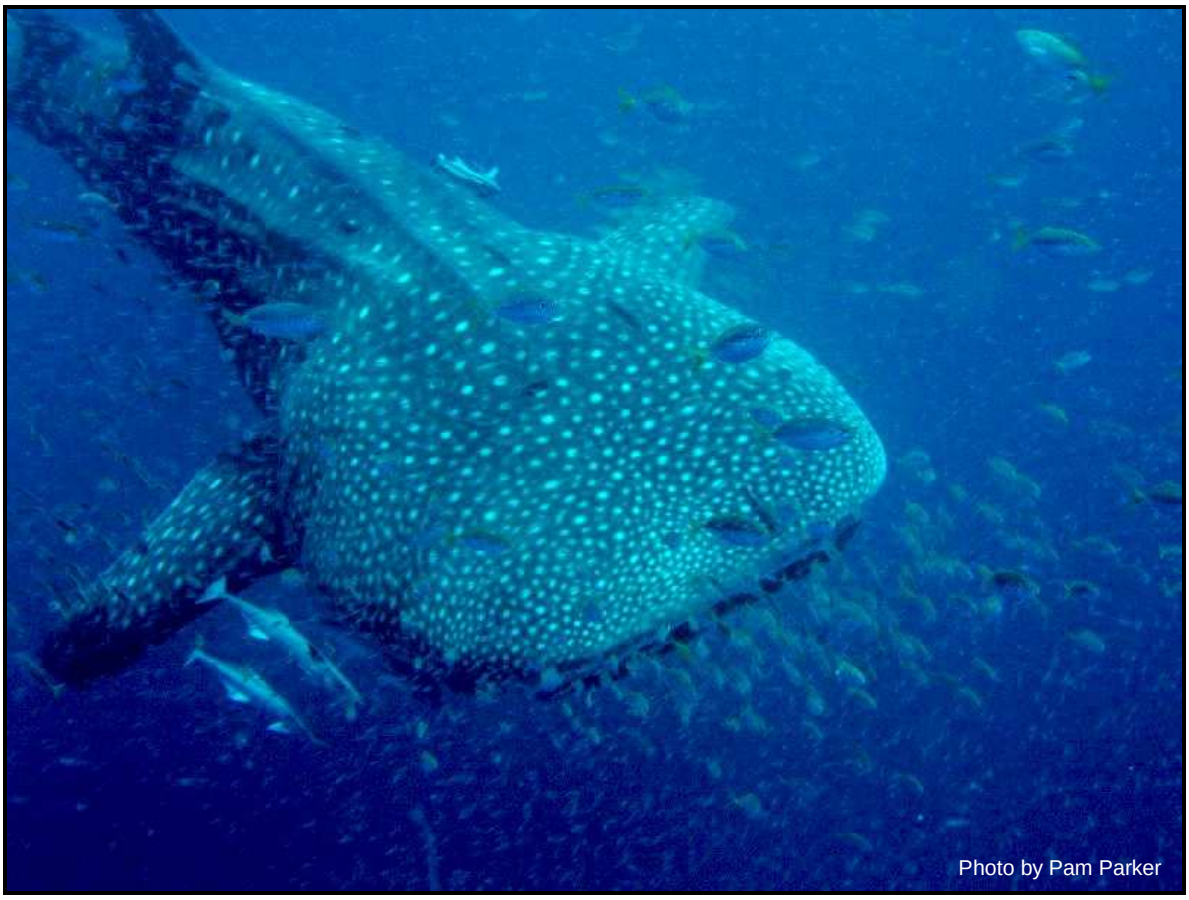
Wildlife Management Program No.27 Progress Report

Whale Shark Interaction Management Ningaloo Marine Park



Progress Report: 2004 Whale Shark Season

Department of Conservation and Land Management

Preface

The Western Australian Department of Conservation and Land Management (CALM) has a legislative responsibility to manage wildlife on CALM managed lands under the CALM Act 1987, and to manage fauna for conservation State-wide under the Wildlife Conservation Act 1950. The Department also has a recreation policy, the objective of which is to facilitate enjoyment of the natural attributes of public lands and reserved waters in a manner that does not compromise conservation and other management objectives. Management of whale shark interactions in marine reserves requires an integration of CALM's conservation and recreation objectives, and the principal role of CALM in this respect is to manage the commercial and recreational activities of visitors.

The Whale Shark Management Interaction Program 1987 – 2007 (Wildlife Management Program 27) has been approved by the Executive Director, Department of Conservation and Land Management, the Marine Parks and Reserves Authority and the Minister for the Environment. Approved Wildlife Management Programs are subject to modifications as directed by new findings, changes in the status of the species and completion of management actions.

Acknowledgements

The advances achieved in whale shark conservation and management are only possible through team effort. It is therefore essential to thank everybody that has dealt with whale sharks at whatever level for their contribution. Specifically, it is the effort beyond the minimum required which allows us to move forward in strides. With this in mind special thanks go to the whale shark industry staff, North-West Air works and pilots, CALM Wildlife Officer's Doug Coughran, Peter Lambert and George Watson, CALM volunteers Rena Koufakis, Emily Watson, Jessica Kittsin and David McKinney; the motivated Allison Richards; Brad Norman and Jason Holmberg for their commitment to the Ecocean Whale Shark Photo-id Library; and to the many researchers who continue to find an interest in this gypsy of the sea.

Citation:

Mau, R., Fitzpatrick, B. and Chindemi, M. (2004). *Whale shark Interaction Management: Progress Report 2004*. Progress report for the Department of Conservation and Land Management Wildlife Management Program No. 27.

Table of Contents

Table of Figures

List of Tables

List of Attachments

Executive Summary

In 2004 there were a total of 15 whale shark licenses issued, 12 for operations based at Tandabiddi and three based at Coral Bay. A total of 408 day trips were conducted. There was a 7% reduction in paying participants from the 2003 all time peak. The average number of passengers per tour dropped from 14.6 in 2003 to 13.9 which is still well above the 10.6 average from 1996. Overall, the average duration of a whale shark experience trip has increased by nearly 2 hours since 1996.

Approximately 5000 'Experiencing Whale Sharks in Ningaloo Marine Park' brochures were distributed to the public during the 2004 whale shark season. CALM sponsored a reprint of the popular Whale Shark Public Awareness Brochure initially produced under a NHT grant. A series of posters were produced for public display such as the annual whale shark festival held in Exmouth. Two news print stories were released locally in relation to whale sharks.

The Whale Shark Interaction Logbook completed by operators is an important component for the monitoring of whale shark and swimmer interaction. The total number of whale shark contacts made during tours has reduced by around 27% from 1996 to 2004 even though there has been an increase in the number of tours in that period by nearly 60%. This apparent reduction in whale shark availability for contact is further supported by the reduction in average number of interactions per tour of 2.57 to 1.2 interactions per tour.

At first glance this may indicate that whale sharks are not as abundant or available for interaction today as nine seasons ago. However, what is not reflected in this figure is the level of effort from spotter planes. During the 1990s, there were usually a large number of planes used daily each season. In more recent years, cooperation of operators has seen increased levels of sharing of spotter planes (as well as whale sharks for interactions). It is therefore important to consider the unit search effort each season (e.g. flying hours of spotter planes) when assessing possible causes for reductions in interactions. Furthermore, the data analysed here is from the paying season only (now 1 April to 30 May). However, whale shark interactions occur outside the paying season both before and after this period.

Due to changes in industry practices, the actual time spent by swimmers with whale shark per contact has reduced considerably since 1996 with the most pronounced drop from 2001 to 2002 from 30 minutes to 8 minutes with no significant change in the average number of swimmers per contact. The implications of this practice on visitor satisfaction of the whale shark experience have not been formally examined.

Clear trends become apparent when the logbook data for direction of travel of whale sharks is plotted and compared across years. There is a very strong trend for direction of travel along the north-south gradient with a greater northward bound favour.

The ratio of sharks sighted in relation to the number of spotter plane hours flown (i.e. search effort) was calculated to determine the search effort per sighting. Over the three years of data available, an analysis showed an inter-seasonal trend of reduced search effort (full season) per shark sighted from 2002 to 2004. Anecdotal reports that whale shark numbers are declining is not supported by an analysis of the aerial spotter plane data for the last three years.

CALM made a significant financial contribution from the whale shark levy to allow a continuation of a collaborative study documenting the movements and behaviour of whale sharks that aggregate seasonally at Ningaloo Reef. 15 pop-up archival satellite transmitter tags were deployed in the vicinity of Black Rock and Norwegian Bay in May.

Following a well publicised whale shark that was recorded with very large and fresh shark bites, the individual shark was re-sighted by a keen whale shark tour guide. The two main points from this observation were that the whale shark clearly returned to (or stayed in) Ningaloo waters over two seasons and that whale sharks have a good ability to recover from significant tissue damage.

The 2004 Season has seen the strongest indication yet that the use of the whale shark spot patterns may become an effective way to establish estimates on whale shark numbers, their migration patterns, and morphological changes of individuals over time. The ECOCEAN Whale Shark PhotoID Library provided a central data base that is readily accessible by everybody in the international community and hence may provide a linkage between sightings around the globe.

The whale shark experience has been labelled a “high quality” experience following social surveys in 1996. Since those days, participation numbers have increased by 150% from around 2000 to 5000 passengers. Yet, the actual passenger capacity does not appear to be anywhere near the potential maximum capacity of the existing licensing regime. These tends over the last 10 years combined with experiential knowledge of participants from previous research, suggests that current trends may affect the high quality experiences which visitors enjoy in future.

CALM continued with its operational program which is a combination of boat ramp inspections, boat patrols, industry vessel placement, and aerial surveillance. The CALM Exmouth District Office was supported by visiting Wildlife Officers. There were several incidents which required further investigation and follow up during the 2004 season. One significant issue that will require further follow up is to clear up the license condition relating to the long established practise of queuing and handballing of vessels.

Summary of Recommendations:

Recommendation 1: Season logbooks need to be modified to enable recording to which vessel a whale shark was hand-balled.

Recommendation 2: That a post-graduate student project be prepared to investigate the application and limits of aerial survey data for research and monitoring of whale shark populations at Ningaloo.

Recommendation 3: That CALM request a detailed project brief detailing how information collected to date will be used to meet objectives, the benefits of additional data collection of the same nature, and the future extent of the project before any further funding support is approved.

Recommendation 4: That the CALM Management Team promote the Ecocean Whale Shark Photo-id Library and request all other relevant projects to incorporate their captured images into this database.

Recommendation 5: That CALM support a post-graduate research study into experiential aspects of the whale shark experience in relation to the existing management framework.

Recommendation 6: That CALM consider an appraisal project of the whale shark industry to be conducted through the CRC for Sustainable Tourism.

Recommendation 7: That whale shark license conditions be changed to reflect the “queuing” of a second vessel before contact by allowing the first-in-queue vessel to encroach within the exclusive contact zone for the purpose of handballing only.

Recommendation 8: That all skippers and staff are briefed by CALM personnel about how to complete logbooks and returned logsheets are especially carefully scrutinised following the first two weeks of the season.

1 INTRODUCTION

1.1 Background

The Western Australian Department of Conservation and Land Management (CALM) Wildlife Management Program for whale shark interaction provides a statement of the administrative, compliance auditing and research and monitoring measures to be followed to ensure that human-whale shark interactions in Ningaloo Marine Park are a sustainable activity that assists CALM in meeting both its conservation and recreation objectives.

CALM has several specific objectives in relation to management of whale shark interactions in marine reserves. These are:

1. to conserve whale shark populations by ensuring that individual sharks, or the group as a whole, are not being subjected to an unacceptable level of disturbance;
2. to facilitate the development of ecologically sustainable whale shark tourism in marine reserves;
3. to facilitate safe interaction between people and whale sharks by allowing reasonable access within an appropriate 'duty of care';
4. to raise public awareness and appreciation of whale sharks and broader marine conservation issues;
5. to develop and implement a management framework that provides equitable opportunities for commercial operators to deliver a quality experience;
6. to ensure that whale shark interaction does not adversely impact on other values and users of marine reserves; and
7. to recoup the costs of managing the interaction, whenever possible and appropriate, from the commercial operators, according to the 'user pays' principle.

1.2 Overview

Under the Whale Shark Interaction Management Program, the CALM Management Team is responsible for the implementation and review of the program. In terms of reporting requirements, the terms of reference of the Management Team are:

- to assess monitoring results;
- to make recommendations on further research and monitoring;
- to evaluate whether objectives were met; and
- to evaluate the overall cost-effectiveness of the program.

In order to meet these objectives, an annual progress report is prepared by the Exmouth District for review by the CALM Management Team. The report is divided into several sections namely: Administration – which includes commercial tourism operations licensing and industry logbook assessment; education; research and monitoring; and management, including operations and issues and actions that require further consideration or follow up.

2 ADMINISTRATION

2.1 Commercial tourism operators

In 2004 there were a total of 15 whale shark licenses issued, 12 for operations based at Tandabiddi and three based at Coral Bay. One license became available in late 2003 following a CALM audit of operators compliance with licensing conditions. An expression-of-interest (EOI) process was conducted and the 15th license was issued in May 2004. Due to the licensing condition audit, there was an overall increase in the total number of licensee's active throughout the season. This can be seen in Figure 1, where the 2004 season is the only period where all licenses have had some level of use (based on numbers of tours).

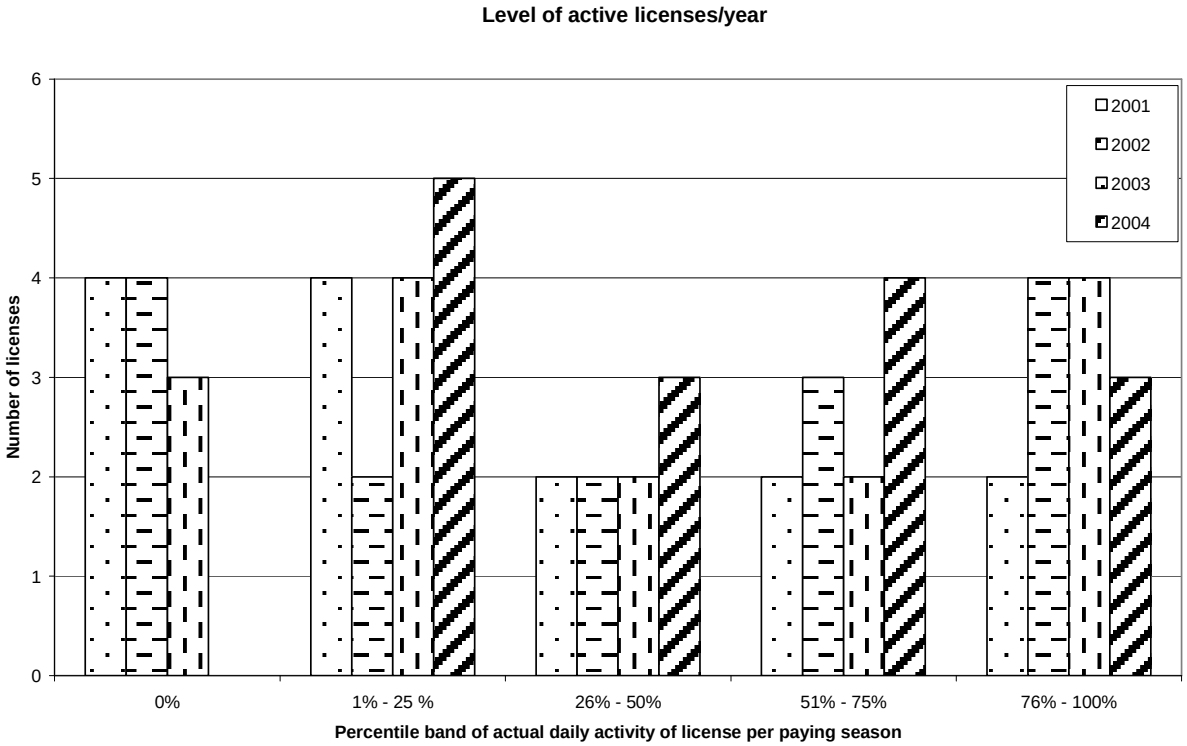


Figure 1: Comparison of the extent of daily use of all issued licenses over the paying season

The CALM Act licences for whale shark interaction tours expired at the end of 2003. As this was the end of the first licence period, there was an option that, subject to consultation with the MPRA and the approval of the Minister, to roll all licences over for up to five years without the need for calling an EOI. Fourteen operators have had their licenses renewed for a period of five years based on their satisfactory performance over the previous five years.

For the purposes of consistency and to reduce confusion, both the CALM Act and Wildlife Conservation Regulation 15 licenses are now issued at the same time for the same period of time (i.e. annual or for 5 years, depending on circumstances).

The actual number of tours conducted by all licensees in 2004 has increased by 2% with a 7% reduction in the number of tours with contact (Figure 2). This is further reflected in the whale shark contact success rate (Figure 3) which has dropped nearly 10% from the previous two seasons. This trend has been observed previously in 1998 and 2001.

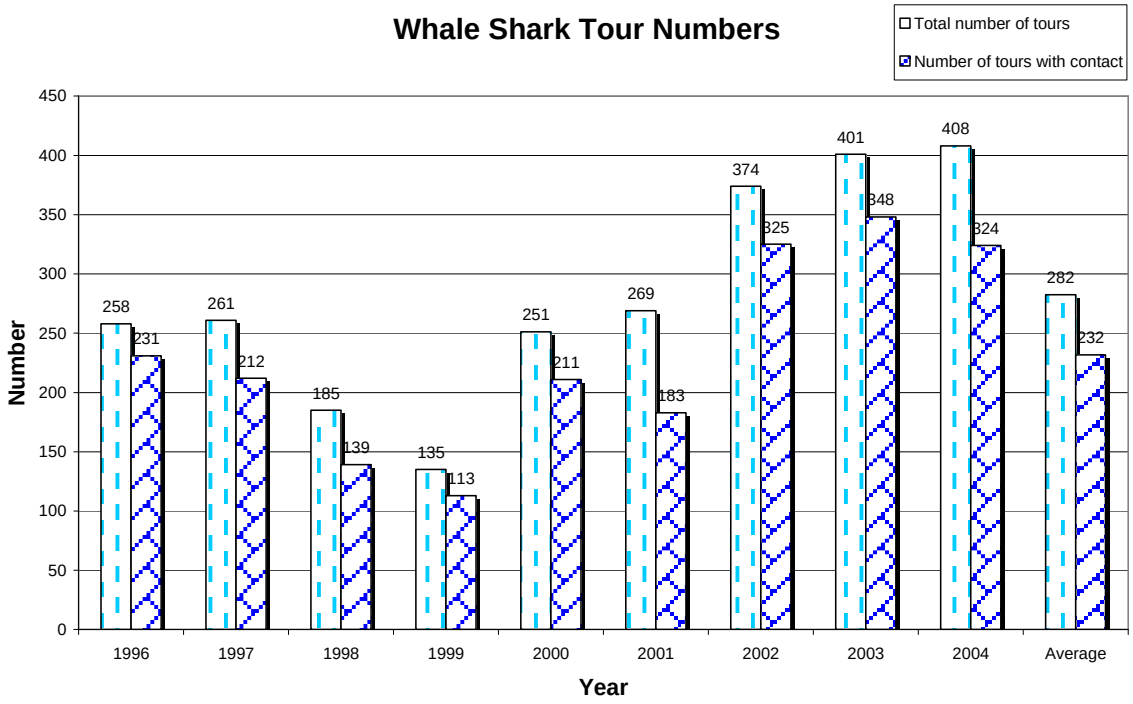


Figure 2: Comparison of whale shark tour numbers with and without whale shark contacts from 1996 to 2004

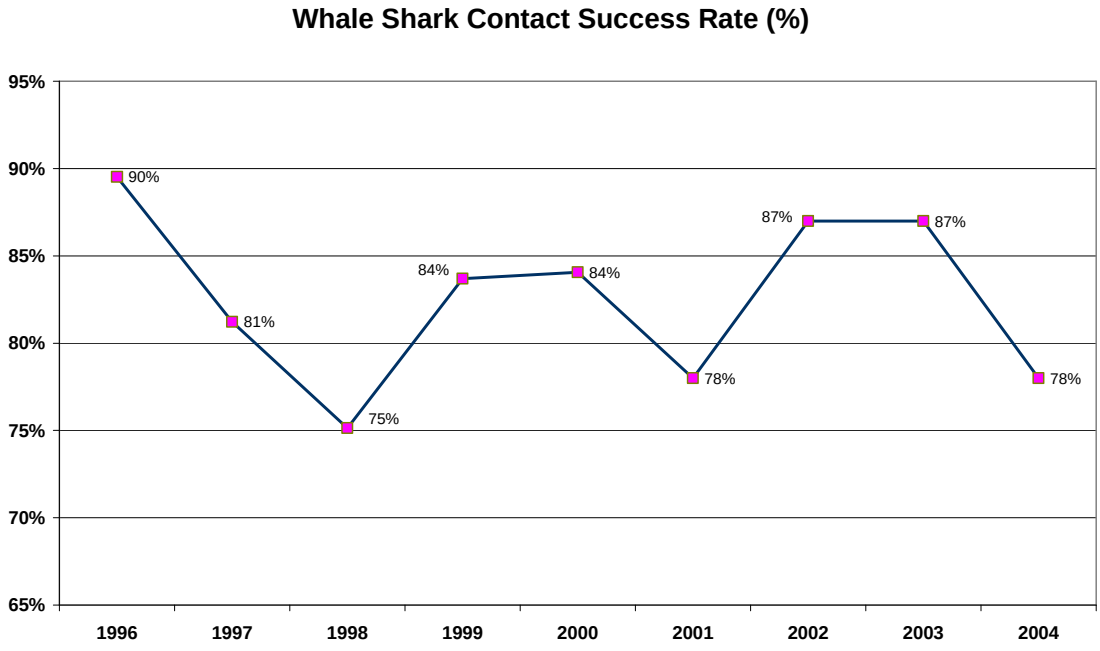


Figure 3: Whale shark contact success rate based on total trips with and without interactions

2.2 Passenger levels

Overall participation in the Ningaloo whale shark experience has been steadily on the increase since licenses were introduced in 1993 (Coleman 1997; Figure 4). A reduction in numbers in 1999 could be attributed to the impact of severe tropical Cyclone Vance which hit Exmouth in March 22. Participation numbers have more than doubled in nine years from 1996 to 2004. In 2004 there was a 7% reduction in paying participants from the 2003 peak.

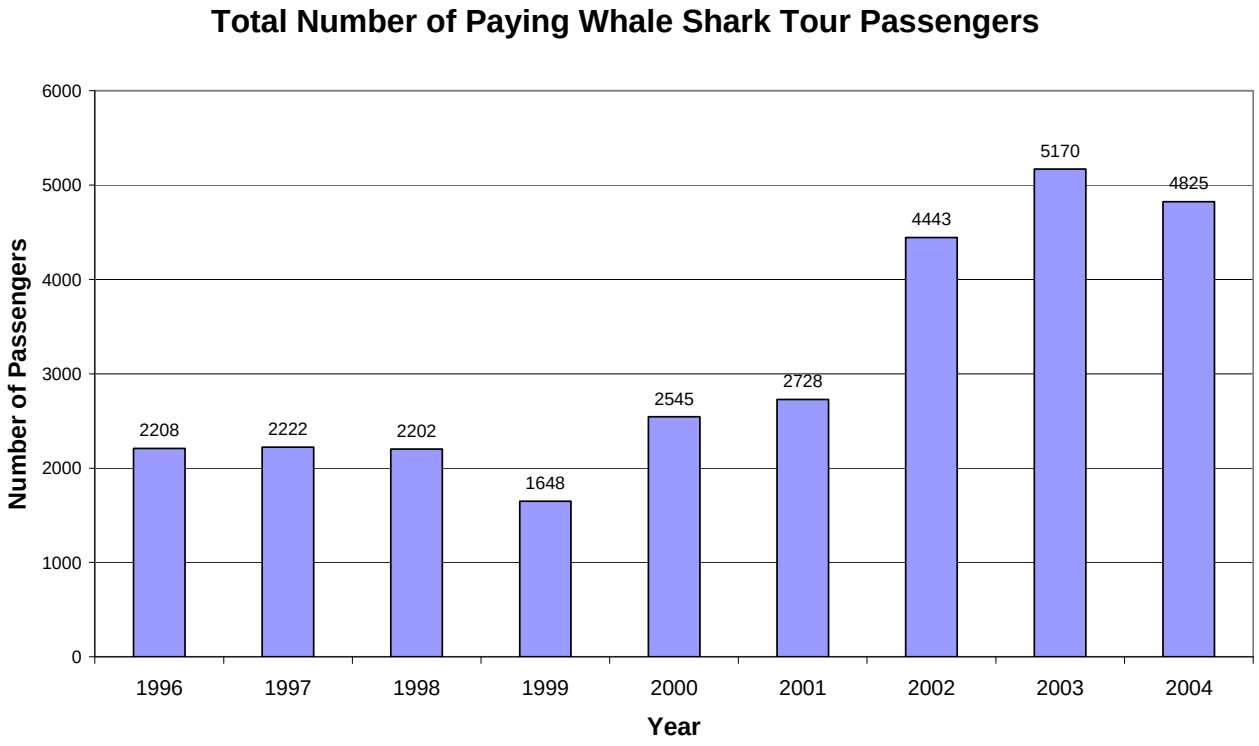


Figure 4: Total number of paying passengers participating in the Ningaloo Whale shark experience from 1996 to 2004

Based on the reduced whale shark contact success rate in 2004 (Figure 3), there was a marked increase in the number of Free-Of-Charge (FOC) passengers (i.e. passengers that are on repeat trips due to the “no show, another go” operators policy) which lifted the actual number of passengers participating in whale shark tours in 2004 by over 17% to 5667 persons (made up of both adults and children).

The average number of passengers per tour dropped from 14.6 in 2003 to 13.9 in 2004 which is still well above the 10.6 average from 1996 (Figure 5). However, it indicates that there was on average a slight reduction in actual participation levels from last seasons all time peak.

The average duration of a whale shark experience trip has dropped by only 9 minutes from last years maximum of 7 hours down to 6 hours and 51 minutes in 2004 (Figure 6). Overall,

the average duration of a whale shark experience trip has increased by nearly 2 hours since 1996. The location of all reported whale shark interactions is shown in Figure 7.

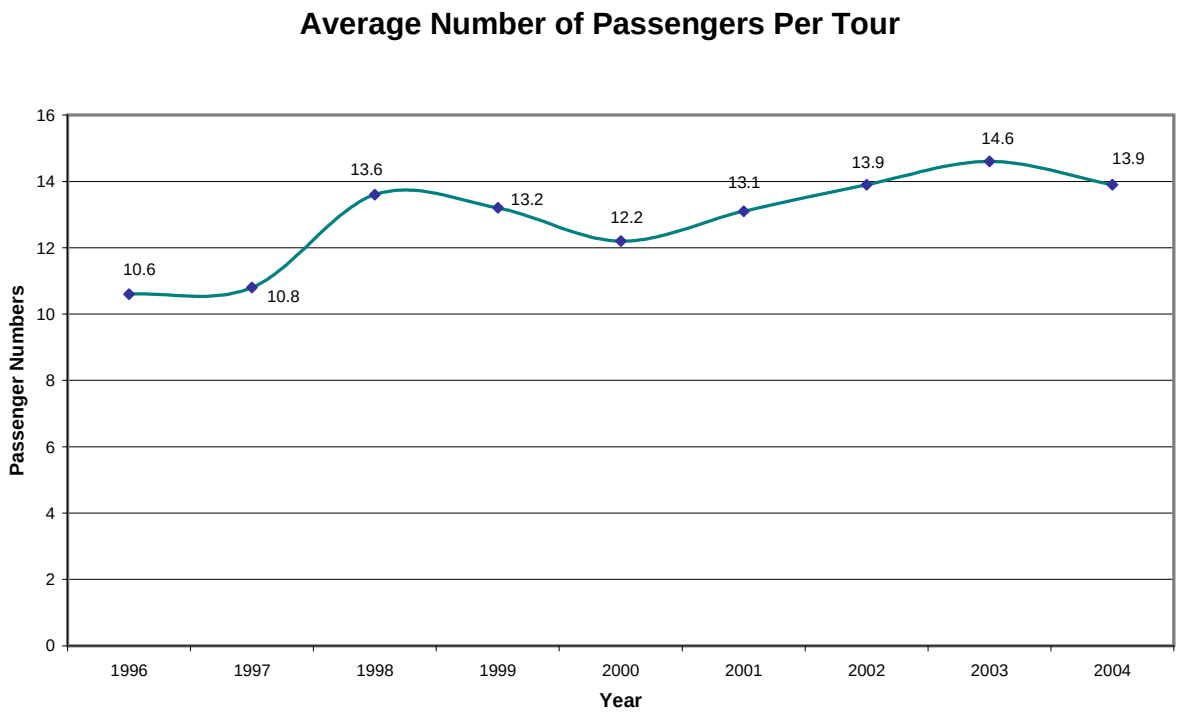


Figure 5: Average number of passengers per tour from 1996 to 2004

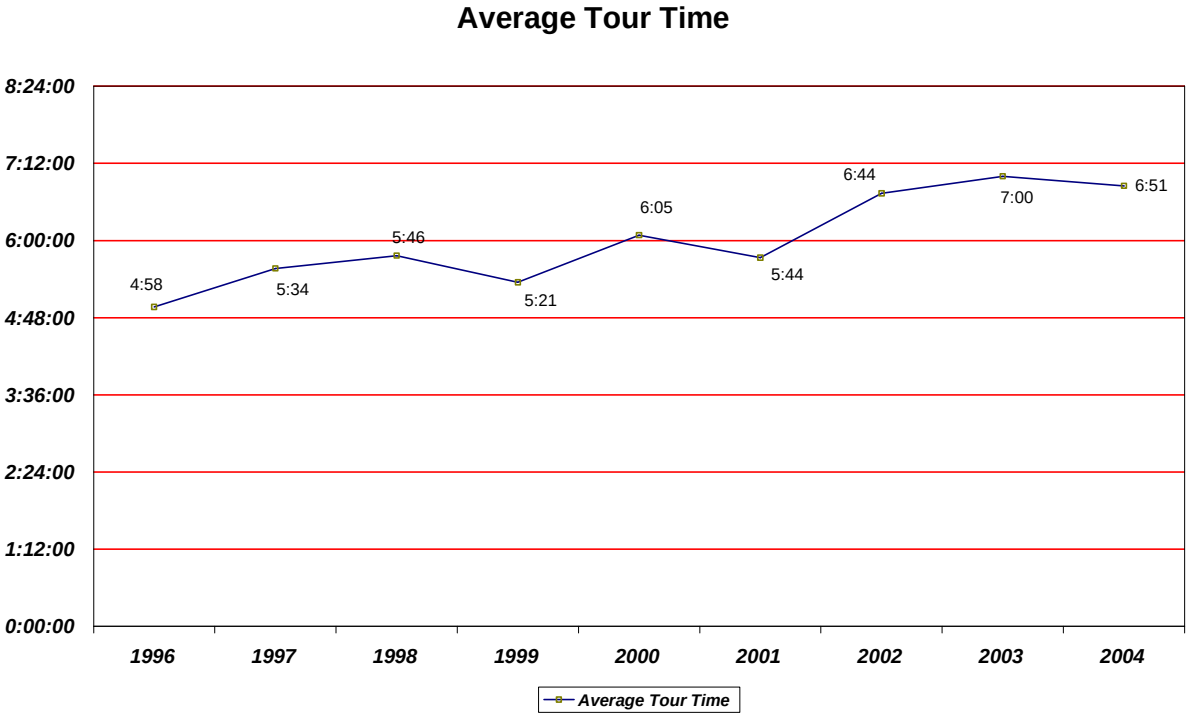


Figure 6: Average whale shark experience tour time from 1996 to 2004

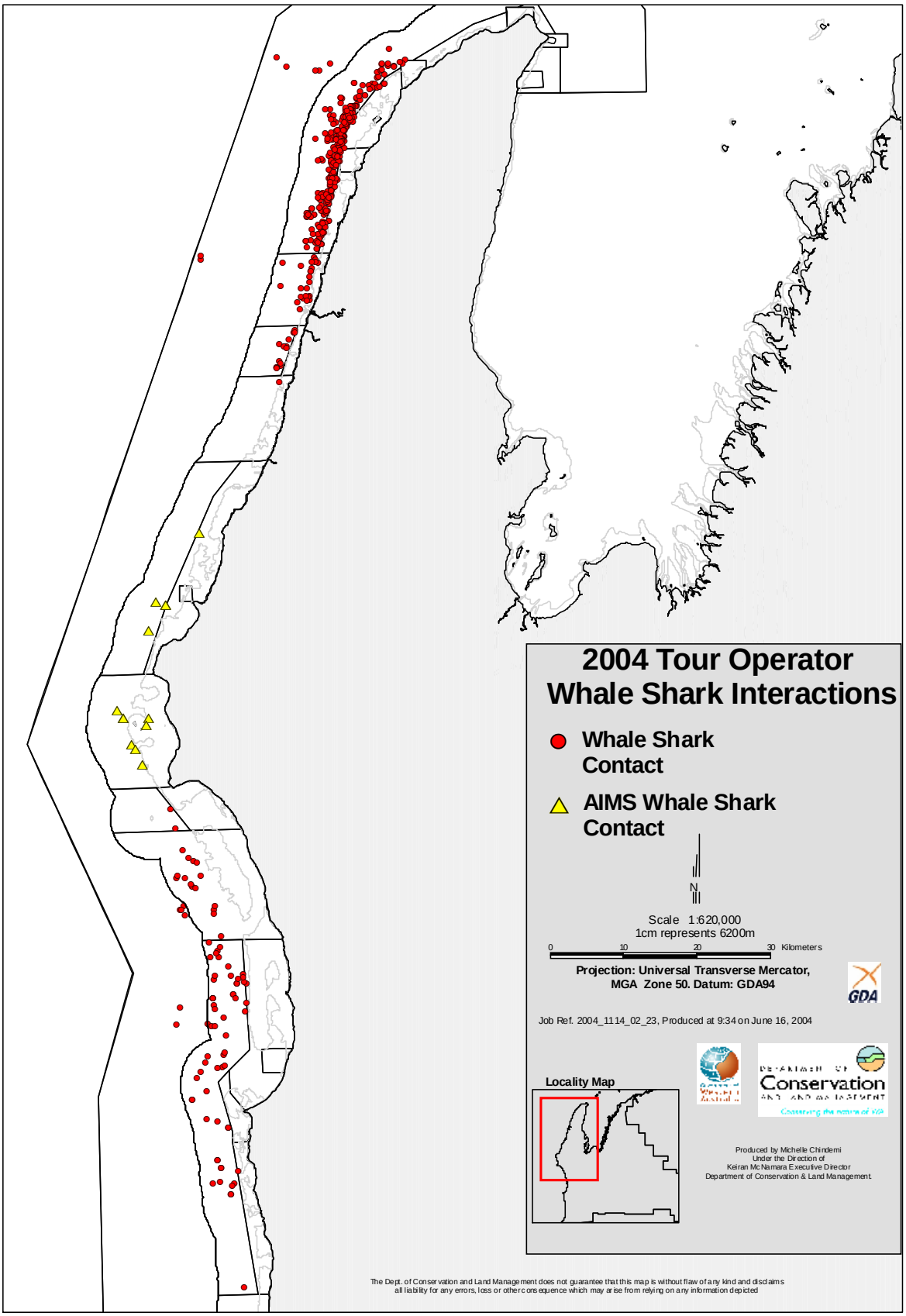


Figure 7: Location of reported whale shark interactions for the 2004 season

3 EDUCATION

CALM considers education as a primary strategy to ensure that visitors and stakeholders have a good understanding of the conservation and management issues associated with whale sharks. CALM recognises that stakeholders are an integral component in the education of visitors and is thus keen to support and promote relevant initiatives whenever possible.

3.1 Print media

Approximately 5000 'Experiencing Whale Sharks in Ningaloo Marine Park' brochures were distributed to the public during the 2004 whale shark season. This brochure provides those interacting with whale sharks a summary of whale shark biology and conservation together with an outline of the interaction code of conduct.

30 laminated whale shark code of Conduct Posters were distributed to whale shark licence holders for display on vessels and at shop fronts. Also 40 Whale Shark Experience posters were printed and distributed to operators and major tourist facilities and organisations.

CALM sponsored a reprint of the popular Whale Shark Public Awareness Brochure initially produced under a NHT grant. Approximately 2000 of these brochures were distributed to licenced tour operators for handout to the public late into the season. This 4-page A4 colour brochure provides a greater level of detail about whale shark biology and conservation. More importantly, it provides information to visitors on how they can assist in the research and management of whale sharks (Attachment C).

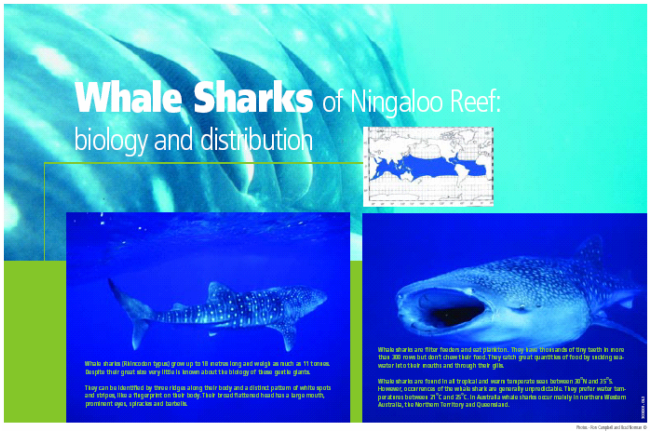
3.2 Presentations

Two whale shark specific talks were conducted at Milyering Visitors Centre during the Easter holidays. These talks were attended by approximately 50 people each and contained a brief summary of international, national and local whale shark information. The talks preceded a showing of the ABC Catalyst episode highlighting recent research undertaken at Ningaloo Reef.

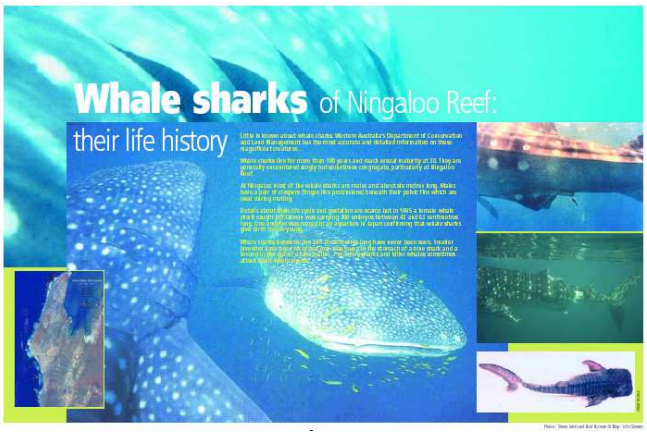
A series of posters were produced for public display such as the annual whale shark festival held in Exmouth (Figure 8). These posters contain up to date information on Whale Shark Biology and Distribution, Life History, the Unique Aggregation at Ningaloo Reef, Threats to their Population, Managing Interactions and Research. The posters will be used at the Milyering Visitor Centre and the Royal Show in Perth later in the year.

3.3 Media releases

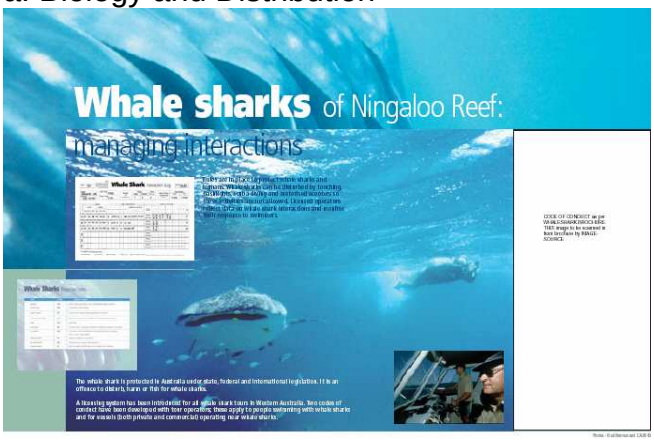
Two main stories were released locally in relation to whale sharks. One of these related to CALM volunteer Emily Watson who had previously conducted work with basking sharks in the UK and provided her perspective on the whale shark experience. The second related to the re-sighting of scarred whale shark which was recorded in the area only the previous year with the fresh wounds. Further reference to this event can be found in section 4.5.4.



a. Biology and Distribution

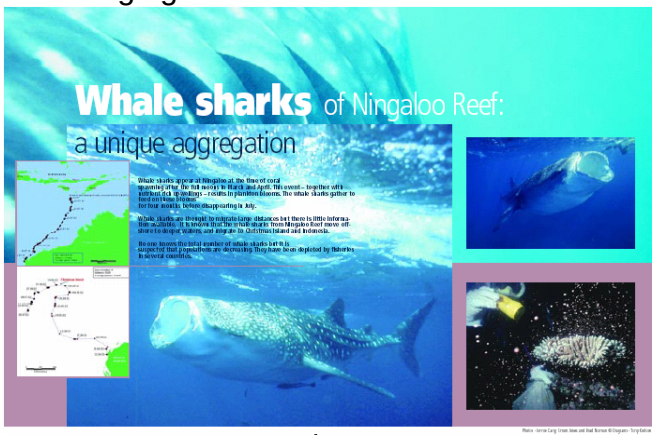


b. Life history

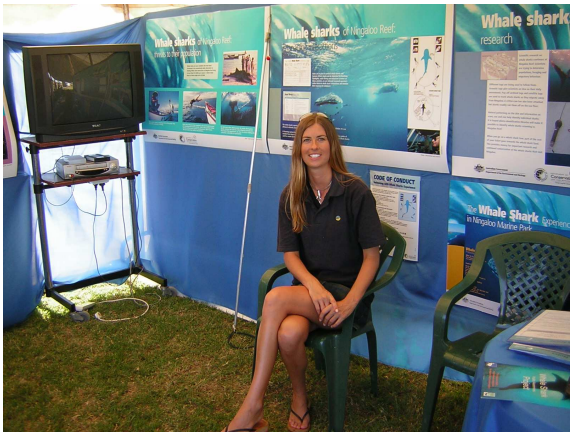


c. Managing Interactions

d. Research



e. Unique aggregation



First display at 2004 Whale shark Festival

Figure 8: New posters prepared for public education displays

3.4 Prompts

In order to give the general public a better reference in regards to the actual size of whale sharks, it was decided to commission a local Exmouth fibreglass artist to develop a wall-mountable “realistic” whale shark head-to-pectoral model. The work was first displayed at the Perth Royal show in October 2004.

4 RESEARCH AND MONITORING

4.1 Whale Shark Interaction Logbook Analysis

The Whale Shark Interaction Logbook completed by operators is an important component for the monitoring of whale shark and swimmer interaction. The Logbook was reviewed in 2002 to improve the quality and usefulness of the data (Chapman, 2002).

The total number of whale shark contacts made during tours has reduced by around 27% from 1996 to 2004 (Figure 9) even though there has been an increase in the number of tours in that period by nearly 60%. This apparent reduction in whale shark availability for contact is further supported by the reduction in average number of interactions per tour of 2.57 to 1.2 interactions per tour (Figure 10).

At first glance this appears to indicate that whale sharks are not as abundant or available for interaction today as nine seasons ago. However, what is not reflected in this figure is the level of effort from spotter planes. During the 1990s, there were usually a large number of planes used daily each season. In more recent years, cooperation of operators has seen increased levels of sharing of spotter planes (as well as whale sharks for interactions). It is therefore important to consider the unit search effort each season (e.g. flying hours of spotter planes) when assessing possible causes for reductions in interactions (section 4.2). Furthermore, the data analysed here is from the paying season only (now 1 April to 30 May). However, whale shark interactions occur outside the paying season both before and after this period. For instance, in 2003 whale shark interactions in June/July were well up to those in April/May indicating that the peak numbers do not necessarily occur at the same time period each season (see section 4.2 for further details).

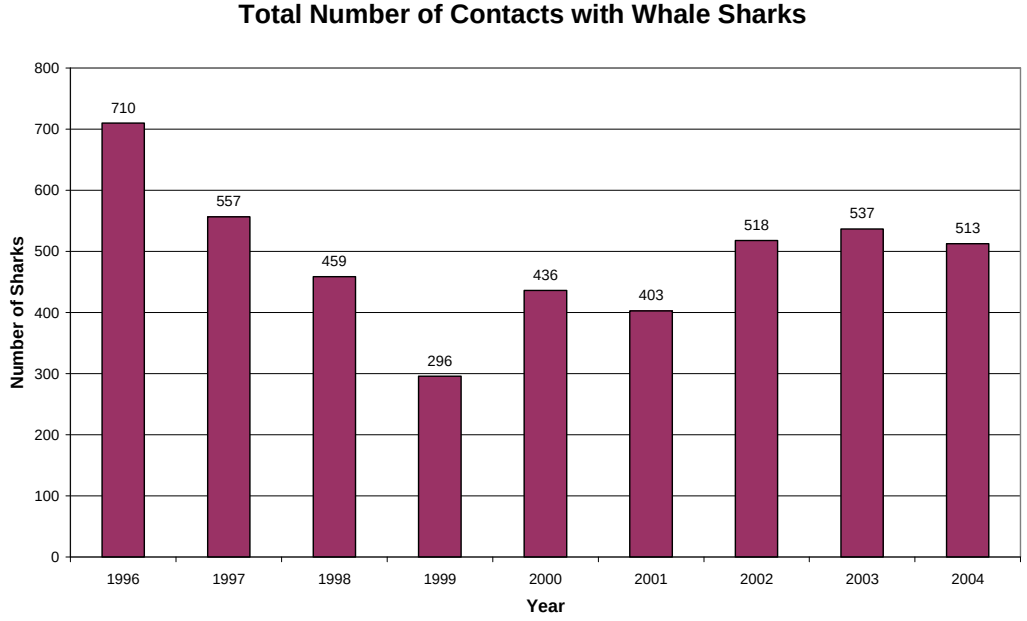


Figure 9: Total number of whale shark contacts during whale shark experience tours during the paying season from 1996 - 2004

The actual time spent by swimmers with whale shark per contact has reduced considerably since 1996 with the most pronounced drop from 2001 to 2002 from 30 minutes to 8 minutes (Figure 10) with no significant change in the average number of swimmers per contact. This reduction in contact time per swimmer is possibly a result of an increased pressure for all operators conducting tours on any one day to ensure their passengers get a swim, often referred to as “getting out of jail” by operators, so as to ensure that passenger will not need to return as FOC’s on future trips.

The implications of this practice on visitor satisfaction of the whale shark experience have not been formally examined. The issue is further discussed in section 4.7.

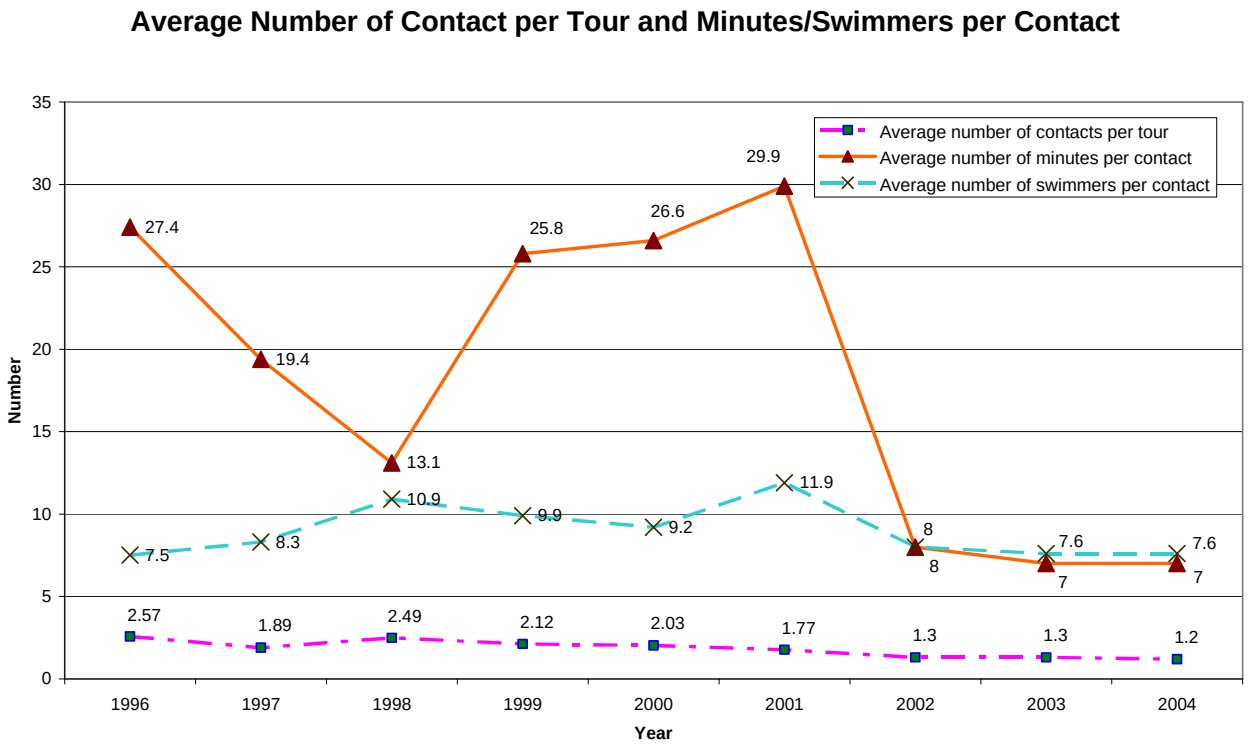


Figure 10: Average number of: contacts per tour; minutes per contact; and swimmers per contact

4.1.1 Whale shark logbook length data

During the months of April and May every season since 1995, operators recorded estimated size in metres and gender of each whale shark interacted with in CALM issued logbooks. Depending upon the number of sharks spotted on any day, multiple operator interactions occur with the same shark, resulting in replicate length estimates recorded in datasets. A preliminary analysis of this data was undertaken with these replicate length estimates included for the period 1995 to 2003 (Figure 11) as a follow up to Chapman (2002). Data therefore contains an inherent measure of inter-observer variability.

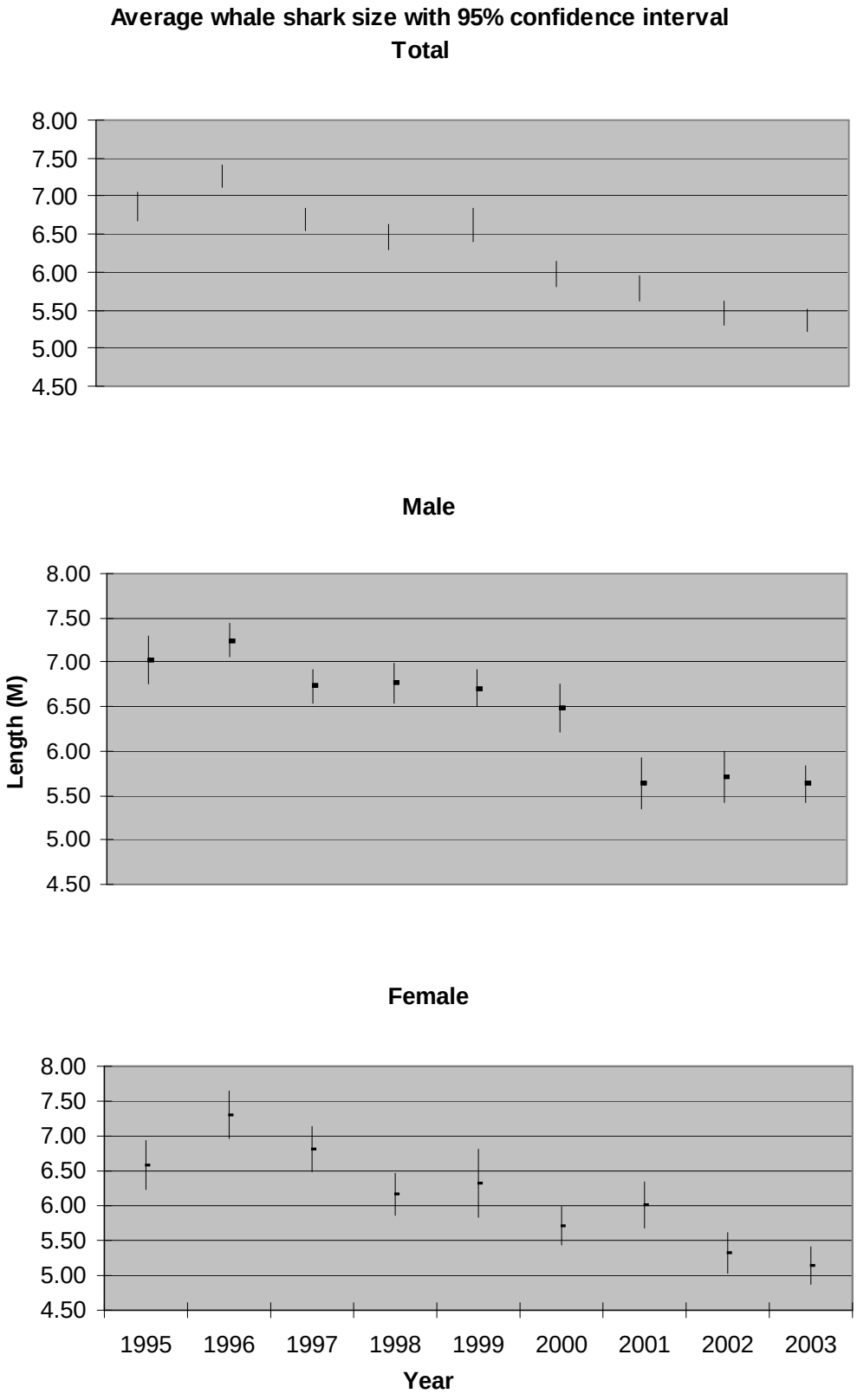


Figure 11: Average whale shark size from 1995 to 2003 from Industry Logbook data

A process of deriving scientifically useful data from historical whale shark interaction data collected by operators in Ningaloo's whale shark interaction industry has been undertaken since the 2003 season with AIMS, Charles Darwin University, CALM staff and volunteers.

In order to derive a 'clean' data set from the historical and current whale shark logbook data a number of issues have been identified. Specifically, a number of individual operator's measures (repeated measures) of the same shark from the same day have had to be identified for removal. This required the sorting of data by date, length and location and then assessing each record (up to 500 plus data records from each year have been compared and repeat measures removed).

However, in order to remove these repeat measures it was first necessary to classify individual operator datasets from most to least 'reliable'. The operator datasets were classified mainly depending upon longevity in the industry and the number of tours conducted within and across seasons. From individual operator datasets, a series of plots were constructed then compared with others. Those datasets that showed most consistency with respect to length data and the number of data points within a season were given the most 'reliable' classification.

When measures of the same shark on the same day were identified (repeated measures), the various operator's measurements, or repeat measures, were identified and all but the most reliable operator data was removed from the dataset. Through this systematic process of elimination, a clean dataset has been derived for the years 1995 – 2003 inclusive. Logbook data from the 2004 whale shark season will be processed in the same way.

Once a clean dataset has been produced, it can reliably be used for comparisons with environmental and oceanographic parameters. However to be useful in assessment of trends in life history data such as length it must be accompanied by a measure of inter-operator variability. This requires production of 2-3 years of data giving repeat measures of the same sharks by multiple operators. By following the same process as outlined for the removal of repeat measures, data from 2002 and 2003 have been largely compiled and with the addition of data from 2004 this objective will be achieved shortly.

The process of data assessment has resulted in one recommendation: operators need to record who they handballed whale sharks to in their logbook. This would remove the need to manually assess each and every logbook entry. On the whole, the logbook data is proving to be an invaluable historical dataset that will yield useful information on this animal and the interaction industry that has developed around them.

Recommendation 1: Season logbooks need to be modified to enable recording to which vessel a whale shark was hand-balled.

4.1.2 Direction of Travel

Clear trends become apparent when the logbook data for direction of travel of whale sharks is plotted and compared across years (Figure 12). There is a very strong trend for direction of travel along the north-south gradient with a greater northward bound favour.

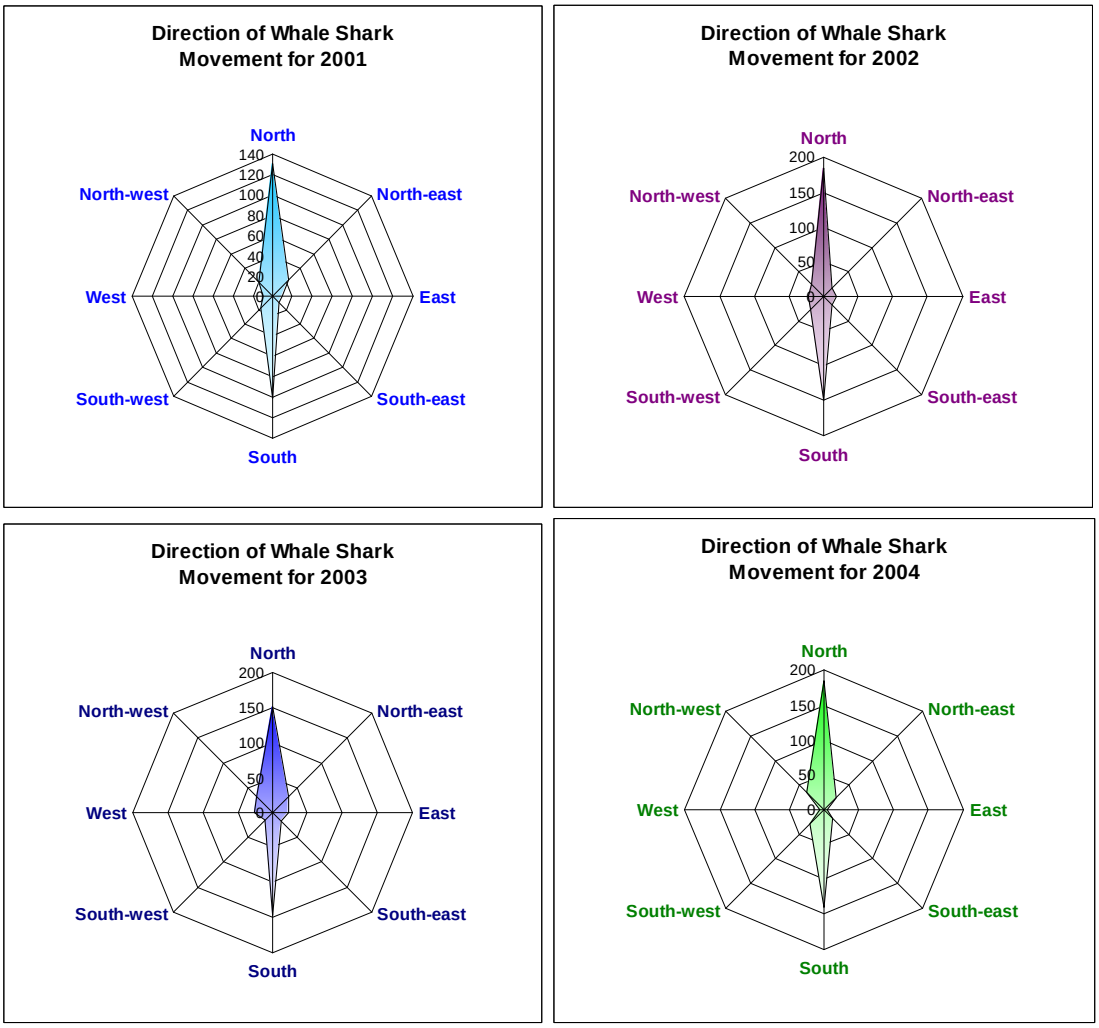


Figure 12: Webs depicting the pre-dominant direction of travel of whale sharks (2001-04)

4.2 Whale shark search effort

The ratio of sharks sighted in relation to the number of spotter plane hours flown (i.e. search effort) was calculated to determine the search effort per sighting (Table 1). Over the three years of data available, an analysis showed an inter-seasonal trend of reduced search effort (full season) per shark sighted from 2002 to 2004. However, when comparing this with the inter-seasonal search effort during the paying season only, it becomes apparent that in 2003 there appeared to a considerable increase in effort per shark spotted. This data seems to indicate a variable intra-seasonal geographical distribution (as search effort is focussed between Tandabiddi and Turquoise Bay for Exmouth and/or an intra-

seasonal temporal abundance variation. These two variables must be considered whenever analysing logbook data for inter-seasonal trends in whale shark abundance.

Table 1: Comparison of search effort (flight time) per sighting

Year	Full Season (hours:minutes)	Paying season (hours:minutes)
2002	02:20	02:15
2003	01:40	03:30
2004	01:25	01:40

NB: Data rounded to nearest 5 minute interval

The greatest ratio of whale sharks sighted per unit effort was recorded over the full 2004 season (Figure 13). The 2003 Paying Season recorded the lowest number of shark sightings (Figure 14) and the lowest ratio of sharks per unit effort for the three years analysed.

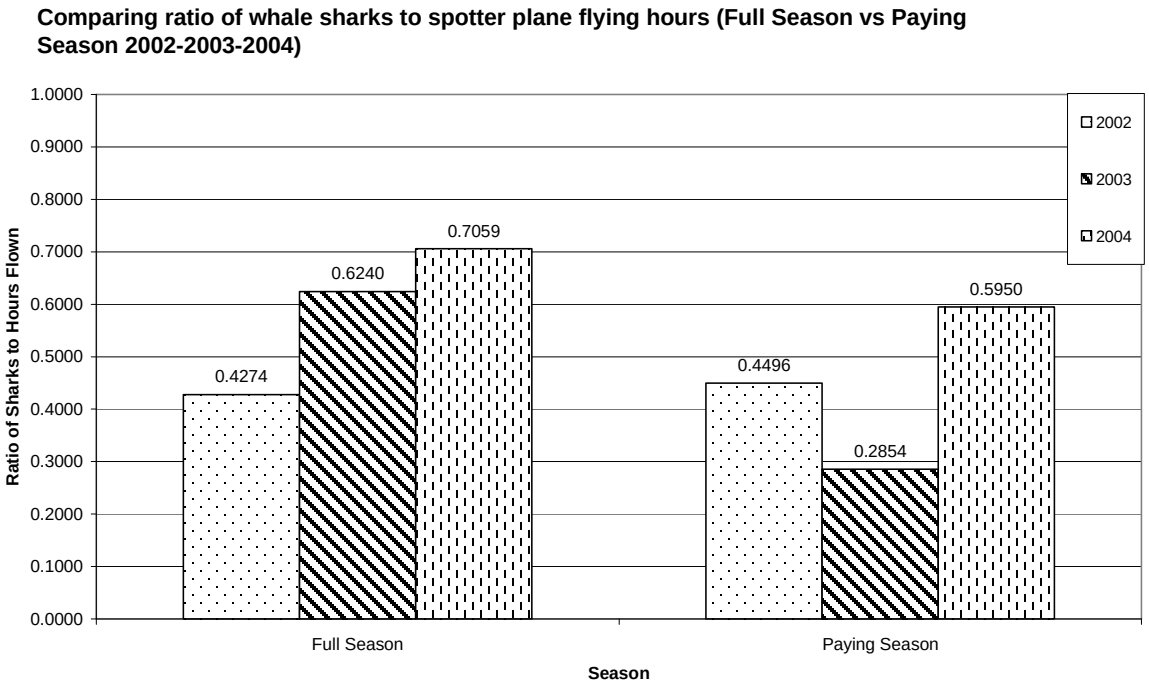


Figure 13: Comparison of whale sharks per unit effort (spotter flying hours) for the full season and laying seasons only in 2002-2003-2004

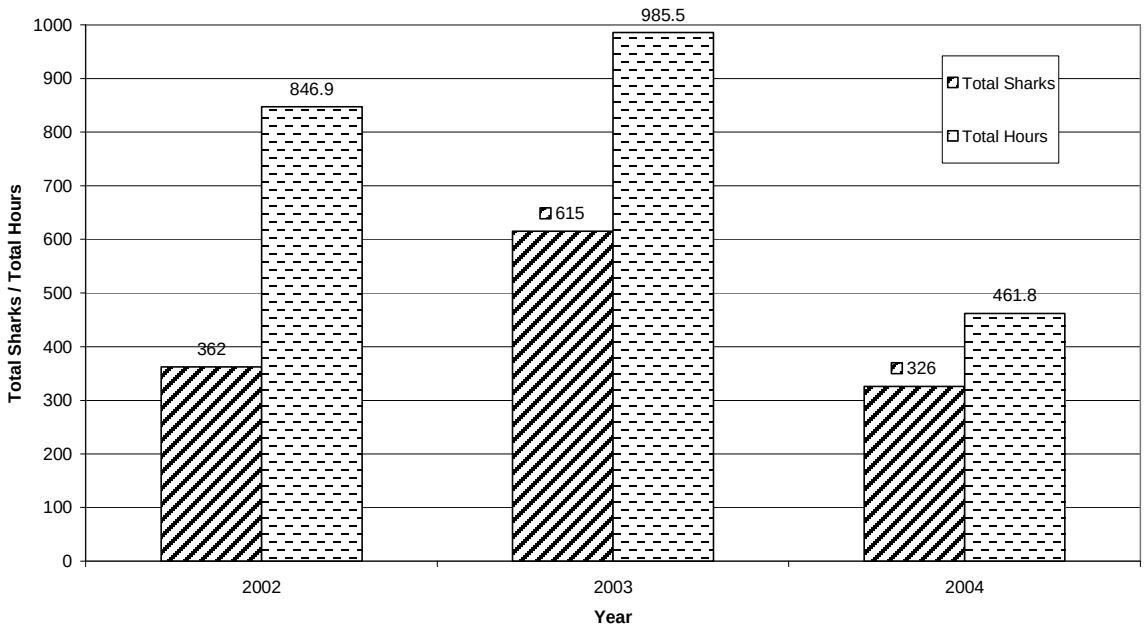


Figure 14: Comparison of the total number of whale sharks sighted in relation to spotting effort (i.e. hours flown) for the full seasons in 2002-2003-2004

The 2004 Full Season recorded the lowest total number of shark sightings of the three years analysed (Figure 14). However this may simply reflect that this was also the year in which the least hours were flown. Only 461.8 hours were flown in the 2004 Full Season, which is less than half the number of hours flown in the 2003 Full Season.

The 2003 Full Season recorded the highest total number of shark sightings. 2003 was unusual in that a large proportion of sightings were recorded outside the paying season. Less than one third of sharks were sighted in the paying season, even though the number of hours flown in the paying season was the highest recorded in the three years studied.

Anecdotal reports that whale shark numbers are declining is not supported by an analysis of the aerial spotter plane data for the last three years from 2002-2004. Daily vessel activity time or vessel days are not indicative of search effort as they are not involved in actively "searching" for whale sharks and only occasionally come across whale sharks while in transit. Rather, changes in the inter-seasonal aerial survey effort may be a causal factor for the apparent reduction in whale shark abundance. In addition, aerial search effort data indicated a considerable intra-seasonal variation in whale sharks per unit search effort.

The analysis of spotter plane effort enforces the need to obtain full season logbook returns to be able to account for variations in perceived abundance based on interaction data. Logbook data is not fully reliable as: not all handball records are recorded; not all sharks spotted are interacted with; and historical logbook data is limited to the two months paying season.

4.3 Aerial surveys

Aerial surveys for whale shark research and monitoring has been conducted since the 1990s for various purposes. The CALM Whale Shark Management Program has identified the need for a "comprehensive and sustained" aerial survey program "as a high priority" with the two objectives:

1. to monitor inter-annual spatial and temporal variability in whale shark numbers throughout the waters of the Marine Park; and
2. to establish what proportion of the whale shark population at Ningaloo is subject to human interaction.

Whereas objective 2 has largely been established through the Industry Logbooks and some researchers which provided the position of interactions, objective 1 has remained ellusive largely due to a lack of a scientifically valid survey methodology (some surveys have been conducted but with no conclusive results). In a recent CALM funded review of whale shark ecology and its implication to management at Ningaloo (Norman, 2002), it was suggested that a low-cost methodology may involve collecting data on distribution and numbers of whale sharks by charter aircraft contracted through the whale shark operators.

In 2004, Exmouth District staff and volunteers investigated the options of collection of whaleshark sighting information through the local charter company North-West Airworks. Using CALM supplied GPS's, pilots recorded their air-time, the location of sharks together with date, time and estimated shark size. This data can provide for the amount of effort required to find individual sharks over seasons and hence allow for monitoring change in the effort expended over years to measure interannual changes in abundence (see section 4.2). Furthermore, the collection of this data may assist in determining the natural variation in whale shark appearance.

Work conducted since 1997 initially by John Stevens from CSIRO Marine Research and more recently by Hubbs-Sea World has provided information on the regularity and percentage of time individual whale sharks spend near the surface (where they can be spotted by planes). The diurnal diving pattern of whale sharks is essential information for estimation of relative abundance by aerial surveys.

Discussions have been held with Helene Marsh, Professor of Environmental Science, James Cook University, to undertake a study to evaluate the usefulness of exisiting aerial data, scope the potential hypothesis that could be answered from existing and potential new aerial survey data, propose a scientifically valid aerial survey methodology that is either stand-alone or complements data gathered from spotter planes, and make recommendations whether aerial surveys are a cost-effective means to meet the set objectives.

Recommendation 2: That a post-graduate student project be prepared to investigate the application and limits of aerial survey data for research and monitoring of whale shark populations at Ningaloo.

4.4 Oceanographic surveys

Further to oceanographic work conducted at Ningaloo in 2002/2003, AIMS researcher David McKinnon was asked about future work in this area relative to whale sharks.

The Australian Institute of Marine Science (AIMS) has maintained a mooring offshore Tandabiddi for some years. According to AIMS researcher Dave McKinnon, this mooring comprises a string of temperature loggers (to examine patterns of upwelling - and when set to a fast sampling rate to study internal wave activity), and also an ACDP. These measure current speed and direction. A volunteer has taken an initial pass through the data, and a report should soon be available.

McKinnon suggested that "*to truly understand the phenomena of the aggregations, we need to understand whale shark movements over wider geographic areas, so we can then try to figure out what the cue is at Ningaloo. Our suspicion is that the area around NW Cape is a "hotspot" of biological production - our own data, and that of Christine Hansen at UWA, each point to this. However, because of the seasonality of our sampling and the prevailing weather, we only have data from a limited period of the year. We are developing a proposal to SRFME at the moment, and one of the things that we are all interested in is getting a better seasonal coverage of oceanographic data from the area*." (McKinnon, pers. Comm.)

AIMS is very interested in continuing work in this area, and in joining with other agencies such as CALM to better understand the oceanography of the area.

4.5 Movement and behaviour studies

4.5.1 PAT Tagging

In 2004, CALM made a significant financial contribution from the whale shark levy to allow a continuation of a collaborative study documenting the movements and behaviour of whale sharks that aggregate seasonally at Ningaloo Reef. It is a collaborative effort involving Dr G Wilson (University of New Hampshire), Dr Brent Stewart (Hubbs-SeaWorld Research Institute, CA), Jeffrey Polovina (NOAA Fisheries, USA) and Dr Mark Meekan (Australian Institute of Marine Science). A progress report on the work to date is attached, including some preliminary results to date (**Error! Reference source not found.**).

In summary, Pop-up Archival Satellite Transmitter tagging (PAT tagging) of whale sharks occurred in the vicinity of Black Rock and Norwegian Bay, Ningaloo Marine Park from the 2nd to 12th May 2004 (see Figure 1). PAT tags work by logging information on whale shark depth, movement and temperature for a set length of time after which they automatically detach themselves from the shark and transmit their data to a satellite. The tags are programmed to detach from sharks at 1, 6, and 9 months intervals.

Following some conflict between researchers and Coral Bay whale shark operators in 2003, CALM identified an area where research may be conducted with minimal risk of conflict with commercial operations (Figure 15).

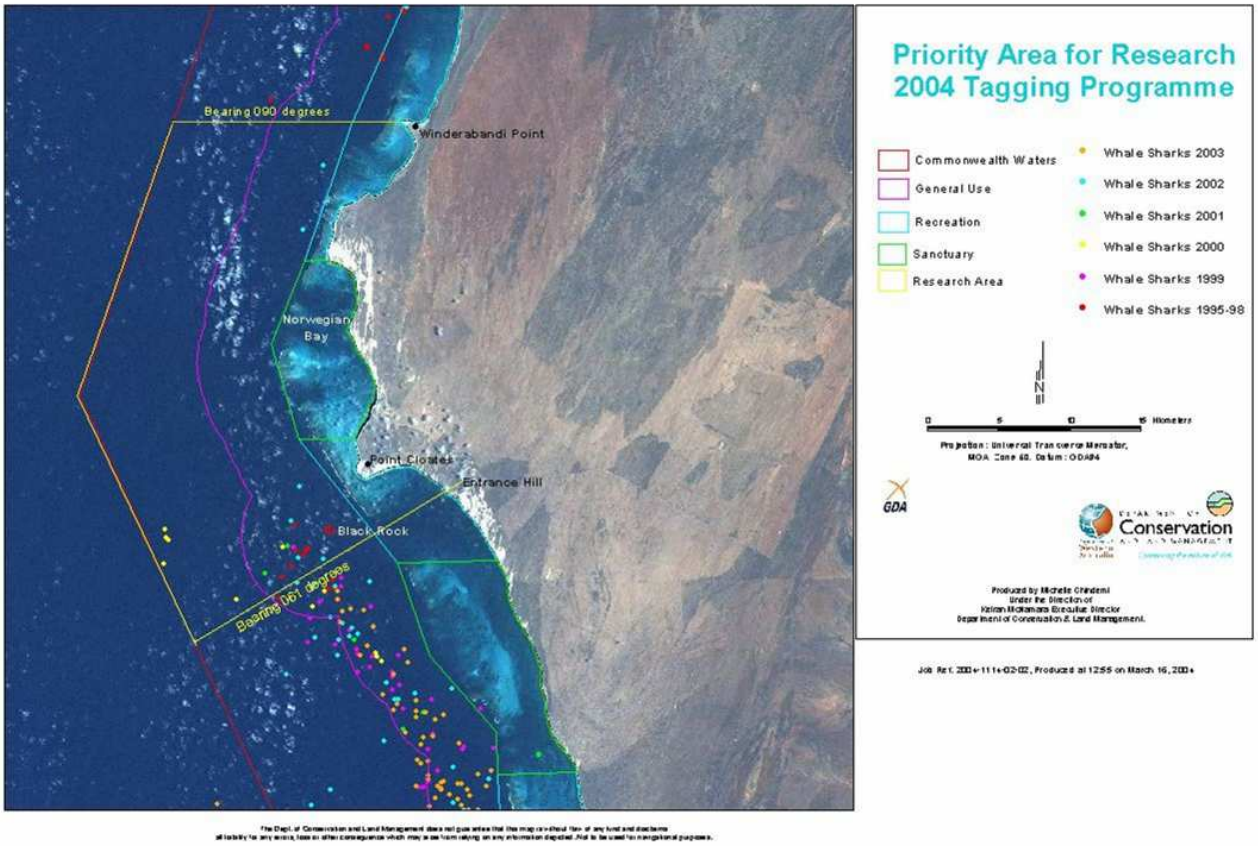


Figure 15: Map showing the priority area for research for the 2004 tagging program

A number of photos of whale sharks with tags have been given to CALM from industry spotters who have resighted them through the season. These photos were of great value in assessing their condition and may suggest a reason for tag failure (Figure 16). For instance, from these types of images it is possible to determine if the tether to the tag is affecting the skin tissue of the animal, the condition of the tag and how quickly fouling growth and barnacles accumulate on the tag through time.

Overall, the 2004 fieldwork was considered a success (M. Meekan, pers. Comm.). Of the 15 tags that were deployed, four detached prematurely (within days of deployment), three have reported on time, and 10 are still at liberty. The next tag is scheduled to report in early September and the final tags in early February. Mark Meekan is expecting to take the lead on the first paper resulting from this work – estimated to be submitted for publication sometime between April and July of next year (M. Meekan, pers. Comm.).

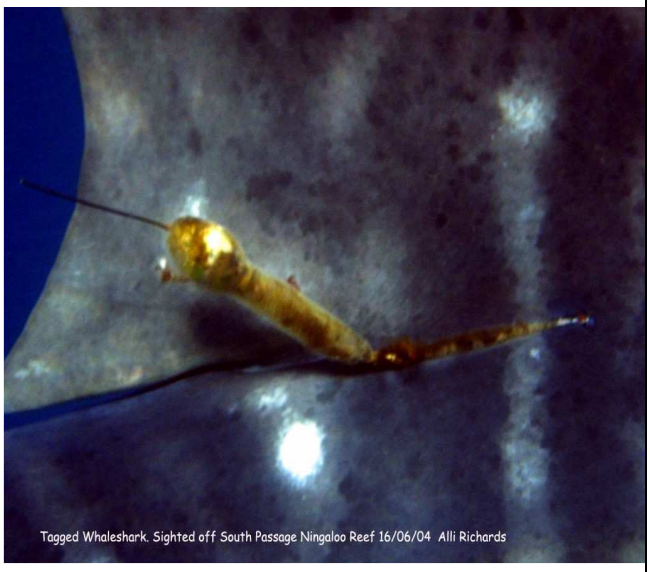
The collaborators are planning for more deployments next year - at least another 15 PAT tags, and are hoping to raise additional funds for towed satellite tags. A liability associated with data from PAT tags is that the locations provided are estimates that have a fair amount of error associated with them. Towed satellite tags provided much better locations that would allow for analysis of shark movements in relation to satellite imagery - but the tag is much bigger and attaching one is much more difficult (M. Meekan, pers. Comm.). No firm direction has been set for studies beyond next year.

Recommendation 3: That CALM request a detailed project brief detailing how information collected to date will be used to meet objectives, the benefits of additional data collection of the same nature, and the future extent of the project before any further funding support is approved.

a. PAT tag before application

b. PAT tag in-situ (May 7, 2004)

c. PAT tag in-situ (June 3, 2004)
(©Allison Richards)



d. PAT tag in-situ (June 16, 2004)
(©Allison Richards)

Figure 16: Images showing the progressive fouling of PAT tag in 2004

4.5.2 PAT Tag costs

The CALM Exmouth Office received several requests from filming companies who wished to film tagging in progress. Discussions with these companies or groups had shown a willingness to purchase tags for the purpose of filming. This could be considered an avenue to get additional tags out there by CALM staff accompanying these film crews on commercial operator vessels to deploy tags. Dr Steve Wilson advised CALM, that PAT tags cost between US$4000 and US$4200, and satellite data distribution costs are about US$500 per tag (those are this years costs, so factor in inflation for future years). Dr Wilson could source these tags and would be interested to process the data and incorporate into relevant reports (S. Wilson, pers. Comm.)

4.5.3 Ecocean movement pattern study

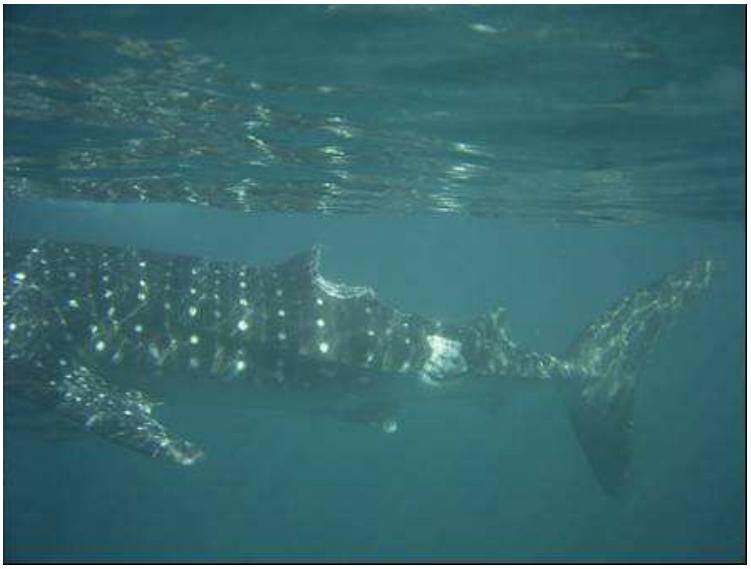
CALM District staff supported Brad Norman in his Natural Heritage Trust funded study entitled “Whale shark critical habits and movement patterns within Australian waters”. Norman’s field work was based at Christmas Island with CALM facilitating the deployment of three archival tags at Ningaloo. A progress report on his project to January 2004 was made available (**Error! Reference source not found.**).

This study uses archival tags which require to be manually recovered for data to be downloaded. For this reason, it was considered best to apply the tags from Coral Bay and recover the tags at Exmouth based on anecdotal evidence and previous satellite tagging that there is a general northward migration. Unfortunately, the opportunities for deployment did not present themselves as the tags were not available until well into the season and by the time staff briefings had been conducted at Coral Bay, whale shark sightings became less frequent and operators were reluctant to risk “spooking” the last whale sharks of the season out of the area.

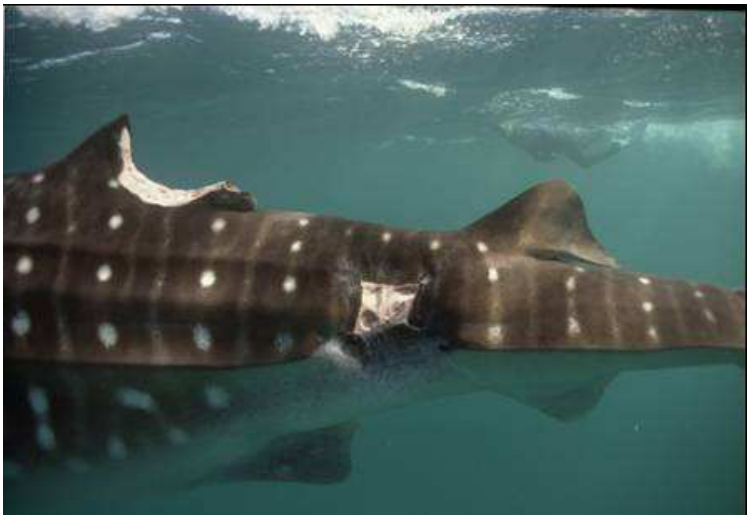
It was decided to put on hold the tagging attempts using archival tags and instead focus on the Ecocean Whale shark photo identification library.

4.5.4 Revisited healing

Following a well publicised whale shark that was recorded with very large and fresh bite marks believed to have originated from a great white (recorded in the Exmouth Gulf last year) or tiger shark, the individual shark was re-sighted by a keen whale shark tour guide. The two main points from this observation were that the whale shark clearly returned to (or stayed in) Ningaloo waters over two seasons and that whale sharks have a good ability to recover from significant tissue damage.



a. April 2003: very fresh wound (Note possible cookie cutter shark bites in wound)



b. July 2003: Partially healed wound

c. June 2004: Completely healed around (Copyright of Allison Richards)

Figure 17: A whale shark's healing process documented after a one-year interval

4.6 Whale shark photo identification

The 2004 Season has seen the strongest indication yet that the use of the whale shark spot patterns may become an effective way to establish estimates on whale shark numbers, their migration patterns, and morphological changes of individuals over time. Unfortunately, there currently appear to be three separate players outside of CALM who do not seem to be able to work cooperatively thereby decreasing the value of another's efforts. Considerable effort has been spent by CALM staff attempting to 'build bridges' but there still appears to be apprehension to cooperate amongst the parties.

4.6.1 Ecocean whale shark Photo ID Library

As a migratory marine species, conservation efforts for the whale shark are dependent on international cooperation. Where do Ningaloo's whale sharks come from and where do they go? The ECOCEAN Whale Shark PhotoID Library (at www.ecocean.org) provides a central data base that is readily accessible by everybody in the international community and hence may provide a linkage between sightings around the globe.

The whale shark ecotourism industry and interested individuals can help this research by providing photos and accompanying information. These can be submitted online for collation and identification of new sharks or re-sightings. Photos submitted can be viewed and recalled anytime and participants are advised via email whenever a match with their photos has been made with other photos in the library.

Behind the scenes, the database is quite technically complex using mathematics to establish relationships of dot patterns. Using a standard left-hand flank shot (or right flank), possible matches are ranked from highest possibility to lowest. The database manager has to manually confirm a match and has access to other information submitted (e.g. additional photo's, scarring or markings of fins). An example of an actual match is shown in Figure 18. The database manager, of which there could be any number, can reside anywhere in the world when conducting the manual assessment. This is one of the strengths of this database: it will allow a level of control at a local level thereby empowering the stakeholders. The database has great potential.

CALM volunteers assisted in the development of a manual that provides standard operational procedures for anyone who wishes to contribute whale shark photo images and information to the PhotoID library (**Error! Reference source not found.**). Although taking photos of whale sharks is a relatively easy activity, the value of effort and hence the quality of the information can be greatly improved through better understanding of these procedures.

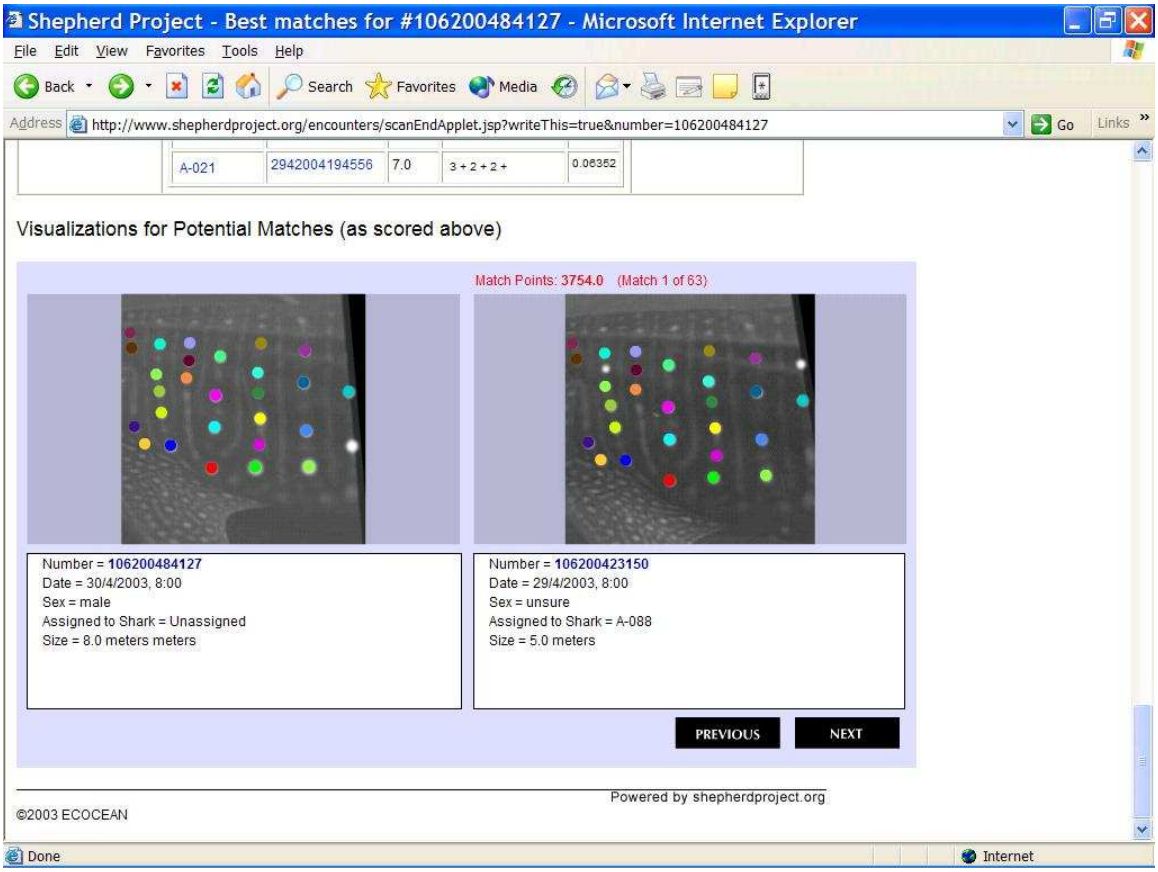


Figure 18: Example of a photo match using the Ecocean Whale shark photo-id library

4.6.2 Honour's Project

Mark Meekan is supervising an honour's project at Darwin University which involves 'by-eye' manual categorising and comparing images of whale sharks obtained from Geoff Taylor in the early 1990's, from AIMS recent research work and by sourcing current images from dive guides at Ningaloo. Meekan has suggested that this work can be used to ground-truth the Ecocean Whale Shark Library by comparing the results of his students 'by eye' method and the Ecocean Photo ID Library semi-quantitative method. Unfortunately, no images will be made available to Ecocean until the project work has been written up (Meekan, pers. Comm.). CALM staff were not made aware of this project until recently.

4.6.3 Ningaloo whale shark watch project

Following the 2003 season, local whale shark guide Allison Richards expressed an interest to further develop the idea of "photo monitoring". From this time on, the concept of a "Ningaloo Whale Shark Watch" was developed. The proposed project is an operator-based photo monitoring program aimed at logging and identifying individual whale sharks that visit the Ningaloo Reef each year. The project is now supported by the Exmouth Cape Conservation Group.

The program proposes to utilise whale shark guides or video-graphers in a volunteer capacity to photograph, log and thus monitor the numbers and size of the whaleshark population on the Ningaloo Reef. This project effectively shares its objectives with the

Ecocean Whale Shark Photo Identification Library (see sub-section 4.5.3). Attempts have been made by CALM District staff to merge these projects. Some key preliminary outcomes from this project include re-sighting of one individual shark 13 times over the season and further refinement of standard operating protocol.

Recommendation 4: That the CALM Management Team promote the Ecocean Whale Shark Photo-id Library and request all other relevant projects to incorporate their captured images into this database.

4.7 Visitor satisfaction

The whale shark experience has been labelled a "high quality" experience following social surveys in 1996. Since those days, participation numbers have increased by 150% from around 2000 to 5000 passengers. Based on operator logbook data, components of the experience have changed in the last 10 years, for instance, the duration of an average trip has increased by 2 hours, the average interaction time per swimmer has reduced from 20 to 8 minutes, and average number of whale shark encounters per trip halved from 2.4 to 1.2 sharks per trip.

Yet, the actual passenger capacity does not appear to be anywhere near the potential maximum capacity of the existing licensing regime. For instance, working on the assumption that each of the 15 restricted entry whale shark licensee's would be able to carry up to 20 persons per daytrip, the maximum daily industry capacity for participation is 300 persons. Over the month of April and May, the paying season, up to 18,300 participants could partake in the whale shark experience. Based on these assumptions, during the 2004 paying season, the industry had a 30% latency (i.e. the actual capacity used in relation to the total capacity). This figure is based on paying and free-of-charge (FOC) repeat passengers (as FOC are considered in license passenger limits).

Coleman (1997) identified the need for management to establish a monitoring program of visitor satisfaction and behaviour as the interaction industry grows and develops. This suggestion was based on research conducted by Davis *et al* (1996) who analysed data and information on the recreational aspects of the industry, particularly the expectations and experiences of users and their willingness to pay for the quality experience.

According to Davis *et al*., visitors indicated that their best experiences involved some type of interaction with whale sharks. Other responses related to the amount of time spent swimming with whale sharks, and many people offered emotional descriptions of the experience including "the calmness of it". Good weather conditions were also mentioned by small numbers of people as contributing to visitors' best experiences. In contrast, when asked about their worst experiences, crowding emerged as a major area of concern among visitors. Although these crowding experiences were related largely to in-water activity, the results of this research are still relevant to management as indicators of social carrying capacity of the whale shark experience.

CALM as the management agency has to date not been able to identify any biological threat from the whale shark experience and hence in 2002 a decision was made that 15 licenses would be retained. However, the implications of the significant growth in

participation (potentially by 70%) based on trends over the last 10 years combined with experiential knowledge of participants from previous research, suggests that user patterns may affect the high quality experiences which visitors enjoy. For CALM to meet its objective of "*implement[ing] a management framework [to facilitate] commercial operators to deliver quality experiences*" (Coleman, 1997), further research and monitoring of social carrying capacity is essential to guide decision-making.

Discussions have been held with Dr David Woods, Curtin University, in relation to conducting a social carrying capacity study on the Ningaloo whale shark experience. Dr Woods has expressed a keen interest to supervise a post-graduate student to conduct a visitor satisfaction-type study. Furthermore, it was proposed that an appraisal study of the whale shark industry, the managing agency and visitor satisfaction would go one step further in developing a management framework that meets the needs of all stakeholders.

Recommendation 5: That CALM support a post-graduate research study into experiential aspects of the whale shark experience in relation to the existing management framework.

Recommendation 6: That CALM consider an appraisal project of the whale shark industry to be conducted through the CRC for Sustainable Tourism.

A social carrying capacity study based on concepts of visitor satisfaction and perceptions of crowding should include demographic characteristics and several experimental aspects of swimming with whale sharks (including Japanese language questionnaires). Questionnaires should be distributed at the boat ramp and at collection boxes at each licensees shop or operational centre to avoid Davis et al problem where many licensees apparently disregarded the survey and made no effort to distribute the questionnaire to their customers. Any future surveys should consider this pilot survey as a baseline.

4.8 Marine Conservation Society in the Seychelles

The CALM District office has been contacted by the chairman of the Marine Conservation Society in the Seychelles (MCSS). Since 1996, this group has been monitoring whale sharks around Seychelle Islands and since 2001 have been undertaking a major study including the placement of satellite tags on whale sharks. The study showed that they radiate away from Seychelles and one animal passed south of India and over to Sri-Lanka and ended up off the coast of Thailand, another to Somalia and a third went across to Zanzibar. MCSS is keen to communicate with as many partners as possible, to share experiences and ideas and to move forward with the understanding of whale sharks and ensure for their conservation. CALM Exmouth intends to continue to facilitate communication between ourselves and other institutes, organisations and individuals that are actively involved in the conservation of whale sharks at Ningaloo Marine Park.

5 MANAGEMENT MATTERS

5.1 Operations

As in previous years, CALM continued with its operational program which is a combination of boat ramp inspections, boat patrols, industry vessel placement, and aerial surveillance. The CALM Exmouth District Office was supported by visiting Wildlife Officers. The presence of these Officers proved, as always, invaluable as a number of incidents required further investigations. Overall the operational effort increased by 7 days from 2003.

Table 2: Comparison breakdown of operational field effort over season (1998-2004)

Primary Task	NUMBER OF DAYS				
	1998	2000	2001	2003	2004
Field Research	6	8	8	18	10
Aerial Surveillance	3	4	2	2	4
On Industry vessels	0	7	5	8	8
Boat Ramp Inspections	0	36	42	22	21
Compliance Monitoring in CALM vessel	36	12	9	0	14
TOTAL	45	67	68	50	57

5.1.1 Wildlife Officer reports

Three Wildlife Officers spend time in the Exmouth District to provide support and guidance to Exmouth Field staff (**Error! Reference source not found.**). Unfortunately, there were several incidents which required further investigation and follow up during the 2004 season. All parties involved have been contacted and are aware of the issues. As investigations are still on-going, no further details can be disclosed at this time.

One significant issue that will require further follow up is to clear up the license condition relating to the long established practise of queuing and handballing of vessels. Due to the larger number of vessels operating and fewer apparent shark sightings this season, this practice required CALM operational involvement several times.

The handover/change over procedure of a vessel “in contact” to the next vessel that has “queued” works extremely well and safely. This procedure has the second (“queue” vessel) encroach within the 250 metre contact zone thus in effect breach condition 10.2 of the WCA Regulation 15 licence. The procedure is supported by CALM operational and District staff. The issue was first raised by D. Coughran in the 1996 end of season report. It is well overdue for the licence conditions to reflect this procedure to make it legal.

Recommendation 7: That whale shark license conditions be changed to reflect the “queuing” of a second vessel before contact by allowing the first-in-queue vessel to encroach within the exclusive contact zone for the purpose of handballing only.

5.1.2 Recreational boaters

There were no reports to CALM of non-compliance of recreational boaters with the Wildlife Conservation (Closed Season for Whale Sharks) Notice. This issue arose last season and operators were requested to report any breaches they experienced. It appears that this remains a minor compliance issue to be dealt with on an as-need basis.

5.2 Industry Logbooks

Industry logbook data is required to be submitted to CALM every fortnight during the whale shark season. This shorter interval was introduced last season as a license condition as it was found that the previous interval of monthly meant that if there were problems with completing the logbook, it would be picked up too late and thus compromise data quality. Although the regularity of the submissions was overall maintained with some reminding by CALM staff, the compliance with this license condition needs improving.

5.2.1 Completion of logbook

During the data interpretation and entry into the database, the following issues were identified:

- Some operators employ a number of different recorders that seem to be insufficiently informed about the correct way of filling out the Interaction Log**.**
- Confusion with number of passes: What to do with customers on the repeat policy? Are they to be treated as paid or F.O.C. customers and are their pass numbers to be put down? (Different ways of recording by the various Operators)
- No information about GPS coordinates and depth given by Operators.
- Many recorders do not state whether 'Handballing' occurred or not.
- Some entries from different operators contradict each other in the interaction log about the sex of the shark, the water depth and even the number of sharks e.g. one operator states that Handballing of 2nd shark occurred but other operator has logged only 1 shark.
- No contact information (amount of time with the shark and number of swimmers) given by operators on many occasions. Therefore it is often not clear whether any actual interaction occurred.
- Operators sometimes give the total amount of interaction time with the whale shark and the total, added up number of swimmers, instead of stating contact times and number of swimmers separately.
- Are operators supposed to log days that are days off anyway and it was clear beforehand that the vessel was not going to go out (Some operators do, others don't). Does the Operator have to account for any single day of the season?
- In case of no sightings many operators tick the box 'No Sharks' at the bottom but state start and finish time and sometimes pass numbers, or either one or the other. Confusing for log interpretation: Have they gone out or not?!
- In case of no shark sightings, some operators do not state start and finish times on several occasions and do not give pass numbers and number of passengers.
- Operators log start and finish times as the actual interaction time with the whale shark and not as the total duration of the cruise.

It is apparent from the outline of the issues, that more time must be spent by CALM District personnel to ensure that data quality is maintained. Staff briefings and training was offered to operators during the pre-season meeting. However, licensees present felt it was not necessary.

Recommendation 8: That all skippers and staff are briefed by CALM personnel about how to complete logbooks and returned logsheets are especially carefully scrutinised following the first two weeks of the season.

5.2.2 Performance assessments

A meeting was held between Whale Shark Western Australia (WSWA) representatives Dave Hall (Exmouth Dive Centre) and John Jenkin (consultant) and Jim Sharp, Director, Parks and Visitor Services and Rod Quartermain from CALM in February this year to discuss a number of issues.

One of the issues WSWA raised was the process for performance assessments for the operators at the end of each season. There are obvious advantages with the idea of reviewing each operator's performance during the season and providing some feedback. Apart from the recommendations of the Wildlife Management Plan that this should be done, it would give CALM better grounds to ensure compliance with conditions in future years if they are followed up at the end of each season.

From the CALM Act licenses point of view, the following are the sort of issues that should be reviewed:

- Latency issues;
- Provision of fortnightly log book returns;
- Compliance with requirements in relation to promotional material (e.g. websites with licence name and number and next year on printed material)
- Compliance in the way of ticketing and payment of licence fees
- Any warnings or breaches from the season

It was suggested that these issues be discussed at the 2004 end of season meeting and meetings with individual operators if there is a particular concern.

5.2.3 Complaints

Throughout each whale shark season, CALM receives verbal and written complaints from operators, staff and clients. All complaints are taken seriously and investigated. In some cases, the nature of the complaint lies outside the responsibility of CALM, for instance specific business practices impacting on other operators. The following issues related to CALM's legislative responsibility were raised by the public and operators during the 2004 season:

- Operators did not provide the right information about the nature of the whale shark experience, e.g. refund policy, provision of equipment, weather conditions;

- Breaches of whale sharks exclusion zones of operator vessels (multiple);
- Breaches of 3m buffer around whale sharks head, especially during rough sea conditions (Guide to client "*that happens all the time*");
- Herding of whales towards the end of season during opportunistic encounters;
- Skippers endangering swimmers and whale sharks by maneuvering too fast and too close to swimmers in water or whale shark;
- Bad mouthing of other operators in front of customers;
- Whale shark experience based on chaos theory.

A number of recommendations have already been made in other sections of this report in order to address these issues. There was a perceived increase in complaints during this season especially relating to the behaviour of industry. Unfortunately, these complaints do little for the argument of self-regulation.

5.3 Licensing of videographers

The licensing of videographers is an issue which requires addressing. Most licensee's now employ videographers who film participants during their whale shark experience. However, some of this footage is then used for the development of video's offered for sale. As there is commercial gain, the activity requires a CALM Act license. The issue is whether this activity should be covered through the operator's license or whether each videographer should be licensed individually or whether the activity warrants licensing at all.

5.4 Department of Premier

In recognition of the significance of whale sharks at Ningaloo, the Premier of WA gave an undertaking to explore opportunities for WA to partner the Commonwealth Government in boosting whale shark conservation efforts in this region (Attachment A). The Department of Premier has contacted various stakeholders in whale shark research and management directly without coordination through CALM. It is therefore unknown what the future intend for additional State government funding in the area of whale shark research will be.

5.5 Draft Commonwealth Recovery Plan

The Commonwealth Department of Environment and Heritage requested comments to a draft whale shark issues paper through the National Shark Recovery Group. As Fisheries is a State member of this group, CALM was contacted for comments both directly by the responsible Fisheries representative and formally through the Director of Nature Conservation. A copy of the Whale Shark Recovery Plan Issues Paper is attached (**Error! Reference source not found.**).

The Draft Whale Shark Recovery Plan was released in early September and this draft recovery plan will be available for public comment for a period of three months (**Error! Reference source not found.**). At the end of this period the plans will be revised, taking into consideration any comments received. A hard copy of the draft plan may be obtained from the Community Information Unit, ciu@deh.gov.au or by phoning 1800 803 772.

5.6 Carry-over actions from 2003 Season Report

The following items from the 2003 progress report still require action:

1. To aid increased public awareness of interacting with whale sharks, CALM Exmouth should investigate the erection of signage at Tantabiddi Boat Ramp and Coral Bay.
2. Pre-season briefings should be conducted for both commercial operators staff and charter pilots.
3. License condition 11.7 should be amended to read as follows: “the number of swimmers to be in the water with a whale shark at any time will be limited to a maximum of 10 and one dive master/spotter or one videographer/photographer.”
4. CALM should consult the industry as to what amount of free diving on whale sharks is acceptable and whether this can be incorporated into the license conditions or code of conduct.
5. All operators should reminded by letter of the 30 metre rule for tender vessels, and that tender vessels are not to be used to enable disabled persons to view sharks unless by prior approval in writing with the District Manager.
6. A review of the time operators can utilize sharks for interactions should be explored.
7. In 2004, the dates for the whale shark season should be entered into the logbooks to reduce some of the confusions regarding recording of tour information.
8. Request that operators record the position the whale shark was first contacted by swimmers in World Geodetic System 1984 (WGS84).
9. Log sheets should be completed outside the official season to increase the usefulness of the data set. We are currently losing out on valuable ecological information about the whale shark at Ningaloo.
10. It is recommended that condition 6 of the Section 101 License issued to all Whale Shark Interaction Tour Operators regarding the issue of tickets be amended to read as follows:
    “*The license holder must ensure that upon boarding the vessel, each paying passenger is issued a passenger validation ticket appropriate to their age group, to be supplied by the Executive Director, for each day, or part thereof, that the passenger spends on a whale shark interaction tour conducted by the license holder, and that each ticket issued is validated as required by the Executive Director*.”
11. CALM needs to encourage a higher compliance with license conditions for logbook completion for every whale shark interaction conducted by licensed operators.
12. CALM needs to coordinate efforts at individual identification of whale sharks to reduce double up of effort.
13. CALM should encourage researchers to develop stronger links with industry to achieve research objectives.

5.7 Financial Statement

All licensed whale shark operators are charged a levy for each client participating in the whale shark experience. Ticket books are issued at the beginning of the season in March and operators are invoiced at the end of each paying season. Funds collected by CALM are used for whale shark conservation and industry management purposes. Adults participants are charged $20 and children $10. These funds have allowed CALM to implement many of the strategies of the Wildlife Management Program in collaboration with research institutes and not-for profit organizations. A balance of income and expenditure for the 2004 whale shark season is shown in Table 3.

Table 3: Levy Income and Expenditure for 2004 whale shark season

Management Strategy	Specifics	Credit	Debit
2003 season carry-over		+ $ 12, 084	
2004 Management levy		+ $ 95,850	
Research	➢ Hubbs Sea World Project ➢ Ecocean		- $ 36,235
Monitoring	Logbook data analysis, photo-id		- $ 17,856
Compliance	Surveillance and patrols (vessels, flights, vehicles, additional staff); Investigations		- $ 19,012
Education	Posters, brochures, ticket books, logbooks, Whale shark Festival, Display, Ecocean Brochures, Powerpoint presentations		- $ 7,255
Administration	Licensing, meetings, EOI, Progress Report		- $ 18,269
Total		+ $107,934	- $ 98,627
BALANCE		**+ $ 9,307**	

6 REFERENCES

Coleman J (1997) Western Australian Wildlife Management Program No. 27: Whale shark interaction management, with particular reference to Ningaloo Marine Park. Western Australian Department of Conservation and Land Management, Fremantle WA.

Chapman T (2002) Whale shark log sheet data 1995- 2001, Unpublished Report: Western Australian Department of Conservation and Land Management, Exmouth WA.

Davis, D., Birtles A., Valentine, P., Cuthill, M. and Banks, S. (1996). Whale sharks in Ningaloo Marine Park: Managing Tourism in an Australian Marine Protected Area. Report to the Department of Conservation and Land Management, WA.

McKinnon, Dr David, pers. Comm.,Research Scientist, Australian Institute of Marine Science
Meekan, Dr Mark, pers. Comm.,Research Scientist, Australian Institute of Marine Science

Wilson, Dr Steven, Department of Zoology, University of New Hampshire, Durham, NH
Stevens, Dr John, CSIRO Marine Research, Hobart.

Attachment A: Press release from Government in relation to whale shark research

Premier seeks further protection for whale sharks 20/5/04

Ensuring the future of the whale shark will become a key project for the State Government, according to Premier and Science Minister Geoff Gallop.

The annual visit by whale sharks is recognised as a major tourist attraction along the Ningaloo Coast in the State's North.

But Dr Gallop told State Parliament there were disturbing signs that whale shark numbers were declining because the species was continuing to be the target of fishing operations in some South East Asian countries.

"A recent episode of Catalyst on ABC TV highlighted the fact that whale sharks were sought after as a food product in some of these countries," he said.

"This is of particular concern, given that the whale shark has been recognised as being vulnerable to exploitation and is a protected species in Australia."

The Premier has written to Prime Minister John Howard seeking a joint Federal-State approach to whale shark conservation.

Dr Gallop said a major effort was needed to protect this magnificent creature.

"While it is primarily a Commonwealth responsibility to press for conservation of threatened species in the international arena, Western Australia has a particular interest in whale shark conservation, by virtue of its annual visits to our waters and the associated ecotourism industry in this State," the Premier said.

"For this reason, this Government is interested in exploring opportunities for WA to partner the Commonwealth Government in boosting whale shark conservation efforts in our region."

Dr Gallop said despite its size and the public affection it generated, not a great deal was known about this pre-historic fish, so any scientific research that found out more about the whale shark should be encouraged.

Premier's office: 9222 9475

Attachment B: Experiencing whale sharks in Ningaloo brochure

Attachment C: Ecocean brochure

Attachment D: Hubbs-Sea World Technical Report: Pop-up archival tag deployment (3-9 May 2004)

Attachment E: Ecocean 2004 Tagging Information Flyer

Attachment F: Ecocean Progress Report January 2004: Whale shark critical habits and movement patterns within Australian waters

Attachment G: Best Practice Manual for photo identification of whale sharks

Attachment H: Wildlife Officer Report: 2004

Attachment I: Draft Whale Shark Recovery Plan 2004-2009 (Commonwealth)

Attachment J: Whale Shark Recovery Plan Issues Paper (2004)