WHALE SHARK POPULATION STUDY

REPORT ON WHALE SHARK RESEARCH UNDERTAKEN IN 1996

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INTRODUCTION:

The field work undertaken in 1996 endeavoured to continue the building up of an extensive database on the individual whale sharks visiting Ningaloo in the March/April season. The photographic and tagging work undertaken since 1992 has already established that the same sharks are resighted at Ningaloo in successive seasons suggesting that this is a discrete population. The study has a long term objective of assessing growth and age of whale sharks at Ningaloo. This is expected to take at least ten years.

OBJECTIVES:

1. To continue the photographic database on individual sharks, so that these animals may be recognised in future seasons, recording scars, sex, and in the males, maturity.

2. To record resightings of sharks from previous seasons, identifying them by tags and photographic data.

3. LONG TERM - To obtain measurements of as many of the whale sharks as possible in the database, to allow future estimates of growth and maturity.

METHODS:

Over the period 31 March to 12 April, for each animal encountered that was successfully photographed, a reporting form was completed noting Date, Time, Location (GPS), approximate size, sex, maturity (males only). The presence of any identifying scars was recorded. The presence of tags from the 1992 season was recorded. Each shark was photographed, with a left and right flank photograph, and where possible, shots of scars, and tags. In most sharks the genitals were also photographed.

Where possible, after photography, the dorsal fin of each shark was measured, with a metre rule, from the anterior end of the posterior "slit" at the base of the fin to the top of the fin. In many cooperative animals the dorsal fin was measured repeatedly. Attempts were then made to take lateral shots of the whole shark with a diver holding the metre rule horizontal over the midline of the shark, behind the dorsal fin. Projection of these photographs has allowed estimation of the total length of the sharks (head to tip of tail) and the standard length (head to tail peduncle).

A new reporting form was generated for each shark encountered, where identification photos were taken, unless it was immediately evident that the shark was a resighting from earlier in the same day, or of an animal recently encountered that season.

RESULTS:

1996 was a good shark season. Weather conditions were initially good, but the season was interrupted by Cyclone Olivia which threatened the region on 10 April. The cyclone turned east and crossed the coast at Mardie station. The Cape was affected by strong easterly winds and large swells. The water became extremely turbid greatly reducing underwater visibility.

55 shark encounter forms were completed in 12 days of diving. Matching of the animals on the basis of scars and photographic markings, has currently given a total of 34 individual animals encountered.

SEX: All encountered sharks had their sex determined, 28 were male and 6 female (17.6%). All of the male sharks were sexually immature. The proportion of female sharks was lower than recent seasons (1994 and 95), but the proportion is significantly higher than in 1992, when only 2 female sharks were seen out of a total of 32 sharks that were sexed, and in 1993 when there was only one female in 22 sharks.

SCARS: Three sharks had major scars enabling immediate identification. Two of these sharks were resightings, and one a new addition to the database. Minor scars were present in several other sharks allowing identification by experienced observers. In all, 16 sharks had scars that allowed identification, and photography of these scars has assisted in matching of individuals.

TAGGED SHARKS: Of the 25 sharks tagged in 1992, 1 individual (92 A-12-4) was resighted on 1 April this season. This shark had been resighted in 1995 on the 6 April, and in 1994 on three occasions (31-3-94, 12-4-94 & 13-4-94). Dorsal fin measurements had been taken on several encounters.

DORSAL FIN HEIGHT: 26 sharks were successfuly measured. Two of these sharks had been measured in previous seasons.

Shark 92-A-12-4 was extensively measured in 1994 with a mean DF height of 58.4cm. This season the DF was measured as 59.5cm (2 measurements)

Shark 94-A-14-2 nicknamed "Scraggytail" was measured in 1994 as DF of 48cm. This season it was remeasured as 52cm (3 measurements).

In the light of these new measurements, it is worth reviewing the repeat measurements from 1995:

Shark 94 A-2-3 is a female shark with damaged Right

Pectoral fin that was first measured in 1994 with two measurements of 47 and 48 cm. Three measurements in 1995 were 48, 49, 49 cm.

Shark 92-A-12-4 is the tagged male shark. Measurements in 1994 gave figures of 57, 58, 59, 59, 58 cm. One measurement in 1995 gave a figure of 57 cm.

Shark 86 A-15-1 is a male shark with damaged left pectoral fin. It was first filmed and observed extensively in 1986. Repeated measurements (approx 10) in 1993 gave a dorsal fin height of 62.5cm. The shark was measured 7 times in 1995 giving a height of 64 cm. This is in keeping with the estimates of dorsal fin height of 56 cm in 1986.

An analysis of length data is shown in Table 1. The Standard and total length of each shark was computed from the measurements on the photographs. As in previous seasons, the results show that the Dorsal fin height is approximately 10% of standard length and 8% of total body length. Standard deviations were less than 10% for both measurements.

DISCUSSION:

The 1996 season added 30 sharks to the database bringing the total records to 162 animals. While matching of tagged and scarred sharks is relatively easy, the matching of animals bearing none of these features is a huge task. There is little doubt that some of these animals will be matched in the future, reducing the total number in the database. Population estimates in the past have generally given a figure of approximately 200 animals. This assumes that the animals presenting on the reef front at the surface each year are drawn from a constant population living off-shore. The situation is obviously more dynamic than this in reality. However, with the number of sharks now in the database, this order of population is not unrealistic.

The use of tags for population analysis has limitations because of tag shedding. Only one shark from the 25 tagged in 1992 was identified. It is likely that after the four year interval a large proportion of the sharks will have shed their tags. Future analysis of the photos may demonstrate that some of the sharks encountered this year were previously tagged. Such analysis awaits computerisation of the photographic record.

The data obtained this year once again shows that the measurement of dorsal fin height is a rough "field" guide to the length of a shark. For any dorsal fin size it is to be expected that there will be a normal distribution of lengths of sharks. 1996 data agrees with previous data that the standard length is approximately 10x the dorsal

fin height. Total length is approximately 12.5x. The standard deviation of less than 10% supports the view that there is a relationship between length and dorsal fin size.

Where two photographic measurements were made of the same shark it is evident from Table 1 that the standard length measurements are comparable, but the total length is not so reliable. This is quite evident on the original photographs, and explained by the large lateral excursions of the tail. The estimates of length could be improved if the position of the tail is centralised at the moment of taking the photograph, and this aim could be achieved in the field in future. This will require greater coordination between divers.

The long term objective of the present study is to determine the age and growth rate of whale sharks. As previously predicted, the growth of shark dorsal fins is very slow, and it will take a time span of up to ten years to show significant differences in the height of dorsal fins.

Conclusions from the dorsal fin figures must be viewed as preliminary. It is evident that repeated measurements are necessary to produce reliable results. Notwithstanding the difficulties of the technique, they suggest that whale shark growth is very slow. These sharks in the 5-9 metre range are still sexually immature, and should be in a phase of steady growth. We know that fully grown whale sharks attain a total length of greater than 12 metres. Hence, these preliminary figures suggest a growth rate of the order of 12.5 cm per year for 5-9 metre sharks.

Under normal growth circumstances, the growth of the fin should be related to the age and size of the shark. Remeasurement of animals over a ten year period should allow the generation of growth velocity curves for sharks of different maturities, and for the first time allow estimates of the age of the sharks, and of the age they reach sexual maturity. This will greatly add to our understanding of the species.

WHALE SHARKS LENGTH DATA 1996

SHARK	DF	STAND L.	TOT.L	SL/DF	TL/DF
96M-31-1	59.00	5.07	6.50	8.60	11.02
96M-31-1	59.00	5.39		9.14	
96M-31-5	65.50	7.15	8.88	10.92	13.56
96M-31-5	65.50	6.28	7.73	9.59	11.81
96A-1-1	71.00	6.12	7.72	8.63	10.87
96A-1-1	71.00	6.85	8.65	9.64	12.19
96A-1-2	56.00	5.76	7.50	10.29	13.39
92A-12-4	59.50	6.20	7.60	10.42	12.77
92A-12-4	59.50	6.37	6.94	10.71	11.66
96A-2-1	40.50	3.98	5.29	9.83	13.06
96A-2-2	66.00	6.57	8.47	9.95	12.83
96A-2-2	66.00	7.00	8.92	10.61	13.52
96A-2-5	60.00	5.71		9.52	
96A-2-5	60.00	5.51	7.17	9.19	11.95
96A-1-4	40.00	4.35	5.41	10.88	13.53
96A-1-4	40.00	4.36	6.01	10.89	15.04
96A-3-3	82.00	6.74	8.25	8.22	10.06
96A-3-3	82.00	7.29	9.13	8.89	11.13
96A-3-5	40.00	4.10	5.08	10.25	12.69
96A-3-5	40.00	4.28	5.26	10.69	13.15
96M-31-2	70.00	6.58	8.37	9.40	11.96
96M-31-2	70.00	6.57	8.58	9.38	12.25
			ave	9.80	12.42
			stdev	0.71	0.90

TABLE 1 The Standard length, and Total length of whale sharks as estimated from photographs, is related to the dorsal fin height. Each shark is coded according to year of first sighting, month (A=April;M=March), data, and number. Column 5 relates Standard length to dorsal fin height; column 6, Total length to dorsal fin height.