

Consolidated Summary of the  
Fieldwork Studies done on the  
Whale Sharks (Rhincodon typus)  
off the East Coast of Southern Africa  
for the period  
1993 to 1998.

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**AERIAL SURVEYS OF WHALE SHARKS (*Rhincodon typus*)**  
**OFF THE EAST COAST OF SOUTHERN AFRICA**  
**FROM 1993 TO 1998**  
(Report No. 1)

By Albert Andrew Gifford, Shark Research Institute (South Africa)

**ABSTRACT**

From 1993 to 1998, the Shark Research Institute conducted aerial surveys of whale sharks along the coast of KwaZulu-Natal, South Africa. Three types of aircraft were used: two Cessna fixed-wing aircraft and a delta-wing microlight. The microlight proved to be the best choice for this survey due to its slow flight speed, manoeuvrability, portability and low cost of maintenance and fuel. The aerial survey indicated that the sector north of Cape Vidal was the most suitable for a tagging study of whale sharks that was ongoing during this period. In addition, the microlight provided aerial support for a number of fledgling whale shark-based eco-tourism ventures in that sector and in the Seychelles. The aerial surveys documented a drastic decline in the whale shark numbers along the KwaZulu-Natal coast from the start of the 1994 / 1995 season and continuing to the end of the survey period.

**INTRODUCTION**

The occurrence of whale sharks off the East Coast of southern Africa, particularly during the summer months, is a seasonal phenomenon that has never been adequately investigated or documented. This has resulted in a complete absence of data regarding the annual abundance and

movements of this species along the coastline of KwaZulu-Natal. Due to this lack of data, in December 1993, the Shark Research Institute initiated, developed and implemented an aerial survey program of whale sharks from Port Edward 158 kilometres southwest of Durban (31°02'5S, 30°13'6E) to Kosi Bay 392 kilometres northeast of Durban (26°52'8S, 32°53'1E) in order to establish and support their whale shark tagging program. It is anticipated that data collected from this survey may also provide a basis for the development of an environmental tourism industry focused on this species and prove useful in the development of future management plans designed to protect whale sharks from commercial harvesting and irresponsible over-exploitation.

## **METHODOLOGY**

### **AIRCRAFT USED**

Three types of aircraft were used during the survey period from December 1993 to January 1999. Initially, long distance surveys were conducted using a Cessna 182, as it facilitated the deployment of three dedicated observers in addition to the pilot, and the aircraft had the range to cover the entire survey area without refueling.

To reduce costs, a Cessna 172 was used for two survey flights but the aircraft could only comfortably accommodate the pilot and two observers and because of its limited fuel capacity, it could not cover the entire survey area without refueling. The inclusion of a third observer further reduced its range due to the additional weight. Because of the dangers of performing tight turns at low altitudes and airspeeds, it became apparent that the cruising and stall speeds of both aircraft were too high and their respective safe turning circles too wide to ensure the accurate and quick return to an area where any unusual whale shark activity was over-flown. A further complicating factor was

that the fuselage structure and cockpit design of both aircraft tended to obscure the observers' line of sight and it also made it difficult to obtain good-quality photographs. In order to accommodate what by now had developed into the highly-specialised needs of the tagging project, a Solo Wings delta-wing microlight aircraft was brought into service on October 17, 1994. Even though it was crewed by only the pilot and one observer, its speed and manoeuvrability proved to be ideal and the lack of any fuselage structure made visibility from the aircraft almost unlimited.

At the commencement of the survey protocol, Durban was used as the control centre and the aircraft was first flown north along the coastline as far as Kosi Bay, and then south as far as Port Edward in preliminary reconnaissance missions. Since there were no verifiable local or international benchmarks to follow, and in order to determine the flight level that would provide the best possible whale shark sightings, we flew at flight levels that varied between 1 500, 1 000, 750 and 500 feet above sea level. It was found that flight levels between 500 and 850 feet above the sea proved to be the most productive relative to the wind direction and velocity, haze and glare from the sea surface.

The prevailing winds over the survey area are either north-easterly or south-westerly, which tend to make the sea very choppy with sunlight reflecting off its surface, the spotting of whale sharks becomes extremely difficult and at times almost impossible. In view of the aforementioned, it was decided not to conduct the aerial surveys on a fixed schedule but rather when weather and sea conditions were most favourable for sighting the animals. Aerial surveys were performed as often as budget, sea and weather conditions permitted.

A minimum of two experienced observers were deployed on each fixed wing flight, one at port, one at starboard, and whenever possible a third person was onboard to record data. The microlight could accommodate only one observer who also recorded data.

### **AIRCRAFT EVALUATION**

<b>Type</b>	CESSNA 182	CESSNA 172	MICROLIGHT TRIKE
<b>Engine</b>	Single	Single	Single
<b>Cruising Speed</b>	+/- 244 kph (130 knots)	+/- 205 kph (110 knots)	+/- 65-100 kph (35-55 knots)
<b>Stall Speed</b>	+/- 92 kph (50 knots)	+/- 92 kph (50 knots)	+/- 40-50 kph (25 knots)
<b>Range</b>	+/- 1600 kms	+/- 860 kms	+/- 400 kms
<b>Capacity</b>	Pilot plus (3)	Pilot plus (2)	Pilot plus (1)
<b>Cost</b>	+/- R324 per hour	+/- R233 per hour	+/- R50 per hour

### **RESULTS**

On each survey flight, the aircraft were flown directly above the backline of breaking waves at between 500 to 850 feet above sea level, and the following data were recorded.

(a) Survey period December 31, 1993 to April 14, 1994

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	FLIGHT DIRECTION NORTH TO SOUTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
12	5	7	25 hrs, 20 mins	184

The greatest number of whale sharks sighted in a single day was on January 15, 1994 when 95 animals were counted between Durban and Umtentwini on the KwaZulu-Natal south coast, a distance of approximately 110 kilometres.

(b) Survey period December 3, 1994 to April 30, 1995

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	FLIGHT DIRECTION NORTH TO SOUTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
10	6	4	19 hrs, 40 mins	31

The greatest number of whale sharks sighted in a single day was on December 3, 1994 when 23 whale sharks were counted between Zinkwazi and Kosi Bay on the KwaZulu-Natal north coast, a distance of approximately 330 kilometres.

(c) Survey period October 1, 1995 to April 30, 1996

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	FLIGHT DIRECTION NORTH TO SOUTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
36	9	27	82 hrs, 10 mins	79

(d) Survey period October 1, 1996 to April 30, 1997

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	FLIGHT DIRECTION NORTH TO SOUTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
42	10	32	96 hrs, 18 mins	93

(e) Survey period October 1, 1997 to April 30, 1998

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	FLIGHT DIRECTION NORTH TO SOUTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
14	8	6	40 hrs, 15 mins	65

Budget constraints prevented us from performing more aerial surveys during this period.

**DISCUSSION:**

Based on the results of our aerial surveys it would appear that during the period under review there was a definite and significant increase in the whale shark population during the summer months. This observation is supported by sighting reports received by the Shark Research Institute (South Africa) from sport divers and spearfishermen who operated in the survey area.

(a) On average, a typical “Whale Shark Season” lasts for approximately six months, usually beginning in October



and extending through to the end of March of the following year. No whale shark sightings were recorded during the random aerial surveys done in the autumn and winter months. (April to September)

(b) During the course of conducting the aerial surveys, it was found that the majority of whale sharks were swimming alone as fairly widely-spaced individuals. Occasionally, we encountered a pair and only once did we observe five sharks swimming together. The five sharks were recorded off Turton on the south coast of KwaZulu-Natal on January 15, 1994.

(b) During the five-year survey period we recorded the directions that the individual sharks appeared to be heading and the results are summarised as follows:

**1993 – 1994 Season**

59% were swimming south to north, 36% were swimming north to south, 4% were swimming west to east, and 1% were swimming east to west.

**1994 – 1995 Season**

68% were swimming south to north, and 32% were swimming north to south.

**1995 – 1996 Season**

61% were swimming south to north, 37% were swimming north to south, and 2% were swimming west to east.

**1996 – 1997 Season**

54% were swimming south to north, and 46% were swimming north to south.

### **1997 – 1998 Season**

48% were swimming south to north, and 52% were swimming north to south.

- (c) There was a significant decline in the number of whale sharks sighted after the 1993 / 1994 season, despite an increase in the experience of both the observers and the pilots as evidenced by the following comparative tables:

<b>SEASON</b>	<b>TOTAL NUMBER OF SIGHTINGS</b>	<b>TOTAL NUMBER OF FLIGHT TIME MINUTES</b>	<b>NUMBER OF SIGHTINGS PER FLIGHT TIME MINUTE</b>	<b>NUMBER OF SIGHTINGS PER KM OF COASTLINE</b>
1993/1994	184	1520 mins.	0,121 sharks per min.	1/3,04 kms.
1994/1995	31	1180 mins.	0,026/sharks per min.	1/18,06 kms.
1995/1996	79	4930 mins.	0,016/sharks per min.	1/7,09 kms.
1996/1997	93	5776 mins	0,016/sharks per min.	1/6,02 kms.
1997/1998	65	2415 mins	0,027/sharks per min.	1/8,62 kms.

We can offer no explanation as to the probable causes for the progressive decline and then marginal increase in the number of sightings recorded during this five-year survey period.

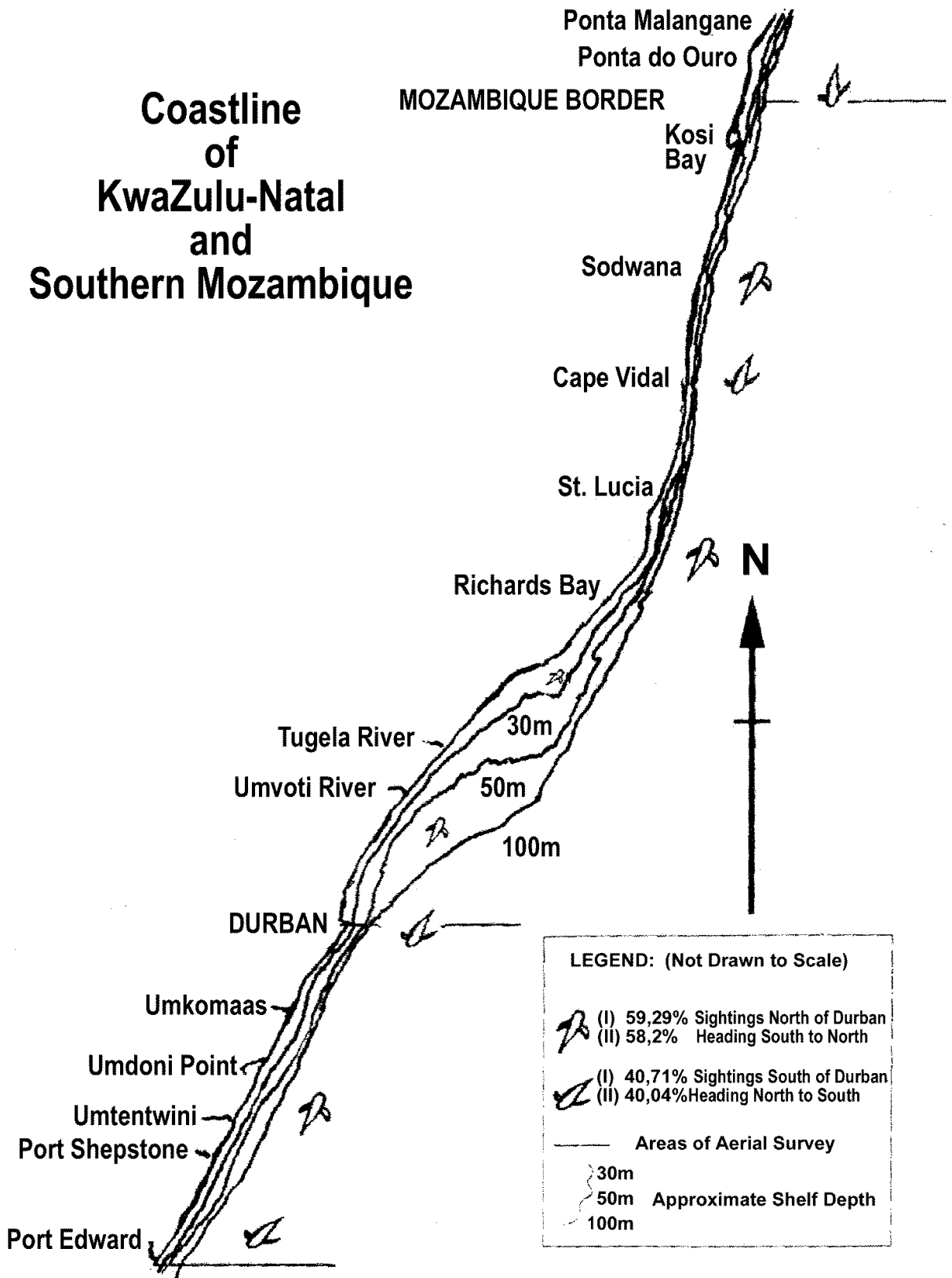
- (d) Of the 452 documented aerial survey sightings, 40,71% were recorded south of Durban and 59,29% to the north of the same city.

SEASON	TOTAL NUMBER OF SIGHTINGS	NUMBER OF SIGHTINGS DURBAN TO PORT EDWARD	NUMBER OF SIGHTINGS DURBAN TO KOSI BAY	PERCENTAGES
1993/1994	184	117	67	40,71%
1994/1995	31	6	25	6,86%
1995/1996	79	15	64	17,48%
1996/1997	93	27	66	20,57%
1997/1998	65	19	46	14,38%
<b>TOTALS</b>	<b>452</b>	<b>184 (40,71%)</b>	<b>268 (59,29%)</b>	<b>100%</b>



Delta-winged microlight aircraft

# Coastline of KwaZulu-Natal and Southern Mozambique





## Whale Shark Tagging Project Aerial Survey Data Sheet - South Route

Flight Date:	Height:	Flight No.:	Wind:

Time Out:	Time In:

Location	Number	Size (M)	Distance From Back Line						Time	Direction	Vis Meters	Other Sightings and Comments
			Surf	50	100	150	200	250				
Virginia 390												
Vetch's Pier 401												
Brighton Beach 412												
Umbogintwini 424												
Warner Beach 433												
Umzimbazi River 439												
Mahlolongwana River 450												
Scottburgh 460												
Pennington 472												
Ikfa 483												
Mhlungwa Lagoon 495												
Umzambe River 505												
Umzinkulu 520												
St. Michaels 531												
Ramsgate 541												
Mpanjati River 552												
Port Edward 564												

Total Number of Whale Sharks Sighted: \_\_\_\_\_ Pilot: \_\_\_\_\_

Observer: \_\_\_\_\_ Recorder: \_\_\_\_\_

Photographer: \_\_\_\_\_ Other Comments: \_\_\_\_\_

(Example of working document)

## TYPICAL AERIAL PHOTOGRAPH OF A WHALE SHARK



### **ACKNOWLEDGEMENTS**

I would like to express my sincere thanks and appreciation to the following people, whose assistance and expertise was invaluable in ensuring the success of these aerial surveys.

Mr. Pieter Gent	-	fixed wing and microlight pilot
Mr. Rob Allen	-	microlight pilot
Miss Susan Smith	-	observer

**AERIAL SURVEYS OF WHALE SHARKS (*Rhincodon typus*)  
OFF THE EAST COAST OF SOUTHERN MOZAMBIQUE  
FROM 1995 TO 1998**

(Report No. 2)

By Albert Andrew Gifford, Shark Research Institute (South Africa)

**ABSTRACT**

From 1995 to 1998, the Shark Research Institute expanded its aerial survey program of whale sharks to include a section of the coastline in southern Mozambique. Two types of aircraft were used, a Cessna fixed-wing and a total of three different delta-winged microlights. The aerial surveys indicated that the bays between Ponta Malangane and Ponta do Ouro were the most suitable for the ongoing tagging study of these animals. In addition, the aircraft provided logistical support to several independent dive-tour operators located in the area who were developing whale shark-based ecotourism ventures. The aerial surveys documented a total of 389 whale shark sightings over the three-year period.

**INTRODUCTION**

The occurrence of whale sharks off the coastline of southern Mozambique has not been adequately investigated or documented and this has resulted in a total absence of any data with regard to the annual abundance and movements of this species along the relevant area of coastline. Based on this lack of data, the Shark Research Institute initiated and implemented an aerial survey program that began on May 1, 1995 and ended April 30, 1998.

The selected area of coastline included Ponta do Ouro (26°50'0S, 032°53'14E) in the south to Ponta Mamoli (26°Δ3'3S, 032°54'12E) in the north, a distance of approximately 15 kilometres. Data collected from these surveys made a significant contribution towards the successful implementation of both the passive and subsequent satellite tracking tagging programs of whale sharks. It also provided useful information that could be used in the development of both ecotourism and future management plans designed to protect the species from commercial over-exploitation.

## **METHODOLOGY**

### **AIRCRAFT USED**

The primary aircraft used during the survey period were delta-winged microlights for the following reasons : -

- (i) Easily transportable to and from the survey areas.
- (ii) (Ability to take off and land on the beach.
- (iii) Manoeuvrability and slow flight speeds.
- (iv) Low operational and logistical costs when compared to other aircraft.

- A Cessna 182 was used whenever microlights were not readily available.
- The aircraft were flown at heights that varied between 500 and 850 feet above sea level and the same flying techniques were used that were developed during the course of doing aerial surveys of the coastline of KwaZulu-Natal in order to record the incidence of whale sharks.
- Because the length of the survey area was specifically and intentionally reduced, the pilots and their respective observers were able to ensure the accuracy of the number of whale sharks counted.



## RESULTS

(a) Survey period October 1, 1995 to April 30, 1996

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
16	16	30 hrs, 38 mins	151

(b) Survey period October 1, 1996 to April 30, 1997

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
18	18	34 hrs, 42 mins	135

The greatest number of whale sharks sighted occurred on the weekend of October 31, 1996 to November 3, 1996 when a total of 58 were counted in the bay at Ponta do Ouro. By November 2, 1996, 28 different sharks had been tagged, and on November 3, 1996 a further 30 untagged whale sharks were counted by the three microlight pilots and their observers.

(c) Survey period October 1, 1997 to April 30, 1998

NUMBER OF FLIGHTS	FLIGHT DIRECTION SOUTH TO NORTH	TOTAL NUMBER OF FLIGHT HOURS	TOTAL NUMBER OF WHALE SHARKS SIGHTED
32	32	44 hrs, 32 mins	103

Budget constraints prevented us from performing more aerial surveys during this period.

## **DISCUSSION:**

The results of these aerial surveys indicate a definite and significant increase in the whale shark population off the coastline of southern Mozambique during the summer months. This observation is supported by the numerous sighting reports received by the Shark Research Institute (SA) from sport divers, spearfishermen and commercial dive-tour operators who regularly use or are located in the areas of Ponta do Ouro and Ponta Malangane.

- (a) On average, a typical “Whale Shark Season” lasts for approximately six months, usually beginning in October and extending through to the end of March of the following year. No whale shark sightings were recorded during the occasional aerial survey done during the winter months. (April to September)
- (b) During the course of conducting the aerial surveys, it was found that the majority of whale sharks were swimming alone as fairly widely-spaced individuals on a par with the observations recorded during the course of surveying the coastline of KwaZulu-Natal. No pods or whale sharks swimming in groups were noticed.
- (c) Because the survey area involved only 15 kms of coastline, the directions that the individual sharks appeared to be heading was both ill-defined and inconclusive.
- (d) The decline in the numbers of whale sharks sighted after the 1995/1996 season, despite the additional aerial survey time and an increase in the experience of both the observers and pilots, is evidenced by the following comparative table.

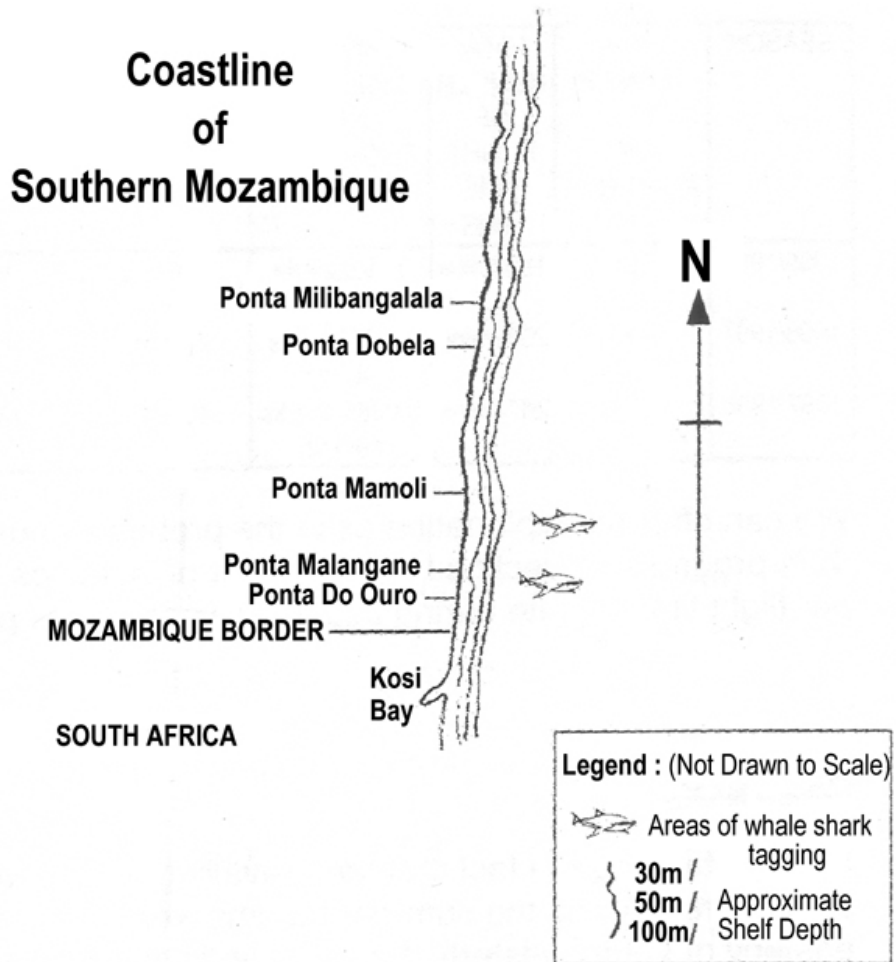
<b>SEASON</b>	<b>TOTAL NUMBER OF SIGHTINGS</b>	<b>TOTAL NUMBER OF FLIGHT TIME MINUTES</b>	<b>NUMBER OF SIGHTINGS PER FLIGHT TIME MINUTE</b>	<b>NUMBER OF KMS FLOWN</b>	<b>NUMBER OF SIGHTINGS PER KM OF COASTLINE</b>
1995/1996	151	1838 mins.	0,082/sharks per min.	240 kms	1/0,63 kms.
1996/1997	130	2082 mins	0,065/sharks per min.	270 kms	1/0,50 kms.
1997/1998	103	2672 mins	0,0385/sharks per min.	480 kms	1/0,215 kms.

We can offer no explanation as to the probable causes for the 47% progressive decline in the number of sightings recorded per flight time minute during this three-year survey period.

## **RESULTS**

Notwithstanding the fact that the prevailing winds over the survey area during the summer months were either north-easterly or south-westerly, the sea conditions, with specific reference to water clarity, in the bays of Ponta do Ouro and Ponta Malangane were generally superior to those experienced south of Cape Vidal on the KwaZulu-Natal coastline.

The relative abundance of whale sharks in the prescribed 15 km survey area, favourable sea conditions and the existence of three commercial dive-tour operators at Ponta do Ouro and one at Ponta Malangane who were willing to support the passive tagging initiative of these magnificent animals were the factors that influenced our decision to focus most of our attention in this area.



## **ACKNOWLEDGEMENTS**

I would like to express my appreciation and thanks to the following people whose assistance was invaluable in ensuring the success of this aspect of the project.

Dr. Chris Kilian	- fixed-wing and microlight pilot
Mickey Biermann	- microlight pilot
Rob Allen	- microlight pilot

**TAGGING OF WHALE SHARKS (*Rhincodon typus*)**  
**IN THE WATERS OFF THE EAST COAST**  
**OF SOUTHERN AFRICA FROM 1993 TO 1998**

(Report No. 3)

By Albert Andrew Gifford, Shark Research Institute (South Africa)

**ABSTRACT**

Prior to conducting the aerial surveys of the coastlines of both KwaZulu-Natal and southern Mozambique to record the incidence of whale sharks in the inshore coastal waters of these two regions during the period 1993 to 1998, as documented in our reports numbered (1) and (2), we were also developing and implementing a passive tagging program in order to discern the movements or any migratory patterns of these animals up or down the relevant areas of coastline.

**INTRODUCTION**

The tagging of marine fishes has been carried out in different parts of the world for nearly a century with, amongst other things, the objectives being to study populations, behaviour and migratory patterns. The net effect of these studies is that there are a wide variety of passive tags available but none specifically designed for deployment on very large fish such as whale sharks. During the latter part of 1993, we were provided with a selection of three different types of tag intended for use on these animals.

## TAG EVALUATION

- (i) The first consisted of a flattened stainless steel pointed tag-head with an M-shaped posterior edge, attached to a heavy nylon line. A hard, transparent plastic hollow cylinder was attached to the distal end of the nylon line and the paper containing the tag number and other particulars was fitted inside the cylinder which was then closed and rendered watertight by means of a threaded plastic plug which had a slotted end to facilitate its re-opening on retrieval.

The total overall length of this particular tag type was approximately 200 mm.

- (ii) The second consisted of a flattened stainless steel pointed tag-head with an M-shaped posterior edge, attached to a heavy nylon line. The distal end of the nylon line was sleeved with a bright yellow-coloured membrane that reflected only the tag number and the return address. The relevant area was rendered waterproof using a transparent “shrink-plastic” overlay that was crimped on both ends. The overall length of this spaghetti-type tag was approximately 275 mm with the information aspect having a length of 140 mm and a diameter of 4 mm.

- (iii) The third consisted of a flattened stainless steel pointed tag-head with an M-shaped posterior edge, attached to a stainless steel wire lead that had been sleeved with a bright yellow plastic membrane. An engraved yellow coloured perspex placard was attached to the distal end of the stainless steel wire lead, which reflected the tag number and contact address on both sides.

The overall length of this tag was approximately 360 mm with the placard measuring 200 mm by 50 mm.

Unfortunately none of these tags were found to be suitable for long-term use for the following reasons : -

- The metal composition of the flattened stainless steel pointed tag heads was found to be too soft to ensure that the respective tags could be adequately deployed and remain embedded in the thick and very hard skins of whale sharks.
- The cylindrical and spaghetti-type tags, as per items (i) and (ii) were found to be too small for accurate diver re-sightings because the average sizes of the sharks tagged varied between six and seven metres, as opposed to a tag size variance of 200 mm and 275 mm.
- Whilst the fundamental design of the placard-type tag might appear to be very acceptable and well founded, in practical terms it had a number of functional shortcomings.
  - (i) The lead wire that connects the tag-head to the placard has been fabricated out of stainless steel and the reinforcing “o”-ring incorporated into the perspex placard to serve as a reinforced attachment point for the stainless steel wire lead had been made out of brass and electrolytic action between these two metals would cause the latter to degrade to the point where the placard could become detached after a relatively short period of sustained immersion in sea water.
  - (ii) A bright yellow fluttering tag could and no doubt would serve as an irresistible lure to the large predatory gamefish that periodically appear to develop a symbiotic relationship with whale sharks, which would result in the tag being pulled free of its host.
  - (iii) The preferred method of tag deployment was using a rubber-band powered speargun as this

provided sufficient velocity to ensure that the tag-head, which served as an anchor, could penetrate the shark's tough skin and that it could be accurately positioned on the animal's body. The hydrodynamic design of the placard tag was too unstable to achieve either of the aforementioned objectives on a sustained and cost effective basis.

- (iv) Because of the shortcomings enumerated under sections (i), (ii) and (iii), it was decided to design, develop and fabricate a passive tag for specific and exclusive use on whale sharks.

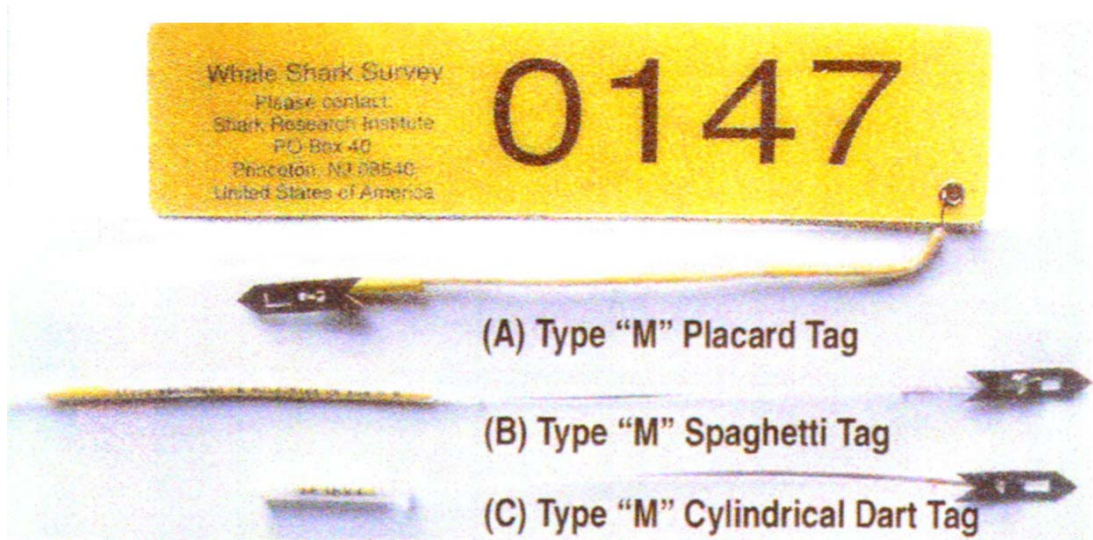
The prototype whale shark tag consisted of an 80 mm by 8 mm stainless steel swiveled tag-head with the pointed end double-beveled at 60° and the trailing end flanged to form a single barb. A 2 mm thick, 19 strand, soft stainless steel cable was fitted through and looped behind a hole drilled through the tag-head approximately midway along its length. This double stainless steel cable had an overall length of 330 mm and was covered with a luminous green PVC tube that reflected the tag number and the report-back address of the Shark Research Institute (S.A.) in the event of a re-sighting or a recovery. The PVC tube was then sealed and waterproofed using a clear heat-shrink plastic membrane that was extended beyond the distal end of the stainless steel cable for 200 mm to create a buoyant air bladder that would hopefully keep the body of the tag clear of the rough and abrasive skin of the shark. As an added precaution the tag number was engraved on the tag-head in the event of a recovery after a stranding.

A total of 12 tags of this type were deployed on whale sharks off the coastline of KwaZulu-Natal during the 1993/1994 tagging season.

We subsequently found that the tensile strength of the double stainless-steel multi-strand cable that formed the inner core of the original prototype tags was more than adequate to keep the heat-shrink plastic outer membrane away from the shark's skin. This resulted in the tags being modified to exclude the air bladder.



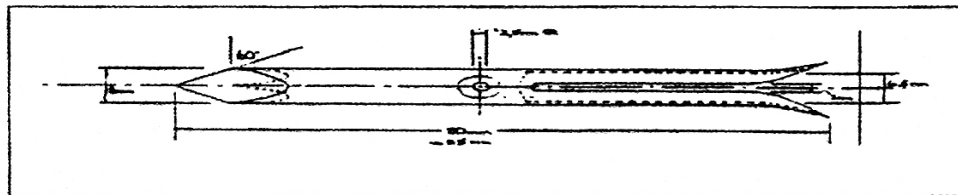
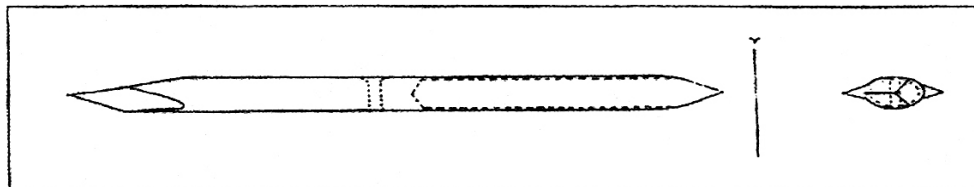
## DART TAGS



(REF: Sub-Sections (i), (ii) and (iii) on page 20)

## **WHALE SHARK TAG** *By Rob Allen*

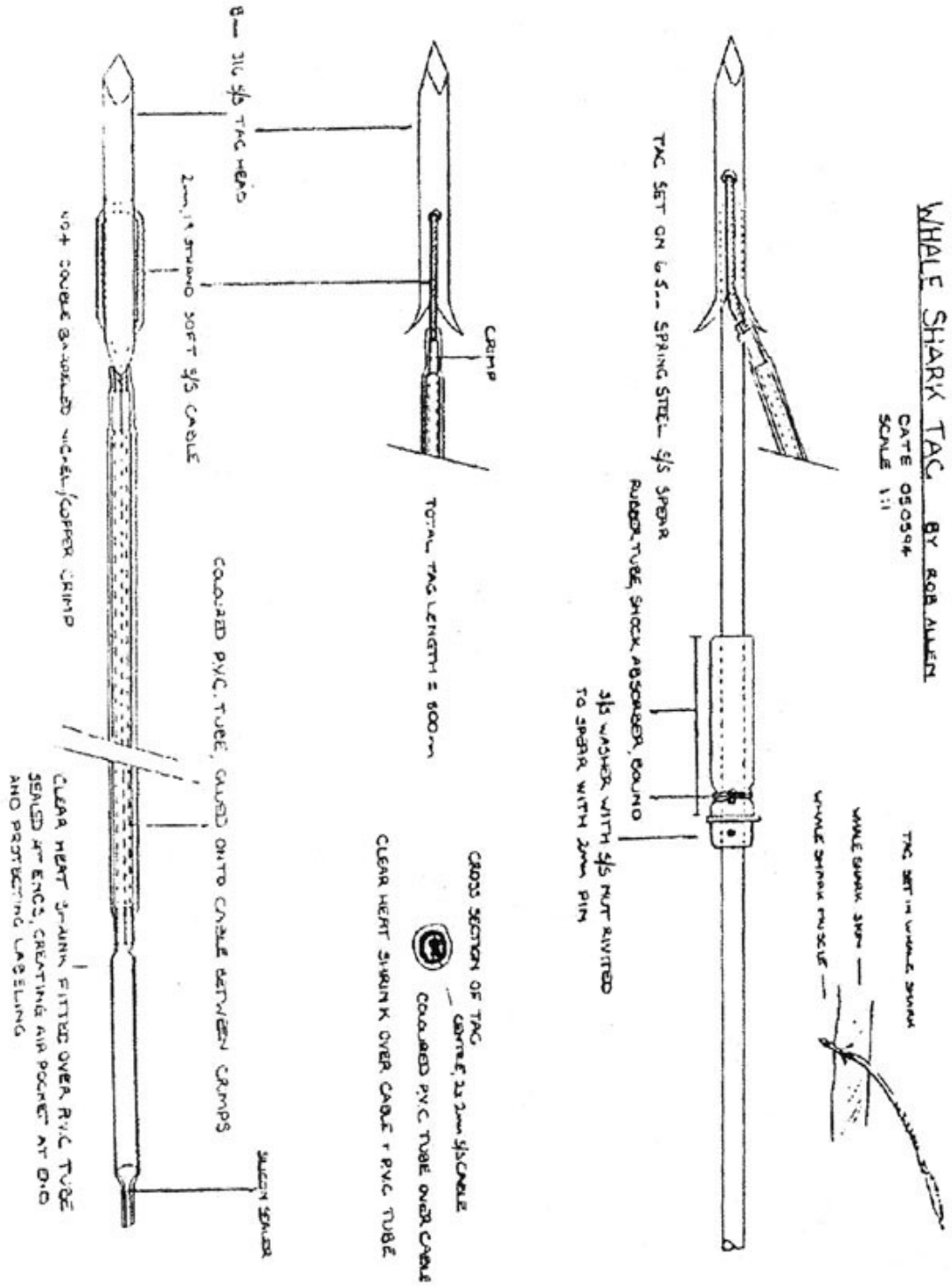
Material 8mm 316 S/S



SCALE 2:1 Date 020594

# WHALE SHARK TAG

By Rob Allen



A total of 220 of these modified tags were successfully deployed on whale sharks off the coastlines of KwaZulu-Natal and southern Mozambique.

### **TAGGING SUMMARY**

<b>PERIOD</b>	<b>TAGGED KWAZULU-NATAL</b>	<b>TAGGED SOUTHERN MOZAMBIQUE</b>	<b>TOTAL NUMBER OF SHARKS TAGGED</b>	<b>%</b>
1993 / 1994	12	--	12	5,17%
1994 / 1995	12	9	21	9,05%
1995 / 1996	6	39	45	19,40%
1996 / 1997	10	70	80	34,48%
1997 / 1998	3	71	74	32,90%
<b>TOTALS</b>	<b>43</b>	<b>189</b>	<b>232</b>	<b>100%</b>

### **TAGGING PROCEDURE**

On December 4, 1993, the Shark Research Institute (South Africa) started its program of deploying passive tags on whale sharks.

Initially the backline search method was used in order to find suitable animals. This entailed using a twin outboard motor powered open-decked ski-boat crewed by at least four people (one skipper, two divers and one observer) to do a zig-zag sea search just behind the backline of breaking waves. Even though this method of locating whale sharks was found to be reasonably productive, it was also very time-consuming and not very cost effective.

The limitations imposed by the backline sea search method of finding whale sharks resulted in the whole tagging operation

being streamlined on October 17, 1994, by incorporating a delta-winged microlight aircraft to act as a spotter plane. This aircraft was used to find the whale sharks and then via radio communications, its pilot talked the skipper of the dive-boat onto the selected animal prior to the divers being deployed to implant the tag. In this regard, the dive-boat would position itself approximately 50 metres ahead of the shark in the direction it was swimming. Then the divers would enter the water as quietly as possible so as not to alarm the animal. One diver would determine the shark's size and sex and the other diver would implant the tag, ideally in the first ridge on the right-hand flank immediately below the first dorsal fin if a male, and in the same position on the left-hand flank if a female. Occasionally "skittish" sharks could not be sexed and the tags had to be implanted on whatever parts of their bodies presented themselves. Fortunately, this situation only occurred on three separate occasions.

The tags were deployed into the shark's thick skin using a specially-developed rubber-powered medium-strength speargun. The spear was fitted with a stop-ring to control depth of penetration of the dart into the shark's skin.

## **METHODOLOGY**

The diver approaches the shark from either the side or from behind and on reaching a point slightly above and less than a speargun length away (~1,1 metres) from the chosen tagging area. The tag is shot into the animal at an angle of between 60° to 90° and then the shaft of the spear quickly retrieved, so that the diver can swim clear of the large and potentially dangerous tail. An angle of less than 60° results in the spear and its attached tag bouncing off the animal's tough skin with the strong possibility that the tag may become detached and lost. The flanged barb incorporated into the trailing end of the

tag-head is designed to swivel and lock into the subcutaneous tissue after successfully penetrating the epidermis.

### **TAGGED WHALE SHARK SEX RATIOS**

PERIOD	MALE	FEMALE	NOT SEXED	TAG TOTALS
1993 / 1994	9	3	-	12
1994 / 1995	11	7	3	21
1995 / 1996	25	16	4	45
1996 / 1997	44	29	7	80
1997 / 1998	38	36	-	74
<b>TOTALS</b>	<b>127</b>	<b>91</b>	<b>14</b>	<b>232</b>

Of the total number of whale sharks tagged, 55% were males, 39% were females and 6% were not sexed.

### **TAGGED WHALE SHARK SIZE RATIOS**

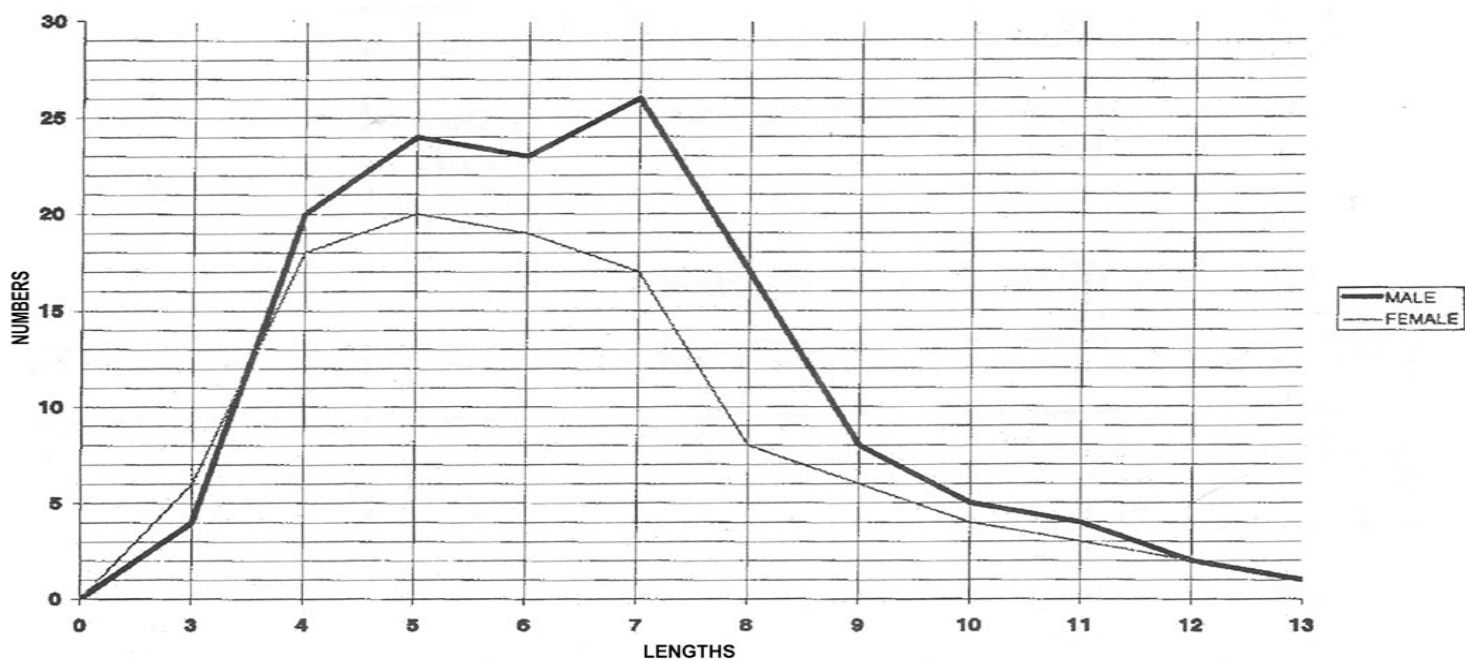
3m	4m	5m	6m	7m	8m	9m	10m	11m	12m	NOT SEXED	TOTAL
5	36	45	42	45	28	12	3	1	1	14	232
2,16 %	15,52 %	19,4 %	18,1 %	19,4 %	12,07 %	5,17 %	1,29 %	0,43 %	0,43 %	6,03 %	100 %

Sharks measuring between 4 and 8 metres accounted for 84,48% of the total number tagged.

The smallest shark tagged measured approximately 3 metres and the largest 12 metres.

## TAGGED WHALE SHARK SIZE TO SEX RATIOS

3m		4m		5m		6m		7m		8m		9m		10m		11m		12m		NOT SEXED	TOTAL
M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	--	--
2	3	19	17	25	20	23	19	27	18	19	9	9	3	2	1	--	1	1	-	14	232
<b>5</b>		<b>36</b>		<b>45</b>		<b>42</b>		<b>45</b>		<b>28</b>		<b>12</b>		<b>3</b>		<b>1</b>		<b>1</b>		<b>14</b>	<b>232</b>



Based on the condition of the claspers, it would appear that all of the male whale sharks tagged that measured between three and eight metres were either adolescent or sexually inactive. This represents 91% of the total number of male whale sharks tagged.

Only one possibly pregnant nine-metre-long female whale shark was tagged in the bay of Ponta do Ouro on 23 August 1997. This particular animal had a visibly distended abdomen in comparison to those of her survey contemporaries.

### **RESIGHTINGS OF TAGGED WHALE SHARKS**

- 1993/1994 Season – nil
- 1994/1995 Season – nil
- 1995/1996 Season

<b>TAG NO.</b>	<b>DATE TAGGED</b>	<b>LOCATION</b>	<b>DATE OF RESIGHTING</b>	<b>LOCATION</b>
WS0050	Nov. 4, 1995	Ponta Malangane	Nov. 4, 1995	Ponta Malangane
WS0055	Nov. 4, 1995	Ponta do Ouro	Nov. 4, 1995	2 km north of Ponta do Ouro
WS0053	Dec. 21, 1995	3 km north of Ponta Malangane	Jan. 23, 1996	13 km north of Ponta Malangane
WS0088	Dec. 28, 1995	7 km north of Ponta Malangane	Jan. 2, 1996	Ponta Dobela
WS0111	Feb. 23, 1996	Ponta Malangane	Feb. 23, 1996	Ponta Malangane

### 1996/1997 Season

<b>TAG NO.</b>	<b>DATE TAGGED</b>	<b>LOCATION</b>	<b>DATE OF RESIGHTING</b>	<b>LOCATION</b>
WS0183	Jan. 19, 1997	Ponta Malangane	Jan. 20, 1997	Ponta do Ouro
WS172	Feb. 23, 1997	Ponta do Ouro	Mar. 23, 1997	2 km north of Ponta do Ouro
WS0256	Apr. 19, 1997	2 km north of Ponta Malangane	Apr. 19, 1997	Ponta Malangane
WS0256	Apr. 19, 1997	2 km north of Ponta Malangane	Apr. 20, 1997	1 km south of Ponta do Ouro

### 1997 / 1998 Season

<b>TAG NO.</b>	<b>DATE TAGGED</b>	<b>LOCATION</b>	<b>DATE OF RESIGHTING</b>	<b>LOCATION</b>
WS371	Oct. 18, 1997	Ponta Do Ouro	Feb. 8, 1998	Ponta do Ouro
WS264	Nov. 22, 1997	Ponta Malangane	May 9, 1998	4 km north of Ponta do Ouro
WS264	Nov. 22, 1997	Ponta Malangane	August 8, 1998	Leven Point, Cape Vidal (KZN)
WS274	Dec. 31, 1997	3 km south of Millibangalala	Jan. 1, 1998	Millibangalala

### **NOTE**

- (i) All of the tabulated resightings were reported by divers other than those who were responsible for deploying the tags.
- (ii) The distance between Ponta do Ouro and Ponta Malangane is approximately 7 kms (south to north).
- (iii) The distance between Ponta Malangane and Ponta Dobela is approximately 40 kms (south to north).



(iv) Of the 13 reported resightings, only 5 were of significance and these are listed as follows : -

- Shark No. WS 0053, an 8-metre female, was tagged on December 21, 1995 and appears to have remained in the general area of Ponta Malangane for 34 days.
- Shark No. WS0172, an 8-metre male, as tagged on February 23, 1997, and appears to have remained in the general area of Ponta do Ouro for 29 days.
- Shark No. WS0371, a 7-metre female, was tagged at Ponta do Ouro on October 18, 1997, and was resighted again in the same area on February 8, 1998 – 114 days later.
- Shark No. WS0264, a 7-metre male, was tagged at Ponta Malangane on November 22, 1997, and was resighted again in the same area on May 9, 1998 – 169 days later.
- Shark No. WS0264 was resighted again, for the second time, off Leven Point, Cape Vidal on the KwaZulu-Natal coastline on August 8, 1998 – 91 days and approximately 132 kilometres south of the first resighting.

### **BATCH TAGGING**

In order to try and establish whether the batch tagging of whale sharks would improve the potential for resightings, four trial excursions were incorporated into our normal field trips.

During the 48-hour period from November 1, 1996 to November 2, 1996, a total of 28 whale sharks were tagged in the bay at Ponta do Ouro in southern Mozambique.

On December 10, 1996, a total of six whale sharks were tagged during a 1 hour, 25 minute work period at Cape Vidal on the north coast of KwaZulu-Natal.

From August 22, 1997 to August 24, 1997, a total of 11 whale sharks were tagged in the bay at Ponta do Ouro during an effective working time of six hours.

From October 17, 1997 through to October 19, 1997, a total of 13 whale sharks were tagged in the bay at Ponta do Ouro over an effective working time of three hours.

Some 58 whale sharks, or 25% of the total number tagged off the east coast of southern area during this five-year survey period, can be classified as being “batch tagged” but to date and at the time of going to print no resightings of any of these particular animals have been reported.

## **CONCLUSION**

- Several reports were received from skin divers with regard to scar tissue being observed in the first ridge immediately below the first dorsal fins of a number of whale sharks. This would suggest that the immune systems of these animals had possibly rejected the passive tags that were implanted in the same areas of their bodies, similar to the rejection problems that were experienced by other research institutions that endeavoured to deploy passive tags on other shark species.
- There is no doubt that passive tags can make a significant contribution towards understanding the migratory patterns of whale sharks through the tropical and sub-tropical oceans of the Indo-Pacific region but the cost per unit of effort, relative to the returns received, is not sustainable on a long-term basis because the infrastructure required to privately operate a project of this nature is effectively both very specialised and expensive.

- The alternatives can be summarised as follows : -
  - (i) The deployment of satellite tracking tags on suitable whale sharks would be the first choice as the scientific data return is immediate and ongoing for as long as the batteries remain active in each tag.

The infrastructural cost of deploying a satellite tracking tag is identical to that of deploying a passive tag even though the basic cost of obtaining the former is considerably greater than that of the latter.

- (ii) The project could possibly be linked to one or more reliable and well-established commercial dive-tour operators under the specific banner of educational eco-tourism, and the cost of providing the infrastructure necessary for deploying passive tags would, as a consequence, be shared between the research institute and the dive-tour operators in the interests of acquiring more and much-needed additional knowledge about the species.
- (iii) Complete corporate sponsorship of the project by a commercial enterprise with the financial resources necessary to fund the acquisition and use of a delta-winged microlight for a minimum period of two years and to carry the cost of deploying and monitoring a total of at least three satellite tags on suitable whale sharks off the coastlines of KwaZulu-Natal and southern Mozambique.

### WHALE SHARK INFORMATION CARD

TAG NO \_\_\_\_\_ DATE \_\_\_\_\_

LOCATION \_\_\_\_\_ TIME \_\_\_\_\_

G.P.S. \_\_\_\_\_ SIZE (EST) \_\_\_\_\_

SEX : MALE \_\_\_\_\_ FEMALE \_\_\_\_\_ UNKNOWN \_\_\_\_\_

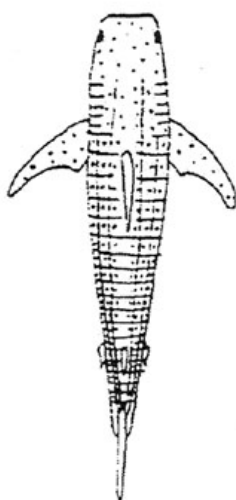
DIVER \_\_\_\_\_ SKIPPER \_\_\_\_\_

VISIBILITY \_\_\_\_\_ TEMPERATURE \_\_\_\_\_

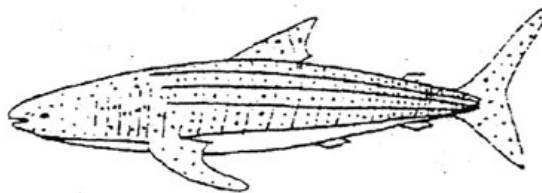
MARKINGS \_\_\_\_\_

\_\_\_\_\_

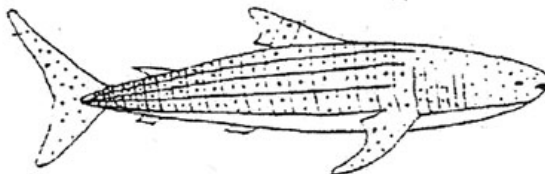
### WHALE SHARK TAGGING PROJECT



DORSAL VIEW



LEFT HAND VIEW



RIGHT HAND VIEW

### POSITION OF TAG

(Example of working document)



# Shark Research Institute

Andrew Gifford - Director - Shark Research Institute - South Africa

P.O. Box 510, Botha's Hill, Natal 3660

Tel / Fax : 031 - 764-0349

**PLEASE MAIL OR FAX COMPLETED FORM TO THE ADDRESS ABOVE  
YOU WILL BE NOTIFIED WHEN AND WHERE THE SHARK IS RESIGHTED.**

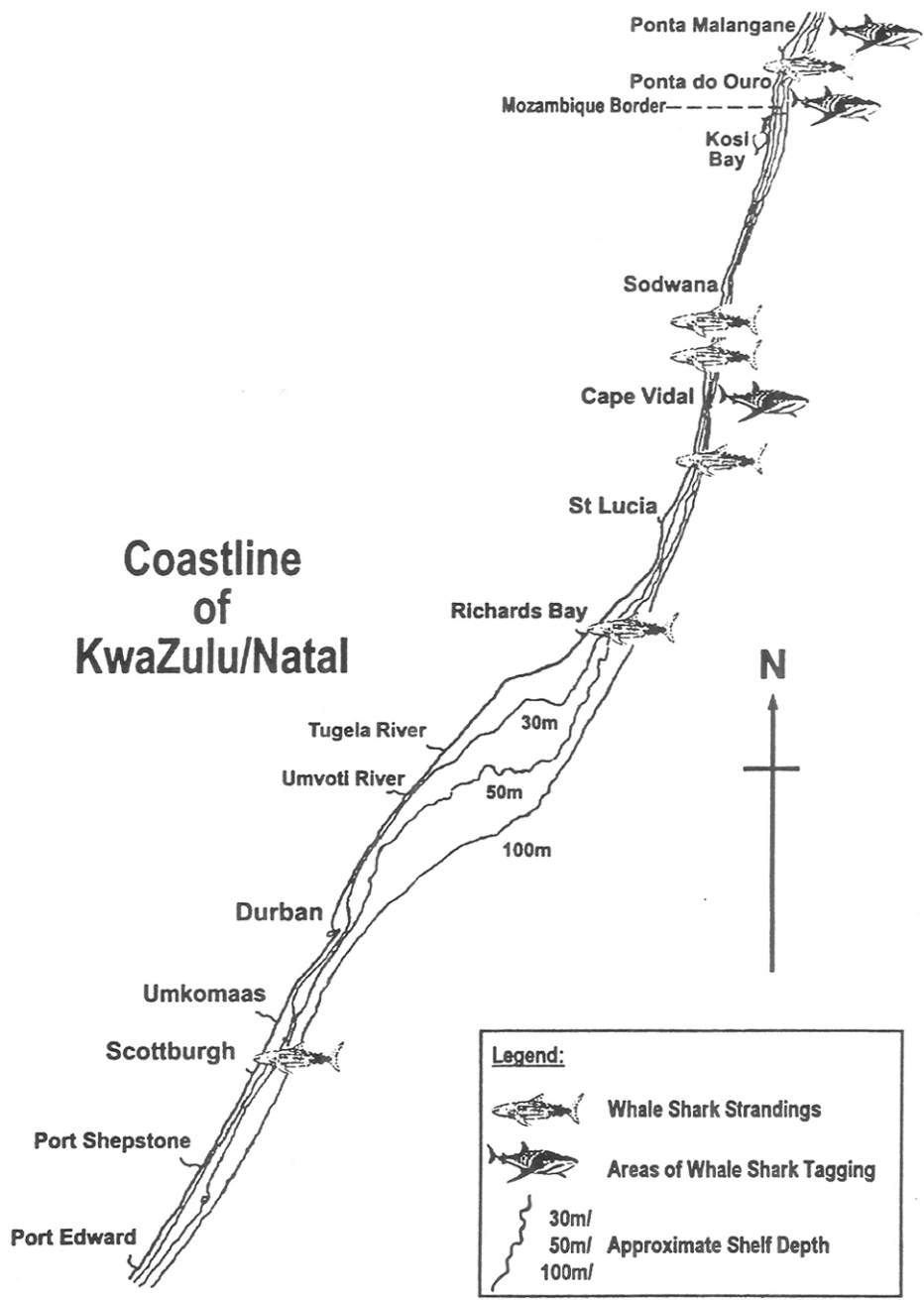
TAG NUMBER: _____	DATE TAGGED: ____ / ____ / ____
SIZE OF WHALE SHARK: _____ METRES	SEX OF WHALE SHARK: _____
LOCATION: _____	GPS (if possible): _____
LOCATION OF TAG ON THE SHARK: _____	

a)	Did the shark have any distinct markings that would serve for reidentification? (eg. Scars)	_____
b)	Was the shark solitary, or were other Whale Sharks nearby?	_____
c)	Water temperature (specify measured / estimated)	_____
d)	Water clarity _____	Time of day _____
e)	Environment (reef, open sea, etc.)	_____
f)	Distance from shore	_____
g)	Depth of water	_____
h)	Was the shark feeding? _____	If so, on what was it feeding? _____
i)	What was the shark's reaction to tagging?	_____

<b>PERSONAL DETAILS OF TAGGER</b>	
Name: _____	Surname: _____
Address: _____	
Contact telephone number / fax / e-mail: _____	

\* Thank you for your support.

(Example of working document)



## ACKNOWLEDGEMENTS

We would like to express our appreciation and thanks to : -

(A) AIRCRAFT PILOTS

Chris Kilian – delta-winged microlight and fixed wing.  
Pieter Gent – delta-winged microlight and fixed wing.  
Mickey Biermann – delta-winged microlight  
Rob Allen – delta winged microlight

(B) KWAZULU-NATAL WILDLIFE

Terry Ferguson – Warden at Cape Vidal  
Steve Hoseck – Senior Ranger at Cape Vidal  
Lionel van Schoor – Warden at Cape Vidal  
Deon Slater – Ranger at Cape Vidal  
John Dives – Senior Ranger for the Durban area  
Joss Josling – Senior Ranger for the Durban area  
Richard Poole – Ranger for the Durban area

(C) COMMERCIAL DIVE-TOUR OPERATORS

African Watersports – Mark and Michele Addison  
Blue Wilderness Dive Expeditions – Mark and Michele Addison  
Blu International – Jose Nunes and Grant Golombick  
Simply Scuba Dive Charters – Kevin Layden  
Trident Divers – Ricki and Lance Schick  
Turquoise Horizons – Christophe Beau

(D) CORPORATE SPONSORS

Independent Building Inspection Services  
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PADI Foundation

**EXPANSION OF THE PASSIVE TAGGING PROGRAM OF  
WHALE SHARKS (*Rhincodon typus*) TO THE  
SEYCHELLES** (Report No. 4)

By Albert Andrew Gifford, Shark Research Institute (South Africa)

**ABSTRACT**

The seasonal abundance of whale sharks off the coastline of the Seychelles appears to correspond with the plankton blooms that occur in the surrounding seas during the summer months. Their annual appearance contributes significantly towards the success of the marine eco-tourism industry that is located in the area, but where these animals come from or where they go is still unknown.

**INTRODUCTION**

On November 16, 1996, the Shark Research Institute – South Africa, working in association with the Shark Research Institute – and Mr. David Rowat of the Underwater Centre, Seychelles, assisted in establishing a pilot eco-tourism based Whale Shark Tagging Program in the Seychelles.



## **METHODOLOGY**

The tagging methods and equipment used were identical to those developed for use on the whale sharks that occur in the waters off the east coast of southern Africa.

In summary, these include the following : -

- (i) A delta-winged microlight aircraft was used for the aerial location of suitable whale sharks.
- (ii) A commercial dive-boat was used to deploy the divers who would ultimately implant the passive tags into the various animals using a rubber-sling-powered speargun.
- (iii) The trailing edges of the standard luminous green tags were specifically colour-coded with a bright pink band to identify them as being exclusively relevant to the tagged whale sharks of the Seychelles.

## **RESULTS**

This particular aspect of the planned passive tagging strategy proved to be reasonably productive with a total of 23 whale sharks tagged over a seven-day work period. Of these, 16 were male, 5 were female, 2 were not sexed, and 4 were accidentally tagged twice – once on the left and once on the right sides of their first dorsal fins.

TAGGED WHALE SHARK SEX TO SIZE RATIO

3m		4m		5m		6m		7m		8m		NOT SEXED	TOTAL
M	F	M	F	M	F	M	F	M	F	M	F	--	--
1	-	5	1	3	2	3	1	3	1	1	-	2	23
1		6		5		4		4		1		2	23
4,5%		26%		22%		17%		17%		4,5%		9%	100%

We received two independent reports of two tagged whale shark resightings in the bay at Ponta do Ouro. Both animals had been tagged in the first dorsal ridge below their first dorsal fins with “pink-tipped green-coloured tags”.

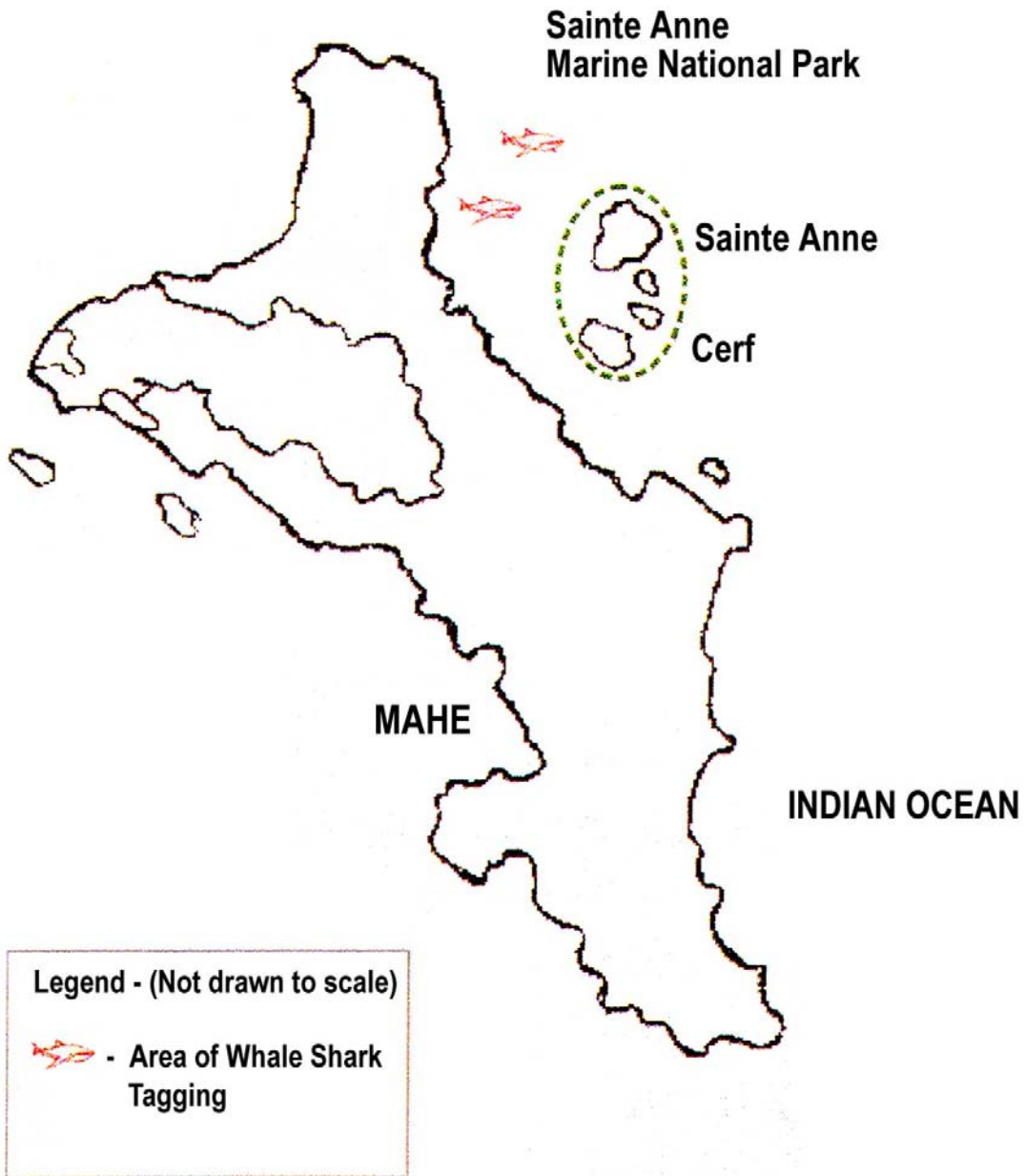
The first occurred on October 2, 1997 and was reported by Jennifer Mostert who was an assistant to a commercial dive-tour operator based in the immediate area.

The second was reported by Lorna Domgaardt on September 19, 1998, who was a member of a recreational dive party that was on holiday at Ponta do Ouro.

Unfortunately, neither diver recorded the tag numbers. In the first instance, the shark would not allow a close enough approach, and in the second, the diver was unaware that the tag was numbered. What is of significance with regard to both of these resightings was that neither of the divers knew that the colour configuration on the tags belonged exclusively to whale sharks that were tagged in the Seychelles as this information was not widely publicized either locally or internationally and was known only to those people directly involved in developing this research initiative. In consequence, the information provided was based entirely on their own individual and unsolicited observations.

This would indicate that either one or both of these sharks had traveled at least 2 939 km (1,859 nautical miles) over an approximate period of 12 or 24 months respectively. Because the relevant tag numbers were not recorded and both were apparently deployed on the right-hand side of each animal, we could not positively establish whether one or two sharks had made the trans-Indian Ocean crossing from the Seychelles to the east coast of southern Africa.

# COASTLINE OF THE SEYCHELLES





1. The SRI microlight parked on the beach outside of the Coral Strand Hotel, Seychelles. (November 1996) Photo: J. Gifford



2. One of the banners that welcomed the South African SRI Tagging Team on their arrival in the Seychelles. Photo: J. Gifford

## **ACKNOWLEDGEMENTS**

We would like to express our appreciation and thanks to: -

1. Cable and Wireless (Seychelles) Ltd., Coral Strand Hotel and the Underwater Centre Seychelles for their sponsorship, which enabled the project to successfully expand the Seychelles.
2. PADI – PROJECT A.W.A.R.E. for providing some of the funding that was required to extend the tagging program to the Seychelles.
3. Cuane and Linda Hall for recording this entire scientific field trip on video.
4. Jason Gifford for assisting with the diving and tagging aspect of the operation.
5. Susan Smith for presenting a paper at the Marine Ecology & Tourism Symposium held in the Seychelles.
6. Rob Allen for flying the delta-winged microlight aircraft.

**PRELIMINARY SURVEY OF THE ECO-TOURISM  
POTENTIAL OF THE WHALE SHARKS (*Rhincodon typus*)  
THAT OCCUR OFF THE EAST COAST OF SOUTHERN  
AFRICA.** (Report No. 5)

By Albert Andrew Gifford, Shark Research Institute (South Africa).

**ABSTRACT**

The cost of developing and financing a marine research initiative that requires a specialized infrastructure is usually very high and when the species being studied does not enjoy a particularly high economic status as a food source the task of finding adequate sponsorship becomes more difficult.

With this in mind it was decided to explore the possibility of including several of the commercial dive-tour operators that were located at various points on the coastlines of both KwaZulu-Natal and southern Mozambique in the passive tagging program of whale sharks as this would serve the dual function of effectively reducing the overall cost of conducting the operation and also promote the conservation of the species through public education.

**INTRODUCTION**

After several unsuccessful attempts to include a number of the commercial dive-tour operators based at Sodwana Bay on the KwaZulu-Natal north coast in the project it was decided to re-focus our attention onto those located at both Ponta do Ouro and Ponta Malangane on the coastline of southern Mozambique.

The decision to use the facilities available in Mozambique proved to be very productive because not only were the summer sea conditions found to be more favourable than those encountered off the coastline of KwaZulu-Natal but the enthusiasm of the various dive-tour operators with regard to promoting this project, albeit to service their own commercial interests, ensured that each excursion was given the best possible chance of succeeding.

## **METHODOLOGY**

The first exploratory field trip took place on March 10, 1994 and on this occasion the facilities were offered by Mr. Ricki Schick of Trident Diving were used. These consisted of an open-decked ski-boat, approximately 9 metres in length, especially designed to carry divers with an observation cockpit erected above and forming part of the semi-enclosed cabin around the skipper's control consol and powered by two 175hp Evinrude outboard motors. The dive party comprised 7 individuals that included the vessel's skipper and one observer/recorder. Using the backline "zig-zag" sea search method, a total of three whale sharks were located and the five divers were afforded the opportunity of swimming with each one of them. The area of operation was the Bluff, which is immediately south of the entrance to the harbour of the port of Durban on the coastline of KwaZulu-Natal, South Africa.

Prior to expanding and further developing this aspect of the project it became necessary to formulate a series of rules that would hopefully control and provide an environmentally acceptable basis for the inevitable interaction between skin-divers and whale sharks. In order to achieve this objective, the owners of a number of selected commercial dive-tour operators located in southern Mozambique were encouraged to implement the following protocols : -

## Whale Shark Weekends – Operational Procedures

### 1. Skipper/Divemaster Disciplines

- (a) Each dive party to be fully briefed by the skipper/divemaster prior to leaving the beach.
- (b) On locating a whale shark, the semi-rigid/dive-boat will immediately tap-off (decelerate) as it approaches and positions itself either on one side or ahead of the animal.
- (c) One experienced diver then enters the water to tag, sex and size the animal and report the relevant details to the skipper who will also record the exact position of the event using the on-board GPS.
- (d) The dive party should then be allowed to enter the water in a controlled manner with a minimum amount of splashing so as not to “spook” or alarm the shark. Physical contact with the animal must be kept to an absolute minimum and its dignity and tolerance of the human intrusion into its environment must at all times be respected.

### 2. Note

- (a) The primary objective behind the creation of the Whale Shark Weekend is to expose as many people as possible to the unforgettable experience of making contact with one or more of these magnificent animals on their own terms. In this way it is hoped to facilitate and promote the conservation of the species.
- (b) Being able to swim or dive with a whale shark is a very special privilege that only a few people will ever experience in their respective lifetimes and each member of the dive party should be made aware of this fact.



### 3. Microlight Aircraft

- (a) At all times the aircraft must be kept in a fully airworthy condition.
- (b) The aircraft must only be flown by fully qualified and licensed pilots.
- (c) Under no circumstances must the aircraft be used to carry fare-paying passengers for whatever reasons, as it cannot be licensed to serve this function in either Mozambique or South Africa.
- (d) A Voluntary Release, Waiver and Assumption of Risk document must be signed in duplicate by any person who makes use of the microlight.

The first experimental “Whale Shark Weekend” took place at Ponta do Ouro on the coast of southern Mozambique over the weekend of October 31, 1996 to November 3, 1996. Our host was a commercial dive-tour operator known as African Watersports and the dive party consisted of 96 divers with a supporting infrastructure of five 6,2 metre semi-rigid inflatable boats and three microlight aircraft. Each boat was skippered by a qualified and experienced divemaster and each aircraft was flown by a licensed pilot. The morning of October 31 was spent making sure that all of the semi-rigid dive boats and all of the diving equipment was in a seaworthy and sound working condition. The three microlights took off from the beach and overflew the bays of both Ponta do Ouro and Ponta Malangane to specifically establish the presence and whereabouts of any whale sharks, to check their equipment and to acquaint themselves with the area.

During the late afternoon of the same day all of the divers, divemasters, skippers and pilots were assembled and fully briefed with regard to the

objectives of the operation, what they should expect and what would be required from each of them. At approximately 08h00 on the morning of November 1 a single microlight was dispatched to reconnoiter the operational area and on receipt of the pilots report the dive-boats were launched together with the two remaining microlights. Each aircraft was assigned to cover different aspects of the bay, one to the north, one central and one to the south. The dive-boats were dispatched on the ratio of 2:1:2 with any potential overlap taking place in the central area, as determined by the availability and positions of the sharks. Just prior to leaving the beach, each divemaster was issued with a tag-gun and tags and were once again given the specific instruction that under no circumstances were any of the divers under their control allowed to touch or hang onto the fins of any whale sharks encountered.

The first shuttle-type diver excursion was successfully concluded at approximately 12h00 with the arrival of the last dive-boat. The second commenced at 14h00 and ended at 16h30, with the third and fourth taking place on November 2 using the same infrastructural support systems and operational procedures within similar timeframes. At the end of this period a total of 28 whale sharks had been tagged and each diver had swum with at least one or two of these accommodating animals. It was at this point in time that we ran out of tags which meant that the excursion that took place on the morning of November 3 was geared exclusively to establishing how many tagged or untagged whale sharks were still in the bay at Ponta do Ouro and to afford as many divers as possible the opportunity of swimming with them. In this regard a total of 30 untagged animals were located from the air.

ESTIMATED TOTAL NUMBER OF DIVE HOURS	ESTIMATED TOTAL NUMBER OF DIVE- BOAT HOURS	ESTIMATED TOTAL NUMBER OF MICROLIGHT AIR-TIME HOURS	TOTAL NUMBER OF WHALE SHARKS TAGGED	TOTAL NUMBER OF WHALE SHARKS SIGHTED
432	65	37	28	58

**NOTE:**

- Total number of dive hours, represents the actual time spent swimming with whale sharks but excludes the programmed reef dives.
- Total number of dive-boat hours, indicates the support time spent with each dive party, including the time spent traveling to and from the various dive points but excludes the programmed reef dives.
- Total number of microlight air-time hours, represents the actual time spent finding whale sharks and then talking the various dive-boats onto them via radio, recorded from the time of take-off to the subsequent landing on the beach but excluding any pre-flight preparations.

The second experimental “Whale Shark Weekend” took place at Ponta Malangane on the coast of southern Mozambique over the weekend of February 28, 1997 to March 2, 1997. This time our host was a commercial dive-tour operator trading as Blue Wilderness Dive Expeditions. The dive-party consisted of 12 individuals that were serviced by one 6,2 metre semi-rigid inflatable boat and one microlight aircraft. Using the same infrastructural support techniques developed during the first experimental Whale Shark Weekend and notwithstanding the adverse weather and water conditions that prevailed at the time, this operation was also a complete success with a total of four sharks tagged over an effective one-day work period. Each member

of the dive-party was afforded the opportunity of swimming with at least two of these specific animals.

<b>ESTIMATED TOTAL NUMBER OF DIVE HOURS</b>	<b>ESTIMATED TOTAL NUMBER OF DIVE-BOAT HOURS</b>	<b>ESTIMATED TOTAL NUMBER OF MICROLIGHT AIR-TIME HOURS</b>	<b>TOTAL NUMBER OF WHALE SHARKS SIGHTED AND TAGGED</b>
36	5	6	4

During the period August 22, 1997 through April 7, 1998 a further seven “Whale Shark Weekends” were held at both Ponta do Ouro and Ponta Malangane in association with the following commercial dive-tour operators: -

- Blue Wilderness Dive Expeditions.
- Blue International.
- Simply Scuba Mozambique Dive Charters.
- Turquoise Horizons cc.

At the time of concluding this aspect of the research program on September 10, 1999 a total of 559 recreational divers had swum with one or more of these magnificent animals, ten divemasters were trained with regard to how and where to tag the sharks, four microlight and two fixed wing aircraft pilots gained considerable experience in spotting their targets from the air and five commercial dive-tour operators were encouraged to deploy sustainable operational procedures in order to enhance the environmental credibility of their respective enterprises.

## CONCLUSION

- (a) The success of this type of excursion should not be specifically equated to the number of whale sharks tagged but rather to the positive diver reactions when exposed, on a one to one basis, to these animals and being given the chance of participating in actual scientific fieldwork is an added long term educational bonus. Based on the enthusiasm and interest shown by the various dive groups during their post-dive debriefing sessions, it is clear that weekends of this nature have a very definite potential to dramatically increase public awareness for the need to promote and implement marine conservation disciplines with an overall reference to sharks of all species.
  
- (b) The concept of developing whale shark specific ecotourism industry off the coastline of KwaZulu-Natal could prove to be commercially viable, however, the topography of the coast is not particularly well suited to this type of venture for the following reasons : -
  - (i) The coastal region of KwaZulu-Natal is located in a summer rainfall area which means that most of the silt-laden rain-swollen rivers discharge directly into the sea, effectively discolouring the inshore coastal waters from Cape Vidal in the north to Port Edward in the south for most of the summer period. What makes this observation significant is that during the aerial survey period (1993 to 1998) the majority of the whale sharks were consistently located either directly on backline or between 50 and 200 metres behind the last line of breaking waves and when these facts are combined with the periodic inshore discolouration of the sea the difficulty of establishing and maintaining an economically

- sustainable dive-tour operation focused exclusively on the species becomes apparent.
- (ii) There are no suitably protected natural bays on the coastline south of Cape Vidal.
  - (iii) Even though there are a number of ideal bays on the coastline north of Cape Vidal they are all located in marine protected areas that have been specifically zoned to exclude both commercial and recreational over-exploitation.
  - (iv) To improve the chances of succeeding with a project of this nature would require the use of a cost-effective microlight or similar type of aircraft for purposes of locating the whale sharks from the air. In this regard, problems would be experienced in obtaining the required permission from both the civil aviation authorities and the various relevant coastal municipalities to take off and land on the beach on a regular basis during a typical season that lasts for on average six months.
  - (v) The use of fixed-wing aircraft, for the purposes detailed in terms of section b(iv), would further limit the areas of operation because of the location of suitable airfields. In our experience the operating costs of a fixed wing aircraft are approximately six times higher than that of using a microlight.
  - (vi) Access roads to and from the various dive-sites used were found to be more than adequate for normal two wheel drive vehicles, including small tour busses.
  - (vii) With the exception of Durban harbour, all of the dive-boats had to launch from the beach and negotiate the surf, which at times was very rough.

- (c) Operating from the coast of southern Mozambique proved to be the most productive based on the following observations: -
  - (i) There are several naturally protected bays on the relevant stretch of coastline.
  - (ii) Sea conditions and water clarity were found to be superior to those encountered off the coast of KwaZulu-Natal.
  - (iii) Subject to permission being granted by the local authorities and the resident community, the microlights could take off and land on the beach on a regular basis.
  - (iv) Although the dive-boats were obliged to launch from the beach, on average the surf conditions were found to be less severe than those encountered south of Cape Vidal.
  - (v) Road access from the border to both Ponta do Ouro and Ponta Malangane required the use of a four-wheeled-drive vehicle. The relevant section of roadway is presently being upgraded.
  
- (d) During the course of the survey period, a number of collateral but environmentally constructive and commercially viable options were explored.
  - (i) At the conclusion of each “Whale Shark Weekend” the participating divers were given a “Friends of the Whale Shark” certificate that reflected the size, sex, date and place where the various animals were observed and experienced by the individual divers. The cost of producing these certificates was carried by the dive-tour operator and included in this calculation was a nominal profit margin intended for use to further shark research. The majority of divers who received these certificates were very

appreciative as it provided them with a tangible keepsake of a memorable event.

- (ii) Divers who formed part of a tagging team were also given the chance of adopting one or more of the tagged animals for a donation of R500.00, - (USD 100.00) each. In return for which they were presented with the following: -
  - An “Adoption Certificate” that reflected the shark’s name, sex, size, date and place where it was tagged. (Each shark was given an ethnic name based on its sex and whether it was tagged off the coastlines of either southern Mozambique or KwaZulu-Natal).
  - A resin model of a diver swimming with a whale shark, mounted on a timber frame with an engraved identification plaque attached to its display surface.
  - In the event of a resighting of any one of these specific animals, the relevant adoptive parent would be advised in writing of when and where it was seen.
- (iii) T-shirts and hand-painted glazed beer mugs bearing different images of whale sharks were developed for possible sale to the public.
- (iv) Exclusive anatomically accurate whale shark pendants, moulded out of sterling silver and 9ct gold, were also developed as a potential source of additional revenue.



# FRIENDS OF THE WHALE SHARK



This is to certify that \_\_\_\_\_  
has dived with a Whale Shark,  
the world's largest known fish,

at \_\_\_\_\_

on \_\_\_\_\_

**SHARK RESEARCH**

and this gentle giant of the deep  
was a male / female with an estimated  
length of \_\_\_\_\_ meters.



\_\_\_\_\_  
DIVEMASTER

DATE ISSUED: \_\_\_\_\_

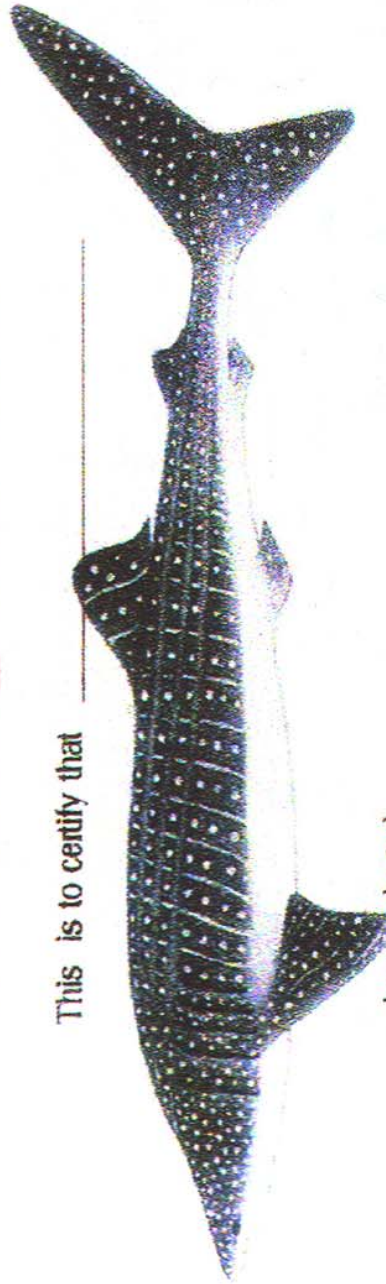
\_\_\_\_\_  
SKIPPER

(Example of working document).

# Certificate of Adoption



This is to certify that \_\_\_\_\_



\_\_\_\_\_ has adopted

Tag Number: \_\_\_\_\_

Size: \_\_\_\_\_

Tagged By: \_\_\_\_\_

Date: \_\_\_\_\_

Tagging Location: \_\_\_\_\_

DIRECTOR, SHARK RESEARCH INSTITUTE

DATE ISSUED: \_\_\_\_\_

PROJECT DIRECTOR, SRI WHALE SHARK STUDY

(Example of a working document).



Resin model of a diver swimming with a whale shark  
(Sub-section (d) (ii) refers)

Photograph by Shelley Scribante



9ct Gold and Sterling Silver whale shark pendants  
(Sub-section (d) (iv) refers)

Photograph by A.A. Gifford

Any profits derived from the exploratory commercial initiatives described under sections d(i) to (iv) were scheduled for use to finance further whale shark research.

- (e) On March 8, 1998 and January 22, 1999, during the course of conducting two combination passive/satellite tag deployment operations at Cape Vidal on the coast of northern KwaZulu-Natal, it was decided to include a number of selected public and private company executives as part of the group in order to determine whether or not it would be feasible to develop field trips of this type into viable corporate team building exercises.

With this in mind and working on a rotational basis, one executive was assigned to the microlight and the balance of the observer-designated dive-boat so that they would all be given the opportunity of observing and experiencing the different facets of the actual operation first hand, including swimming with the whale sharks but excluding the implanting of either the passive or the anchor tags used to attach the tethers of the satellite tags.

Based on the positive reactions of the participating corporate executives at the conclusion of each of these three-day field trips, it was clear that both excursions were completely successful insofar as each of the management objectives for this particular phase of the project had been achieved.

- (i) A total of 7 passive, 3 anchor and 2 satellite tags were successfully deployed.
- (ii) In order to attain the operational targets detailed in terms of section e(i), required teamwork of the highest possible caliber such as: -

- The locating of whale sharks in the immediate area by the pilot and observer in the microlight, despite difficult flying and adverse sea conditions.
- Talking the skipper of the primary dive-boat onto the selected animals from the air via radio in the quickest possible time, to take advantage of a significant drop in wind velocity that only lasted for approximately 90 minutes on each occasion.
- Rapid and accurate responses by the skipper of the primary dive-boat to the instructions given by the microlight pilot.
- Rapid and accurate responses by the tagging diver, the back-up diver and the underwater videographer.
- Accurate data recording by the observers on the primary dive-boat.
- Disciplined and responsible behaviour by the observer divers who accompanied the tagging team.
- Positive social interaction by all members of the group during the post-dive analysis discussion and debriefing sessions.

(f)

**NOTE**

Extreme care should be exercised when deploying specialist personnel to assist with the implementation of the various processes necessary to ensure the success of each facet of the program. This will prevent embarrassing situations from developing such as : -

- (i) On November 1, 1996, two of the five skippers/divemasters responsible for ferrying the divers to and from the various dive locations, allowed their protégés to hang onto the dorsal and pectoral fins, the upper and lower jaws and even stand on the heads of a number of the more accommodating whale sharks. This was done despite pre-dive instruction that under no

circumstances were any of the animals to be touched or handled.

- (ii) A number of divemasters allowed several of their “friends” to deploy passive tags, irrespective of their experience in handling potentially dangerous spearguns. This only became apparent on receipt of the relevant tag return documents.
- (iii) Two of the regular microlight pilots indulged in the highly-illegal practice of charging members of the public a fee for providing them with 10-minute overflights of the bays at both Ponta do Ouro and Ponta Malangane. This was unilaterally done during off-duty hours and for the sole purpose of self-enrichment. Microlights are classified as experimental aircraft and cannot be licensed to carry fare-paying passengers.
- (iv) Two very ambitious commercial dive-tour operators, one of the regular microlight pilots and two avaricious professional videographers decided to capitalize on the whale shark tagging initiative and independently of each other produced two documentaries, neither of which accurately reflected the work being done or the objectives of the research program. Of the two broadcast on South African television, the most bizarre included shots of a “Penthouse-type pet” swimming naked with a whale shark.
- (v) The only reason why situations such as those enumerated under sections f(i) to (iv) were able to develop was because of a total lack of any meaningful and enforceable legislation governing

the commercial exploitation of whale sharks, for whatever reason, in the coastal waters of both KwaZulu/Natal and southern Mozambique.

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**(A) AIRCRAFT PILOTS**

Chris Kilian – delta-winged microlight and fixed wing.  
Pieter Gent – delta-winged microlight and fixed wing.  
Mickey Biermann – delta-winged microlight  
Rob Allen – delta winged microlight

**(B) COMMERCIAL DIVE-TOUR OPERATORS**

African Watersports  
Blue Wilderness Dive Expeditions  
Blu International  
Simply Scuba Dive Charters  
Trident Divers