

SUMMARY ANALYSIS OF WHALE SHARK SIGHTING DATA:-

NINGALOO MARINE PARK, 1993

The data used in the following analyses were provided by pilots and licensed boat skippers involved in the 1993 whale shark interaction season. In all a total of 382 aerial records, covering 45 days and 421 records covering 58 days were received and incorporated into the analyses. CALM would like to thank all of those persons involved in the provision of this data and to acknowledge the time and effort expended by those persons in reporting their observations.

A. SPOTTER - PLANE RETURNS

(Note: For the purpose of this analysis it has been assumed that pilots reported all 'no sighting' searches as well as 'successful' searches.)

1.0 BASIC STATISTICS.

| | | | |
|-----|---|---|--|
| 1.1 | No. of sector searches reported | = | 382 |
| 1.2 | No. of successful sector searches | = | 290 (76%) |
| 1.3 | No. of sightings reported | = | 476 |
| 1.4 | No. of multiple sightings (ie more than one whale shark in a sector) | = | 99 (26%) |
| 1.5 | Vessel in contact | = | 180 of 476 sightings = 38% |
| 1.6 | Days no sharks seen | = | 2 out of 45 days for which returns provided. |

Comment:

It is noteworthy that overall pilots had 76% success in finding whale sharks in each sector and there were only two days reported when no whale sharks were seen. It is also noteworthy that pilots reported a 1 in 4 chance of sighting more than one whale shark in a sector.

2.0 SECTOR PREFERENCE

| Sector | (a) Shark Sightings | (b) Times Searched | (c) Successful Searches | c/b Success (%) Rate |
|--------|------------------------|-----------------------|----------------------------|-------------------------|
| 1 | 2 | 8 | 2 | 25 |
| 2 | 32 | 37 | 25 | 68 |
| 3 | 91 | 72 | 55 | 76 |
| 4 | 151 | 101 | 85 | 84 |
| 5 | 114 | 80 | 64 | 80 |
| 6 | 52 | 51 | 31 | 61 |
| 7 | 34 | 33 | 27 | 81 |
| ALL | 476 | 382 | 289 | 75.7 |

Comment:

While the search effort was definitely focussed on sectors 4, 5, 3 and 6, the highest success rates were also recorded for sectors 4, 5 and 3, indicating whale sharks may spend more time in these blocks. Perhaps surprisingly sector 7 also had a high success rate.

3.0 PROXIMITY TO REEF

Records of whale shark sightings, sorted by zones

| | Inshore | Central | Offshore | Total |
|----|---------|---------|----------|-------|
| No | 411 | 63 | 3 | 477 |
| % | 86 | 13 | 1 | 100 |

Comment:

It is clear that the vast majority of all sharks sighted were within 1km of the reef. On these results it is really not worth searching the off-shore portion of each sector.

4.0 MULTIPLE SIGHTINGS

The following table summarises data on situations where more than one whale shark was sighted in a sector.

Nº. of Whale Sharks In Sector

| Sector | 2x | 3x | 4x | 5x | 6x | 7x | All | Times Searched | Multiple Sighting % |
|--------|-----|-----|----|----|----|----|-----|----------------|---------------------|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 |
| 2 | 5 | 1 | 0 | 0 | 0 | 0 | 6 | 37 | 16 |
| 3 | 6 | *6 | 4 | 0 | 0 | 1 | 17 | 72 | 24 |
| 4 | *18 | *12 | 5 | 1 | 1 | 0 | 37 | 101 | 37 |
| 5 | *9 | 8 | 7 | 1 | 0 | 0 | 25 | 80 | 31 |
| 6 | *7 | *3 | 0 | *2 | 0 | 0 | 12 | 51 | 24 |
| 7 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 33 | 6 |
| ALL | 45 | 30 | 17 | 5 | 1 | 1 | 99 | 382 | 26 |

(NB: In inshore zones of each sector unless indicated by *, meaning 1 multiple sighting in central zone)

Comment:

Multiple sightings of whale sharks were most frequently detected in sectors 4 and 5, even taking account of the heavy search bias for these areas.

It is noteworthy that in 26% of all searches more than one whale shark was seen in a sector, thus while the vast majority of sightings are single whale sharks (74% of all cases), an average of 1 in 4 searches gave more than one whale shark in a zone. Also over 1 in 3 of all searches in Sector 4 showed there to be 2 or more whale sharks in that sector. Multiple sightings of 2 or 3 whale sharks were reported quite commonly, with sightings of larger numbers less frequent.

4.0 TIME OF DAY

Success rate (i.e. sighting of whale sharks) as a proportion of searches.

| Time | (a) No of Searches | (b) No of Sightings | (c) No Successful | % c/a Success/Search |
|------------|--------------------------|---------------------------|-------------------------|----------------------------|
| 0900-1000 | 82 | 102 | 64 | 78 |
| 1001-1100 | 128 | 140 | 96 | 75 |
| 1101-1200 | 82 | 115 | 68 | 83 |
| 1201-1300 | 47 | 63 | 35 | 75 |
| 1301-1400 | 34 | 43 | 22 | 65 |
| 1401-1500 | 9 | 5 | 5 | 56 |
| ALL | 382 | 468 | 290 | 76 |

Comments:

The higher number of sightings in the 1000 to 1100 how is accounted for by the larger number of searches at that time. The success rate (success/search) is fairly constant at around 75-80% in the am, indicating equal chance of finding whale sharks at any am hour.

5.0 DATE OF SIGHTING

| Week | No Seen | Sectors Seen In | Unsuccessful Sectors | Total Searches | % Success |
|-----------------|------------|--------------------|-------------------------|-------------------|-----------|
| a) 14-20/3 | 40 | 29 | 13 | 42 | 69 |
| b) 21-27/3 | 81 | 61 | 15 | 76 | 80 |
| c) 28/3 to 3/4 | 144 | 75 | 10 | 85 | 88 |
| d) 4/4 to 10/4 | 36 | 28 | 27 | 55 | 50 |
| e) 11/4 to 17/4 | 64 | 42 | 24 | 66 | 63 |
| f) 18/4 to 24/4 | 99 | 45 | 0 | 45 | 100 |
| g) 25/4 to 28/4 | 11 | 4 | 3 | 7 | 57 |
| ALL | 475 | 284 | 92 | 376 | 76 |

Comments:

The success rate was broadly similar for each week, with, if anything a decline around the time of the first coral spawning of around 4 April.

6.0 SHARK DIRECTION OF TRAVEL

| Direction of Travel | No of Sightings | % of Sightings |
|---------------------|-----------------|----------------|
| E | 8 | 2 |
| N | 141 | 29 |
| N/E | 2 | 0.5 |
| S | 272 | 57 |
| SE | 6 | 1.0 |
| SW | 5 | 9.5 |
| W | 5 | 1.0 |
| ALL | 479 | 100 |

Comments:

As expected whale sharks are travelling along the reef. A clear majority however, were spotted travelling south along the reef, with the second highest frequency being northwards.

7.0 SHARK SIZE

| Total Length (estimated) | No of Sightings | % |
|--------------------------|-----------------|------------|
| 4.0 - 5.9m | 18 | 29 |
| 6.0 to 7.9m | 16 | 26 |
| 8.0m and longer | 28 | 45 |
| ALL | 62 | 100 |

Comments:

The majority of sightings reported were of whale sharks 8 - 10 metres in length.

8.0 MINIMUM NUMBER OF INDIVIDUAL SHARKS SEEN PER DAY

The number of whale sharks actually in the reef area each day is of interest to all involved in whale shark watching and management. The data collected from aerial returns in 1993 did not cover all sectors every day and so did not provide the exact number of whale sharks using the park each day. It was however possible to calculate, considering reported positions, times and directions of travel the minimum number of sharks seen per day (i.e. at least 'X' sharks were there on day 'Y'). This should be an underestimate of the actual number of sharks that were active on each day.

Individual sharks seen per day

| Date | N ^o . Sharks | Date | N ^o . Sharks | Date | N ^o . Sharks |
|-------|-------------------------|------|-------------------------|------|-------------------------|
| 14/3 | 2 | 30/3 | 10 | 14/4 | 2 |
| 16/3 | 3 | 31/3 | 6 | 15/4 | 4 |
| 17/3 | 5 | 1/4 | 4 | 16/4 | 3 |
| 18/3 | 5 | 2/4 | 5 | 17/4 | 2 |
| 19/3 | 1 | 3/4 | 5 | 18/4 | 2 |
| 20/3 | 3 | 4/4 | 4 | 19/4 | 4 |
| 21/3 | 2 | 5/4 | 2 | 20/4 | 4 |
| 22/3 | 1 | 6/4 | 1 | 21/4 | 4 |
| 23/3 | 2 | 7/4 | 1 | 22/4 | 7 |
| 24/3 | 4 | 8/4 | 2 | 23/4 | 6 |
| 25/3 | 7 | 9/4 | 1 | 24/4 | 3 |
| 26/3 | 5 | 10/4 | 4 | 25/4 | 1 |
| 27/3 | 6 | 11/4 | 4 | 26/4 | 4 |
| 28/3/ | 4 | 12/4 | 2 | 27/4 | 0 |
| 29/3 | 4 | 13/4 | 1 | 28/4 | 0 |

Comments:

- Only two days reported with no whale sharks.
- Average minimum of 3.37 per day.
- Maximum sighting of 10 reported here, but larger numbers reported by boats.

B. BOAT RETURNS**1.0 BASIC STATISTICS.**

| | | |
|-----|--|-------|
| 1.1 | Total numbers of records returned | =421 |
| 1.2 | N ^o . of whale shark encounters reported | =348 |
| 1.3 | N ^o of days whale sharks encountered | = 58 |
| 1.4 | Days reported when no whale sharks encountered by any boats | = 0 |
| 1.5 | Boat days reported = 197 over 58 days, (average of 4 boats per day). | |
| 1.6 | Average N ^o of encounters per boat per day | =1.93 |

Comments:

Boat data has been analysed on an 'encounters' basis, i.e. whale shark encounters reported by boat skippers. An encounter is a sighting where diving was at least considered and basic data on the whale shark was provided. It is noteworthy that while individual boats reported days when they didn't encounter any sharks, on each of these days at least one boat did encounter a whale shark (as reported to CALM).

2.0 SECTOR PREFERENCE.

| Sector | Whale Shark encounters reported | % |
|--------|---------------------------------|-----|
| 1 | 7 | 2 |
| 2 | 70 | 20 |
| 3 | 85 | 25 |
| 4 | 92 | 26 |
| 5 | 43 | 12 |
| 6 | 37 | 11 |
| 7 | 14 | 4 |
| ALL | 348 | 100 |

Comments:

There is a clear bias in the above table towards encounters in sectors 2, 3 and 4, due to the easy access from Tan biddi. The aerial search data has, however, indicated that sectors 5, 6 and 7 would, on average, hold similar numbers of whale sharks.

3.0 SEX OF WHALE SHARKS.

Of 421 reports, 222 sexed (53%)

| Sex | Reports | % |
|--------|---------|----|
| Male | 190 | 86 |
| Female | 32 | 14 |

Comments:

The 222 reports relating to sex cover an unknown number of whale sharks. As we do not know the number of individual sharks involved and if any of the sharks spend longer times at the reef than others, these figures must be considered with caution. You can however indicate to divers that they will be most likely to encounter a male whale shark.

4.0 SIZE OF WHALE SHARKS.

| Length | Reports | % |
|---------------|---------|------|
| <4.0m | 14 | 4.7 |
| 4.0 to 5.99 | 48 | 15.8 |
| 6.0 to 7.99 | 141 | 46.5 |
| 8.0 to 9.99 | 71 | 23.4 |
| 10.0 to 11.99 | 25 | 8.3 |
| >12.0m | 4 | 1.3 |
| All | 303 | 100 |

Comments:

Again, we do not know how many individual sharks these figures relate to. You can, however, indicate to divers that they are most likely to encounter a shark in the 6-8m length category.

5.0 TIME OF DAY OF ENCOUNTERS

| Time | Encounters Reported | % |
|-----------|---------------------|------|
| 0900-1000 | 68 | 18.3 |
| 1001-1100 | 109 | 29.3 |
| 1101-1200 | 88 | 23.7 |
| 1201-1300 | 61 | 16.4 |
| 1301-1400 | 34 | 9.1 |
| 1401-1500 | 12 | 3.2 |
| ALL | 372 | |

Comments:

Again, there is a bias due most boats being on the water by around 10am. As aerial data indicated similar numbers of whale sharks available for interaction at all morning hours the encounter data shows most impact on whale sharks is limited to a relatively short time period.

6.0 DATE OF ENCOUNTER

| Week | Encounters Reported | % |
|------------|---------------------|------------|
| 28/2-6/3 | 7 | 1.7 |
| 7-13/3 | 0 | 0 |
| 14-20/3 | 18 | 4.4 |
| 21-27/3 | 71 | 17.2 |
| 28/3-3/4 | 125 | 30.3 |
| 4/4-10/4 | 44 | 10.6 |
| 11/4-17/4 | 52 | 12.6 |
| 18/4-24/4 | 38 | 9.2 |
| 25/4-1/5 | 28 | 6.8 |
| 2/5-8/5 | 27 | 6.5 |
| 9/5-15/5 | 3 | 0.7 |
| ALL | 413 | 100 |

Comments:

Most encounters (and likely most effort) reported for the week 28 March to 3 April, some 2 weeks after the first coral spawning. The average daily sighting from aircraft for this week was 5.4, higher than the overall average of 73.3 per day. The drop-off in number of encounters in the week 4 to 10 April is mirrored by the lower sighting success rate by aircraft for that week.

7.0 WIND DIRECTION

| Direction | Records | % |
|------------|------------|------------|
| E | 7 | 2.2 |
| NE | 11 | 3.5 |
| N | 5 | 1.5 |
| SE | 51 | 16.1 |
| SSE | 5 | 1.5 |
| S | 10 | 3.2 |
| SW | 146 | *46.2 |
| SSW | 73 | 23.1 |
| WSW | 3 | 0.9 |
| W | 5 | 1.5 |
| NW | 1 | 0.3 |
| ALL | 316 | 100 |

Comments:

No surprises - prevailing wind SW.

8.0 FIN, TAIL AND BODY MARKS

| Marks | Reported |
|-------|----------|
| Fin | 23 |
| Tail | 23 |
| Body | 36 |

Comments:

Unfortunately there were few reports of scars and marks on the boat returns last year, although we did get some very detailed drawings, descriptions and good photos. It would be highly advantageous if skippers could report whether sharks have scars, marks etc or not, in 1994.