on top of the wheel house as lookouts, as we set course on what the trawler skipper felt was the most likely area for whale shark sighting. The survey had to be wound up at sunset as the daylight faded. A suitable anchorage point was found outside Vanakbara harbour, so that we could sleep onboard and resume the survey next day in the early morning. The staying onboard in the night was forced on the team since the tide timings would have resulted in losing in many hours the next morning, waiting for the high tide to exit the harbour.

The routes taken by the trawler were recorded on a hydrographic chart for Day 1 to Day 4 (*Photograph 18*). Days 1, 2 and 3 did not result in any whale shark sightings. We asked fishing trawlers that we met at sea if they had seen whale sharks while they had been trawling. Some reported seeing whale sharks on previous days, but in an area far off from the present location. The search was carried out using the fishermen’s experience on the likely areas where sharks would be feeding. This included reports from other fishermen sighting the sharks, and following the bands of “Lal Pani” where they said the sharks were most likely to be feeding.

The first three days of the survey yielded no sightings. Either the whale sharks were not in the region or we were not at the right place at the right time. The fishing trawler at its cruising speed of 10 knots had inherent limitation on the area of the sea it could survey.

There was an overcast sky on fourth day. It was decided to stay in shallower water off the coast of Kodinar and Sutrapada. By late morning the wind had died down and the swell was very small. At 11:45 a.m., a two-metre whale shark was sighted just 10 m to starboard of the boat. It was swimming on the surface with the tip of its tail showing above water surface. The white spots on its back were clearly visible.

We had decided on the post-sighting maneuver in advance. We turned away from the whale shark to put more distance between the boat and the shark and made a wide circle so that we would be able to enter the water ahead of the shark, and the shark would then come towards us. We readied the camera and entered the water. But somehow the shark seemed to get alarmed and dived. Unfortunately, we could not get a photograph either from water or from the boat before it disappeared. We circled the area for another 20 minutes with the hope that the whale shark would re-surface, but we could not re-locate it. The visibility reading at this spot taken with a Secchi disc was two metres and the water temperature was 26° Centigrade. The water was “lal pani” in the language of the local fishermen; however, we were not able to detect any change in colour of sea water.

d. Aerial Survey

Unfortunately, aerial support for this study was not possible; before a permit for use of a microlight aircraft in this study could be granted by the Ministry of Civil

Aviation, input and clearance from a number of other government agencies was also required. The delay while our application was processed through these ministries would have prevented any field work until after the sharks had departed. The study team, therefore, decided against postponing the date of the study from April, which from all accounts was the best time for sighting of whale sharks off Diu, and conduct the study without any aerial support.

From our enquiries, we had identified M/S Flying Safari based at Silvasa in the Union Territory of Daman as the most likely agency who could conduct the aerial survey off Diu. (M/S Flying Safari; H/10 Gurudev Complex, Saily Road; Silvasa 396 230; Fax 912-602-640-82.) Over telephone and fax, Mr. Sameer Rane, the owner and chief pilot, indicated that he was keen to undertake the aerial survey as a turnkey assignment. However, it was necessary to discuss the modalities of the survey and confirm the competence of the firm as regards equipment and crew. We therefore visited the premises of M/s Flying Safari and met with Mr. Rane at his Silvasa office (*Photograph 19*) (M/S Flying Safari; H/10 Gurudev Complex, Saily Road; Silvasa 396 230; Fax 912-602-640-82)

The SRI report on a five-year aerial survey of whale sharks off the east coast of Southern Africa by Albert Gifford and L.J.B Compagno, Ph.D. provided the framework on which the Diu aerial survey was designed. The above report had concluded that a microlight is the best choice for such a survey due to its slow flight speed, maneuverability, portability and low cost of maintenance and fuel. They had concluded that the flight levels between 500 to 850 feet are most productive related to the wind direction and velocity, haze and glare from the sea surface. Since weather and sea conditions are unpredictable, they had conducted the aerial surveys not on a fixed schedule but at least twice a month and more often when the weather was favorable. We also decided to take into account their observation that the whale sharks tended to avoid dirty waters and were often seen swimming along the clearly defined perimeter that separates the clean from discoloured water.

The list of flying equipment and accessories held with M/s Flying Safari is given at **Annexure –1** along with the endurance and range of each aircraft. The list indicates that the firm has one fixed wing two-seater Microlight, one two-seater powered trike hangglider, one powered two-seater trike paraglider, two two-seater powered paramotors and two powered solo paramotors. The firm has three pilots on its payroll and two pilots available on call.

Based on the Gifford-Compagno report, the fixed wing Microlight is a possibility but it has limited mobility and requires a hanger. The solo powered paramotor was ruled out since it would have no observer. The two-seater powered paramotor was of the foot launch type; it was felt that this would not be safe for long duration aerial survey. The two-seater powered hang-glider with trike landing gear appeared to be the best choice due to its greater gliding capability. The two-seater powered paraglider could also be used. However it was felt that both these aircrafts would have been far safer over sea if they had floats. It was concluded that the firm would be competent to carry out the aerial survey using its own equipment and crew.

During discussions with Mr. Rane, it was observed that it would be more efficient if we are able to find a sponsor to purchase a Flying Inflatable Boat (FIB) or a Flying Rigid Boat (FRB) dedicated to the survey. In such a scenario, the FIB would be stationed at Diu and the flying crew and the observer would shuttle between Diu and their headquarters. The names and address of the manufacturers of FIB & FRB are given at **Annexure-2**.

Response of US Embassy in New Delhi regarding formalities involved in getting Indian Government clearance is given at **Annexure- 3**. It will be seen that the Government clearance for aerial survey in sensitive areas like Diu would be easier if it is conducted by an Indian NGO involving Indian researchers, and the aerial survey through M/s Flying Safari might also stand a better chance for clearance from the Government. All SRI field research in India has been conducted by Indian researchers affiliated with SRI and so steps are being taken to register SRI-India as an NGO. This may make permits much easier to secure and the researchers will continue to have access to SRI resources and expertise.

The details of the proposed aerial survey over one season (October to May) were discussed with Mr. Rane. We would need to base the microlight at Diu throughout the survey period by finding appropriate storage place. The pilot and observer would visit Diu twice a month and fly for three days with two sorties of 2 hours per day. The costing of such a survey is given below:

Hire of Microlight : \$ 750/- per month (pm)
Storage and security for microlight at Diu : \$ 250 pm
Cost of two survey visits to Diu: \$ 2500 pm

Hence the cost of survey is estimated to be \$ 3,500 per month.
The total cost of aerial survey for one season from October to May (8 Months) would be \$ 3500 x 8 = **\$28,000**

If we are able to procure a FIB for the survey, the monthly cost would be \$ 2,750 and the total cost would be \$2,750 x 8 = \$ 22,000/-. This option will result in a safer and more efficient survey. The microlight will also allow us to extend the survey to later years and also be available for the satellite tagging project that is envisaged in near future off the coast of Diu.

RESULTS

We attempted to answer questions raised in the section titled “Objectives of the Study”:

- 1) **Tourism Infrastructure** : Diu has the required tourism infrastructure as regards connectivity by air, accommodation and local tourist attractions. It also has historical, religious as well as wildlife attractions as day-long excursions. The region has its distinctive culture, handicraft and cuisine.
- 2) **Response of local authorities** : The local administration was found to be responsive to this new initiative related to whale shark tourism. The Diu

fishing superintendent gave every possible help related to the contact with the local fishing community.

- 3) **Permits required:** We found that the aerial survey would need clearances from Ministry of Civil Aviation. If the study team involves foreign team members, we found that additional permissions would be required from Ministry of External Affairs and Intelligence Bureau. For surveys near border and other sensitive areas, the permissions would be very hard to obtain, but we do not anticipate any need to survey those areas.
- 4) **Aerial survey and support:**
Diu has an airfield with runway and ATC support. It would be possible to base a microlight at the airfield. However, the cost of hiring a suitable fixed wing aircraft for this purpose is likely to be prohibitively high. Alternatives were explored and discussed on Page 11 of this study.

Since most whale shark ecotourism elsewhere throughout the world relies on aerial support to guide tour boats to the whale sharks, lack of aerial support may hamper development of tourism. However, it may be possible in the future for Flying Safari (or a similar company) to obtain permission for their pilots and aircraft only, and still be able to provide the necessary aerial support for whale shark tour operators and researchers.

- 5) **Creation of database of whale shark sightings :** The database for whale shark sightings does not exist. Data obtained by our team on the fourth day are perhaps the first scientifically recorded data on whale sharks in this region. Our field work suggests that survey by fishing trawler / boat using the methods of the traditional local fishermen are not likely to be effective. Reliability of whale shark sighting information supplied by local fishermen would be questionable since most of the trawlers and fishing boats do not have navigational equipment onboard. Offering monetary rewards to fishermen for whale shark sighting reports is likely to result in false data since data cannot be verified. We therefore feel that systematic aerial survey by a microlight is the only viable method to generate a reliable whale shark sighting database.

The field work suggests that in early April whale shark sightings off Diu are not encouraging. Before we can hope to interest private entrepreneurs in whale shark tourism at Diu, it will be necessary to establish a database of whale shark sightings during non-monsoon months. Only after establishing the commercial viability of the project, can we interest the local entrepreneurs in this new eco-tourism business.

- 6) **Availability of suitable boat :** We had reported in our earlier study in 2002 about a suitable boat "*Kuttch Princess*" based in Diu. During the present study, we found the *Kuttch Princess* still tied alongside the dock in Diu. It has not sailed for the last two years due to differences between the owners. We understand this boat is now likely to be moved out to Mumbai for recreational cruises off Gateway of India. Once the commercial viability of the project is established, it may be possible to charter this or

some other Indian boat for whale shark viewing purpose. However, local entrepreneurs are more likely to build a boat/s especially designed for whale shark viewing and diving to maximize their financial returns.

- 7) **Poaching of whale sharks:** The liver oil of the whale shark continues to have local demand since the traditional trawler construction industry as well as the trawler owners believe whale shark liver oil is less expensive when compared to the alternatives they are using on the hull for anti-fouling protection. A possibility therefore exists that local fishermen may still kill the whale shark if the opportunity presents itself during their normal fishing to cater to this demand. They could cut out the liver at sea which could be easily disposed of in the local market. Involving the fishermen in whale shark ecotourism and ensuring they derive direct economic benefits from the industry is the most effective way to eliminate the threat of poaching.

Summary

Diu already has much of the necessary tourism infrastructure needed for development of whale shark ecotourism including a variety of hotels. Area fishers possess the knowledge needed to spot and approach the sharks at sea, and perhaps some of the divers finishing their tours in the Indian Navy could be induced to relocate to the area to serve as tour guides and operators. At present, Diu lacks suitable or specialized boats, but when all other elements are in place to proceed with development, it is highly probable that local entrepreneurs will acquire or construct suitable watercraft. Government will also need to be involved in setting strict guidelines for whale shark / human interactions.

There is a possibility that the whale shark population off the Saurashtra coast may have been so depleted by the unregulated harvest of the late 1990s that whale shark tourism will not be feasible until stocks rebuild, but it is not possible to determine this without aerial surveys. A structured aerial survey program is also necessary to determine the best times of year and locations of whale shark sightings in order for local entrepreneurs to develop whale shark ecotourism.

Annexure –1
LIST OF FLYING EQUIPMENT OF M/s FLYING SAFARI

Particulars	FlyingHours / Speed	Quantity
2- seater fixed wing microlight single engine a/c “Rajhansa”	4 hours / 80 to 100 km/hr	1
2- seater powered fixed wing hangglider with trike landing gear	4 hours / 80 to 100 km/hr	1
Powered 2 seater paraglider with Trike landing gears ‘Diavolo’	3½ hours / 40 to 50 km/hr	1
Powered 2-seater foot launch paramotor	3½ hours / 40 to 50 km/hr	2
Powered solo paramotor	3½ hours / 40 to 50 km/hr	2

Accessories

Camera for aerial photo : Nikon F75

GPS : Garmine

Communication : VHF with 45 km range, communication helmets with intercom and ptt

Variometers for altitude / vertical speed / forward speed / temperature.

Annexure –2
DETAILS OF FIB & FRB MANUFACTURERS

1) Flying Inflatable Boat (FIB)

M/s Polaris motor srl

Fraz, Valdichiascio, 06024, Gubbio, (PG) Italy

Website : www.polarismotor.it

Email : polaris@polarismotor.in

Approximate cost in Euros 18,000/-

2) Flying Rigid Boat

M/s Ramphos Aircraft

Via del Gumignan

33090 Solimbergo di Sequals (PN)

Italy Tel. : 0427 939211

Email : info@ramphos.com

Website : www.ramphos.com

Approximate cost in Euros 18,000/-

Annexure-3

Email response to SRI from US Embassy, New Delhi regarding government clearance for research projects.

Dear Dr. Levine,

Your request for assistance on permits for a feasibility study in Dui was just passed to me today, as I was on vacation last week. Even if I had received it earlier, I'm afraid I could not have been of much help.

I am repeating below, the standard advice on research visas, which I obtained from the Ministry of Human Resources and Development about a year ago. To the best of my knowledge, it is still current.

Foreign scholars need to complete an "Application for Approval of Research Project and for Authorization of Visa" which can be found at <http://www.education.nic.in/htmlweb/hesch1.htm> SIX copies of this form must be completed and sent to the MHRD: Mr. S.E Rizwi/Section Officer/ Ministry of Human Resource Development(MHRD)/Department of Secondary and Higher Education/ Shastri Bhawan/ New Delhi 110001. The MHRD will forward to other Ministries for approval - a process which takes a minimum of four or five months.

One of the questions on the form requests the name of the affiliated Indian university/institution and SIX copies of a Certificate of Affiliation. According to Deputy Secretary P. Sukumar, an applicant MUST have some affiliation with an Indian institution. The institution does not need to be a university, but it must be an institution which is formally recognized by the GOI. It can be a well-recognized NGO, for example.

When the review process is complete, the MHRD will assign an MHRD approval number, issue a letter of Research Approval and fax the same to the Indian Mission or Consulate, which was indicated by the applicant on the form. The applicant will also receive a copy of the approval by mail. The Indian consulate will issue a visa only after it receives this form. The visa office will generally make a notation on the visa of the research approval number and a short title of the project. A foreigner is not permitted to undertake research in India unless he/she obtains a research visa.

Research in border and tribal areas is "minutely scrutinized." Likewise, the use of remote sensing and GPS in border areas is highly suspect.

As you indicated that your study was commencing the first week in April, so I'm afraid this advice is much too late to do you any good this time. I can only hope it went well!

Lori Peterson Dando
Science and Environment Officer
Embassy of the United States of America
Shanti Path, Chanakyapuri, New Delhi 110021



1. On move in Diu :
The preferred mode of transportation in Diu is two wheelers which are cheap (Rs 100 per day + petrol) & the traffic is very low.



2. Resort Hoka : The reception area of "The resort Hoka" which we used as our team base

3. With fishing superintendent :
Mr Anjani Sukar with the
recently issued poster about
'protected shark species'



4. With village headman Ramjibhai



5. Trawler sets sail: The traditionally built wooden trawler named "*Krishnakumar*" was our home for four days.



6 Cooking on woodfire: The aft deck was the kitchen cum dining hall cum toilet area.



7. Dinner on aft deck : The menu was standard...fish curry and rice or 'rotis'.



8. Ceremony before sailing : Breaking of cocoanut & offering it to the sea was standard practice before the trawler set sail everyday.



9. Testing the underwater video camera : The video camera with underwater housing had to be lowered by rope. It worked beautifully except that the whale shark was too camera shy to oblige when the big moment finally arrived!



10. Survey team with trawler skipper : Arun , Alka , Ajey the dive instructor, Sudershan the RWMC representative, and Kanjibhai the trawler skipper.



11. Trawler crew : Veljibhai the asst skipper, Aakash the deck apprentice, Velji senior the cook, Nilesh the mechanic.



12. Temperature measurement : Commander Arun Patil with a thermometer on a rope.

13. Commander Arun Patil and Alka Patil onboard the trawler *Krishnakumar*. The make shift sunshade & the plastic chairs were additions specially for the survey team.



14a. Church exterior view : Main local attractions of Diu.



14b. Church, interior view.



14c. Church statue.



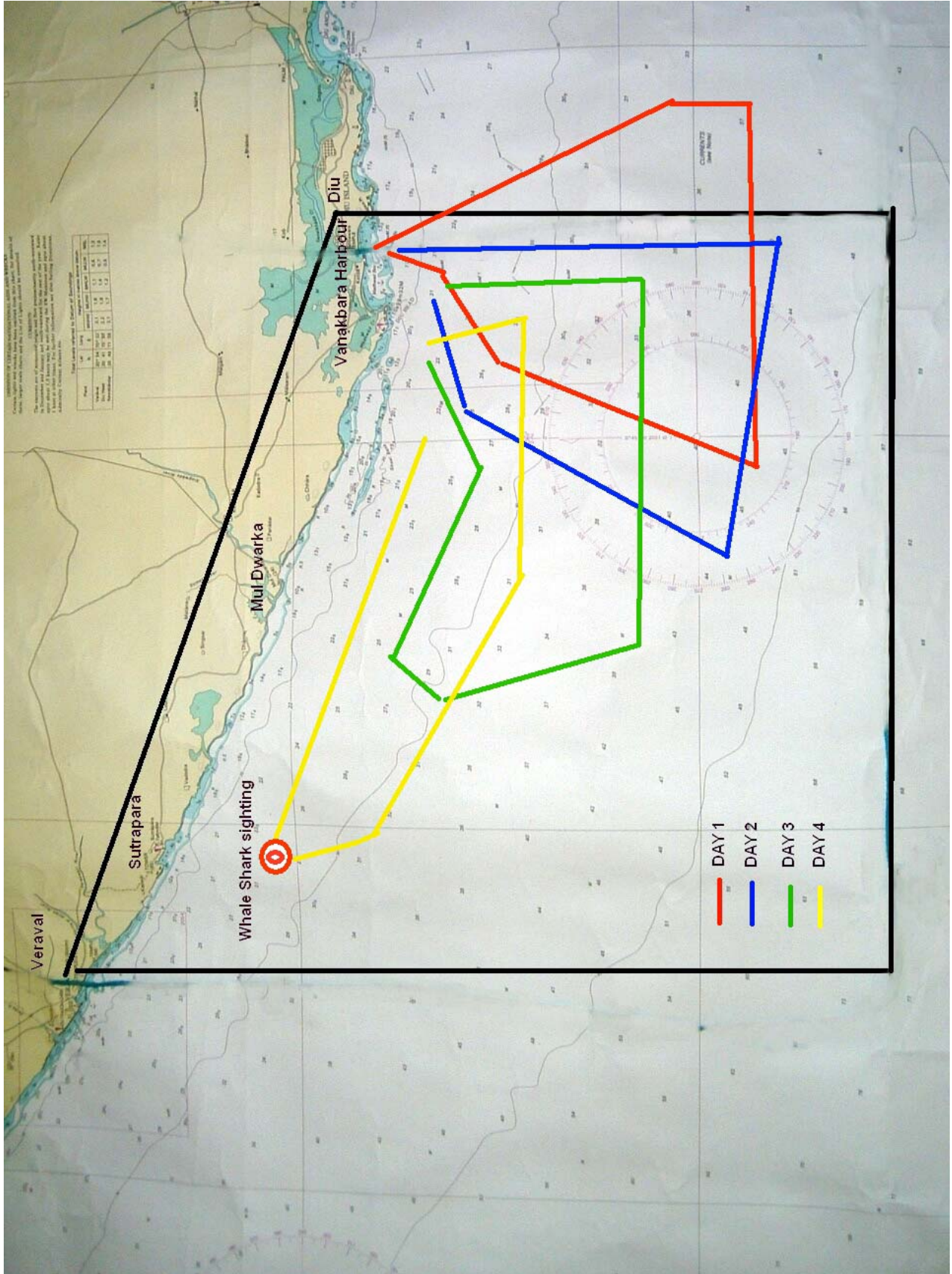
15. Diu caves : Manmade caves by Portugese to build the fort.



16. 'Hoka' tree :
The multibranch palm
typical of Diu.



17. Traditional boat construction.



18. Survey routes on chart : Plot of the route of the trawler showing the location of the whale shark sighting on the last day.



19. Upon identifying the need for aerial surveys to establish the seasonality and numbers of whale sharks visiting the area, Commander Patil returned to Gujarat and met with Sameer Rane of M/s Flying Safari. Together they worked out a flight route to be flown throughout the survey period (see next page.)



20. Proposed route for aerial surveys of whale sharks.