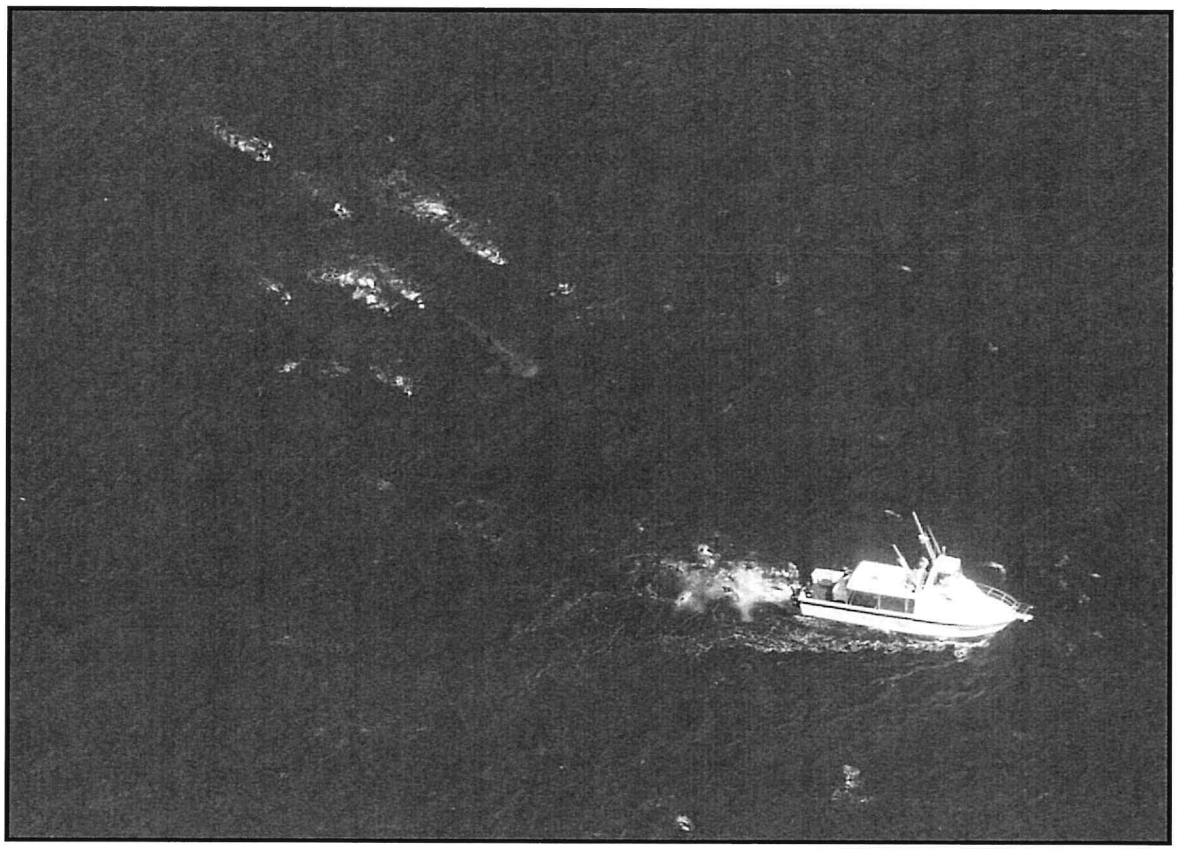
Wildlife Management Program No.27 Progress Report

Whale Shark Interaction Management Ningaloo Marine Park



Progress Report: 2007 Whale Shark Season

Department of Environment and Conservation, Western Australia

Department of
Environment and Conservation

Preface

The Western Australian Department of Environment and Conservation (DEC, formerly CALM) has a legislative responsibility to manage wildlife on DEC 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 DEC's conservation and recreation objectives, and the principal role of DEC 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 Environment and Conservation, 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

Collaboration is the key to successful conservation and management of whale sharks and therefore thanks must go to all involved in the continued effort towards and advances in protection, education and research of this amazing species. I would therefore like to acknowledge all the whale shark industry staff, NorWest Air works and pilots, DEC Nature Conservation Coordinator Roland Mau, DEC Wildlife Officer Brad Daw, DEC Project Interpretation Officer Tony Howard, DEC Data Manager Tristan Simpson, DEC volunteers Melanie Stock and Olli Bourdon, Paul Waghorn & Kellie Ritchie and to all researchers in Australia and worldwide who dedicate so much of their time to unlocking the secrets of this gentle giant that roams the oceans.

Citation:

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EXECUTIVE SUMMARY

In 2007 there were a total of 13 whale shark licenses in use, 10 for operations based at Tandabiddi, Exmouth and three based at Coral Bay. All licenses are due to expire on 31st December 2008 following an Expression of Interest process for the reallocation of existing licenses. A total of 424 day trips were conducted over the paying season and 670 over the entire season. There was a 21% increase in paying participants from 2006. The average number of passengers per tour during the paying season has increased from 14.5 to 16.5 since 2006. In 2007 the average duration of a tour increased by 4 minutes.

Approximately 15,000 'Experiencing Whale Sharks in Ningaloo Marine Park' brochures were distributed to the public during the 2007 whale shark season. Public information talks were held throughout the whale shark season, both in Exmouth and Coral Bay. The Whale Shark Interaction Training Course was reviewed and modified to be more user-friendly in 2007. 48 participants attended representing 8 whale shark licences for the 2007 season. DEC supported the annual Ningaloo Whale Shark Festival by pledging Gold Sponsorship and designing, organising and implementing the 'Discovery Centre' as a focal point for the festival. Two publications have been completed from the first whale shark conference in Perth 2005, a selection of papers was published in a special issue of the journal Fisheries Research and a supplementary proceedings.

Analysis of spotter plane data to determine search effort in the northern Ningaloo region seems to indicate that an intra-seasonal difference occurred in 2007 similar to that seen in 2003. Overall, search effort over the full season has remained relatively constant since 2003. In Coral Bay search effort data seems to indicate that more whale sharks were available for interactions in 2007 than in previous years.

DEC continued to support the collaborative study documenting the movements and behaviour of whale sharks that aggregate seasonally at Ningaloo Reef. Seven tags were deployed, one Pop-up Archival Satellite Transmitter tags (PAT tags), four SPLASH® tags (towed satellite tags) and two fin mounted satellite tags, in the vicinity of Black Rock and Norwegian Bay, Ningaloo Marine Park.

Photo identification is an extremely effective tool to establish estimates on whale shark numbers, their migration patterns, and morphological changes of individuals over time, by using whale shark spot pattern recognition. DEC is working in conjunction with industry videographers to gather images of every shark encountered during the season. These images are provided to Dr. Mark Meekan and ECOCEAN.

DEC continued with its operational program which is a combination of boat ramp inspections, boat patrols, industry vessel placement, and aerial surveillance. Wildlife Officer reports showed that a few incidents occurred this season including two breaches of licence conditions, one resulting in the suspension of a licence. Contact transition (handballing) guidelines were issued to operators this season and the procedure appeared to run well with no operator complaints. Changes to licence conditions to incorporate contact transition are being reviewed with the aim of being in place for the 2008 season. Continual errors in operator data recording show a need for assistance and participation by all operators in the whale shark interaction training course.

Recommendations:

Recommendation 1: Conduct Whale Shark Interaction Training Course prior to the start of the season.

Recommendation 2: DEC to continue working collaboratively with industry and researchers to improve image standards for use in photo ID programs and to ensure as many sharks as possible are captured during a season.

Recommendation 3: DEC to finalise collection of tissue samples in the 2008 season in order to assist Professor Jennifer Schmidt's global genetic study to determine whale shark population dynamics.

Recommendation 4: DEC to prepare a compliance works program for the 2008 season

Recommendation 5: DEC to increase its on-water presence during the 2008 whale shark season.

Recommendation 6: DEC to conduct a logbook training session during the whale shark interaction course to improve data quality.

1 INTRODUCTION

1.1 Background

The annual aggregation of whale sharks at Ningaloo were first documented in the early 1980's and through documentary makers and pioneers in the whale shark industry, Ningaloo is now recognised around the world as a hot spot for whale shark interaction and a model of successful nature based tourism. The Western Australian Department of Environment and Conservation (DEC, formerly the Department of Conservation and Land Management, CALM) was established under the CALM Act 1984 to fulfil a number of functions including responsibility for the conservation and protection of whale sharks (Colman, 1997) whilst facilitating the development of sustainable tourism (Chapman, 2002). DEC recognises how quality tourism can help educate and inform visitors, leading to a greater understanding and awareness of the natural environment (Colman, 1997). With the hunting of whale sharks in other countries still very much in the spotlight, understanding and protection of these gentle giants and their behaviours has never been more important. DEC's 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 DEC in meeting both its conservation and recreation objectives.

DEC 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.

Management of the whale shark interaction industry will continue to focus on education, research and monitoring, whilst working collaboratively with commercial operators.

1.2 Overview

Under the Whale Shark Interaction Management Program, the DEC 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 DEC 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 2007 there were a total of 13 whale shark licenses in use, 10 for operations based at Tandabiddi, Exmouth and three based at Coral Bay. All licenses are due to expire on 31st December 2008 following an Expression of Interest process for the reallocation of existing licenses.

2.2 Reasonable Extent

A cautionary approach to additional licenses and expansion of the industry has always been taken by DEC, despite the demand for whale shark interaction licences being high (Colman, 1997). In order to be equitable existing licences must be used to a reasonable extent throughout the paying season. According to licence condition 49, which states '*The licence holder must ensure that activities authorised under the licence are conducted each year of the licence period. If the licence is not used to a reasonable extent, as determined by the Executive Director, the Executive Director may cancel the licence*', licencee's must offer whale shark tours and be available to accept bookings for at least 50% of the paying season, be actively promoting tours to be available during the paying season, and have valid reasons for non operation.

The level of licence use throughout the paying season has increased over the last few years. The majority of licences in 2007 were being used to a reasonable extent, with ten licences participating in tours for over 50% of the paying season. Failure to complete logbook records for every day of the paying season in the correct manner was proving to be a consistent issue, however this has greatly improved in 2007 with all but one licence holder recording activities for each day of the paying season whether partaking in a tour or otherwise. Daily recording throughout the paying season assists DEC in determining whether a licence is being used to a reasonable extent and to minimise assumptions of why tours were not conducted and therefore maintain data standards.

2.3 Full Season Data

In 2004, DEC placed a greater focus on the requirement to collect logbook data for the entire whale shark season rather than just for the paying season (1st April – 31st May). This was due to the number of whale shark sightings in 2003 which in June/July were well up to those in April/May giving an indication that peak numbers do not necessarily occur at the same time period each season. To improve management strategies DEC needs to have a better understanding of interactions occurring throughout the season and in order to achieve this data must be collected for the entire season. With more detailed information it will be possible to better ensure that whale shark populations at Ningaloo are not being subjected to an unacceptable level of disturbance and that whale shark tourism in marine reserves is sustainable and equitable (Colman, 1997). The 2006 season was the first year full season trends were compared with paying season trends. Previous to that season reports have only reported on paying season data.

2.4 Whale shark tours

The actual number of tours conducted by all licensees during the paying season in 2007 has increased by 12% to the highest ever since logbook recording began in 1995 (Figure 1). Whale shark contact success rate during the paying season has decreased by 12%

since 2006 (Figure 2). This decrease indicates that whale sharks were less available for interaction in the 2007 paying season than in previous years. Overall there has been a slight decline in contact success rate since 1996.

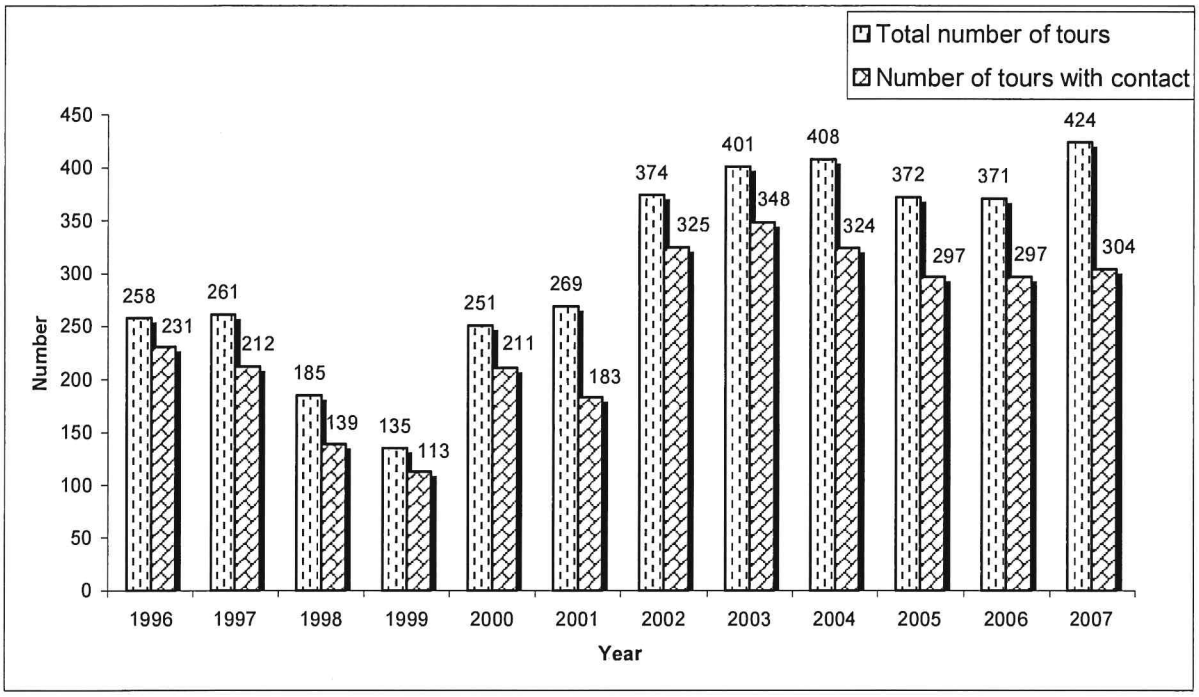

Figure 1: Comparison of whale shark tour numbers during the paying season with and without whale shark contacts from 1996 to 2007.

Outside of the paying season whale shark tours commenced from the 13th March and finished on the 29th July. Of the 670 tours conducted over the entire season, 246 were recorded outside of the paying season and of the 530 tours with contact, 226 were recorded outside of the paying season. Contact success rate over the full season was 78%, eight percent higher than that recorded during the paying season. This increase indicates that whale sharks were more readily available for interaction outside of the paying season.

The actual number of tours conducted by all licensees during the full season in 2007 has increased by 22% since 2006 from 520 tours in 2006 to 670 in 2007. This increase indicates that more tourists were participating in tours, both during the paying and full season, than in previous years. The increase in tours could also be affected by the decrease in contact success rate which would mean that there would be an increase in repeat trips due to the no sighting policy. Whale shark contact success rate over the full season has decreased slightly from 81% in 2006 to 78% in 2007. This decrease is likely to be due to inter-annual variation of abundance.

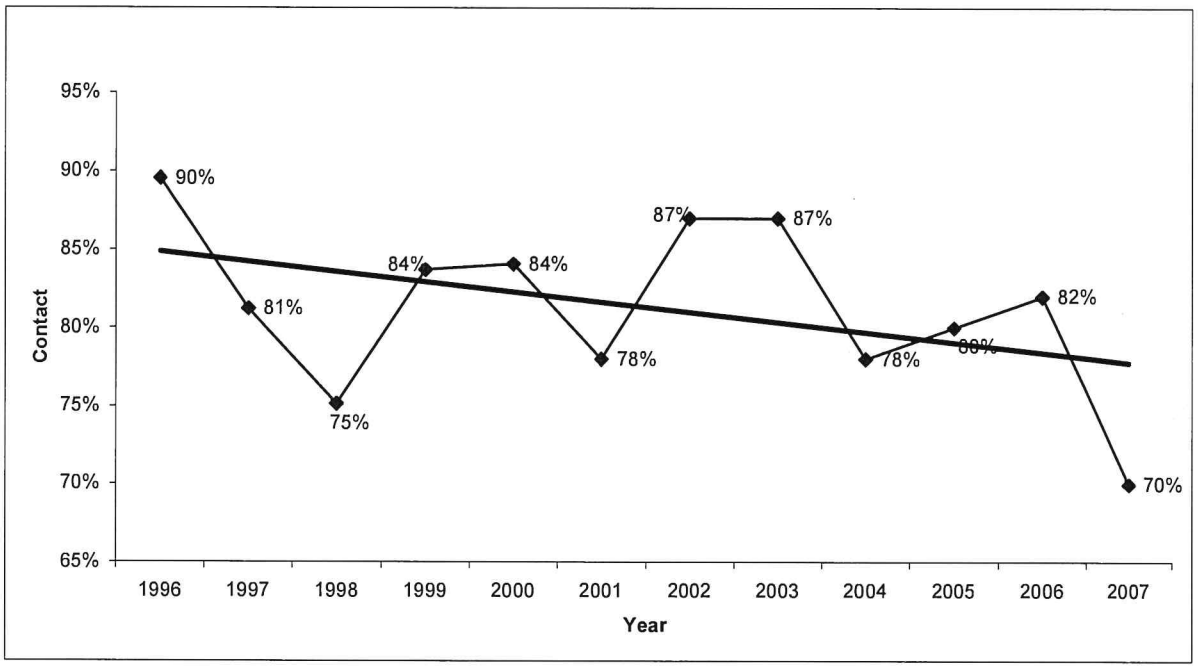

Figure 2: Whale shark contact success rate based on total trips during the paying season with and without interactions

2.5 Passenger levels

Since the introduction of licences in 1993, participation in the Ningaloo whale shark experience has generally been on the increase (Colman 1997), with a decline in 1999 which could be attributed to the impact of severe tropical Cyclone Vance which hit Exmouth on March 22. Since the all time peak in 2003 there has been a slight decline in paying passengers during the paying season. However in 2007 passenger levels increased by 23% from 2006 to the highest ever since logbook recording began in 1995 (Figure 3). Participation numbers are more than double that of ten years ago.

The 12% decrease in whale shark contact success rate in 2007 during the paying season was reflected by the 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 reduced the actual number of passengers participating in whale shark tours during the paying season in 2007 by 21% to 5953 persons (made up of both adults and children) (Figure 3).

In 2007 the total number of passengers participating in the whale shark experience over the entire season was 10,993. Of these passengers 9646 were paying participants. Outside of the paying season the number of passengers was just under half that recorded during the paying season.

Passenger levels over the full season increased in 2007 from 2006 with a 31% increase in the number of paying passengers. This again indicates that more tourists were participating in the whale shark experience than in previous years. The season lasted slightly longer in 2007 compared with 2006 and may have contributed to the increase.

The average number of passengers per tour during the paying season in 2007 (16.5) has increased by 12% from 2006 (Figure 4). This is a reflection of the increase in the number of tours and passenger levels in 2007. Over the full season the average number of passengers per tour was 16.4 in 2007 which has increased from 14.6 in 2006.

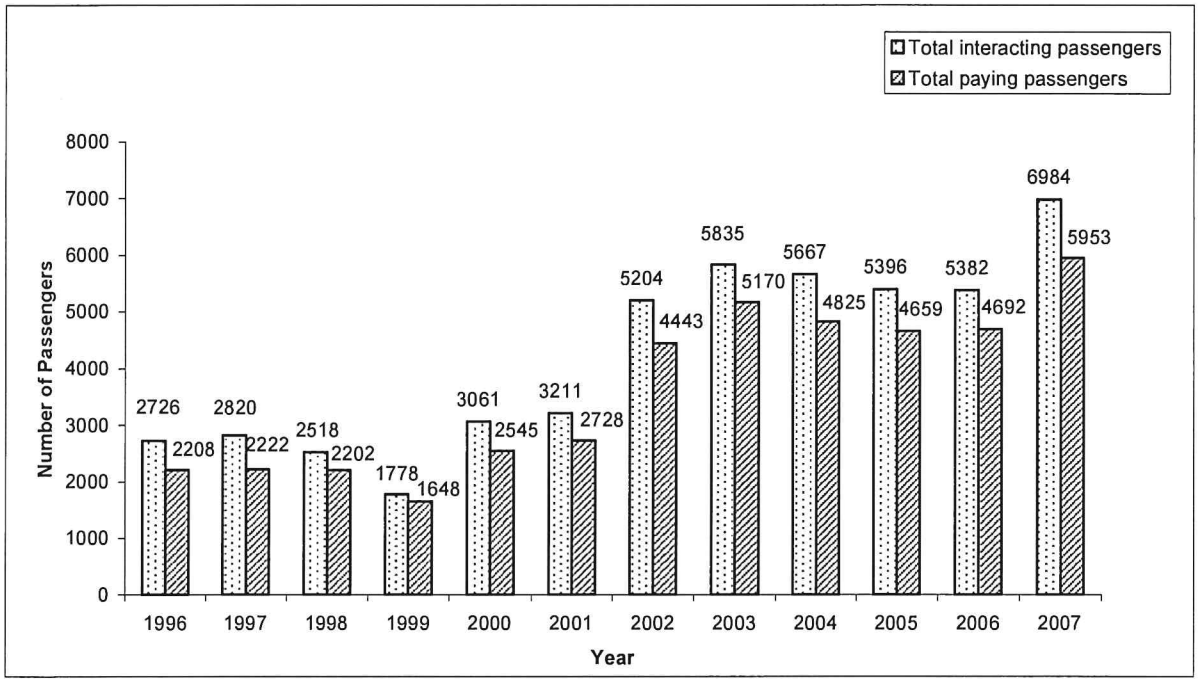

Figure 3: Total number of interacting and paying passengers participating in the Ningaloo Whale shark experience during the 'paying season' from 1996 to 2007

Overall the increase in the number of tours and the average number of passengers per tour highlights that the industry has still not yet reached its carrying capacity.

2.6 Whale Shark Tour Time

The average duration of a whale shark experience trip during the paying season has increased by 4 minutes from last year's time of 6 hours and 30 minutes in 2006 to 6 hours and 34 minutes (Figure 5). Overall, the average duration of a whale shark experience trip has increased by one and a half hours since 1996.

Over the full season the average duration of a whale shark experience trip was 5 hours and 43 minutes. This has decreased by three quarters of an hour since 2006. The decrease in tour time over the full season compared with the paying season is likely due to the fact that whale sharks were more abundant and available for interaction. This would mean that whale sharks were encountered sooner and passengers satisfied quicker resulting in shorter tour times.

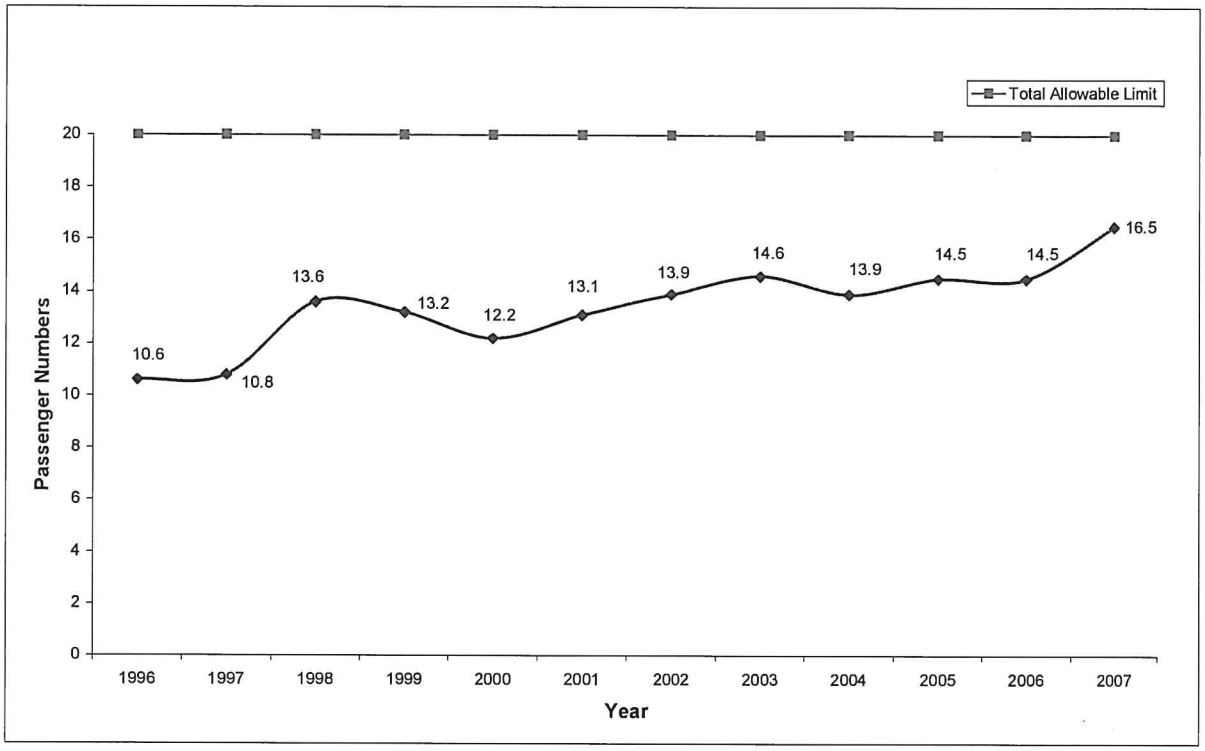

Figure 4: Average number of passengers per tour from 1996 to 2007 and the total allowable limit of passengers per tour

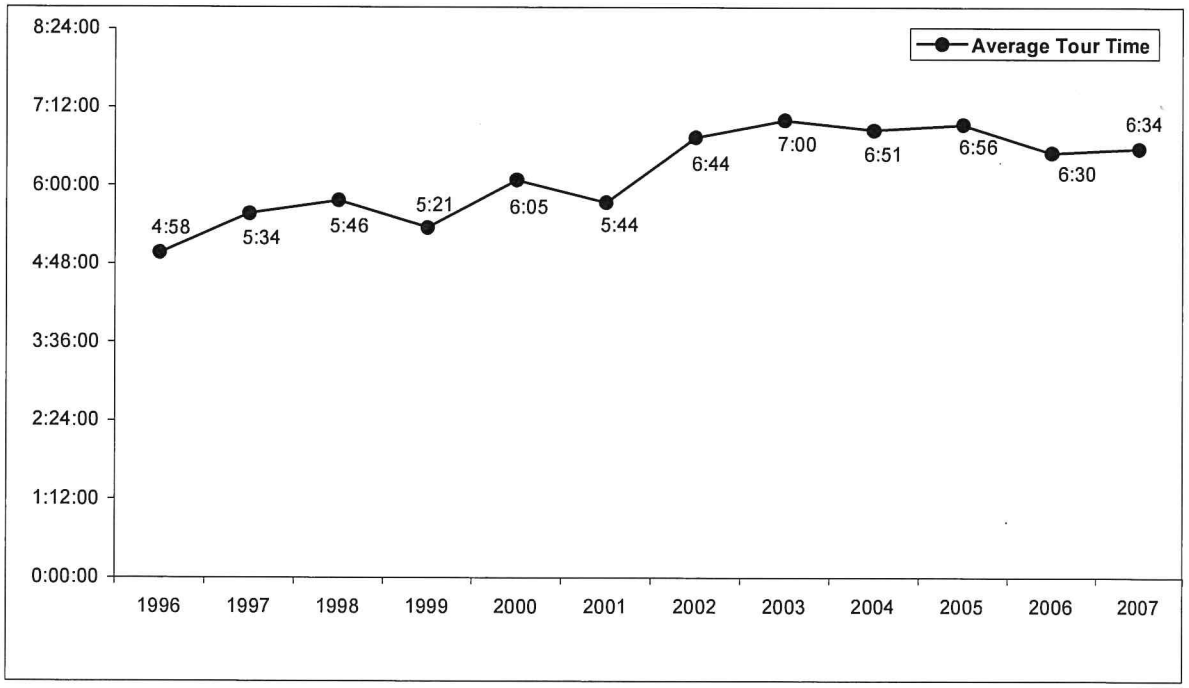

Figure 5: Average whale shark experience tour time from 1996 to 2006

2.7 Reported Whale Shark Interactions

The location of all reported whale shark interactions is shown in Figure 6. In 2007 additional aerial surveys were conducted between Tuerquoise Bay and Black Rock, an area that is not covered by spotter planes or industry vessels, to determine whether whale sharks frequent this area.

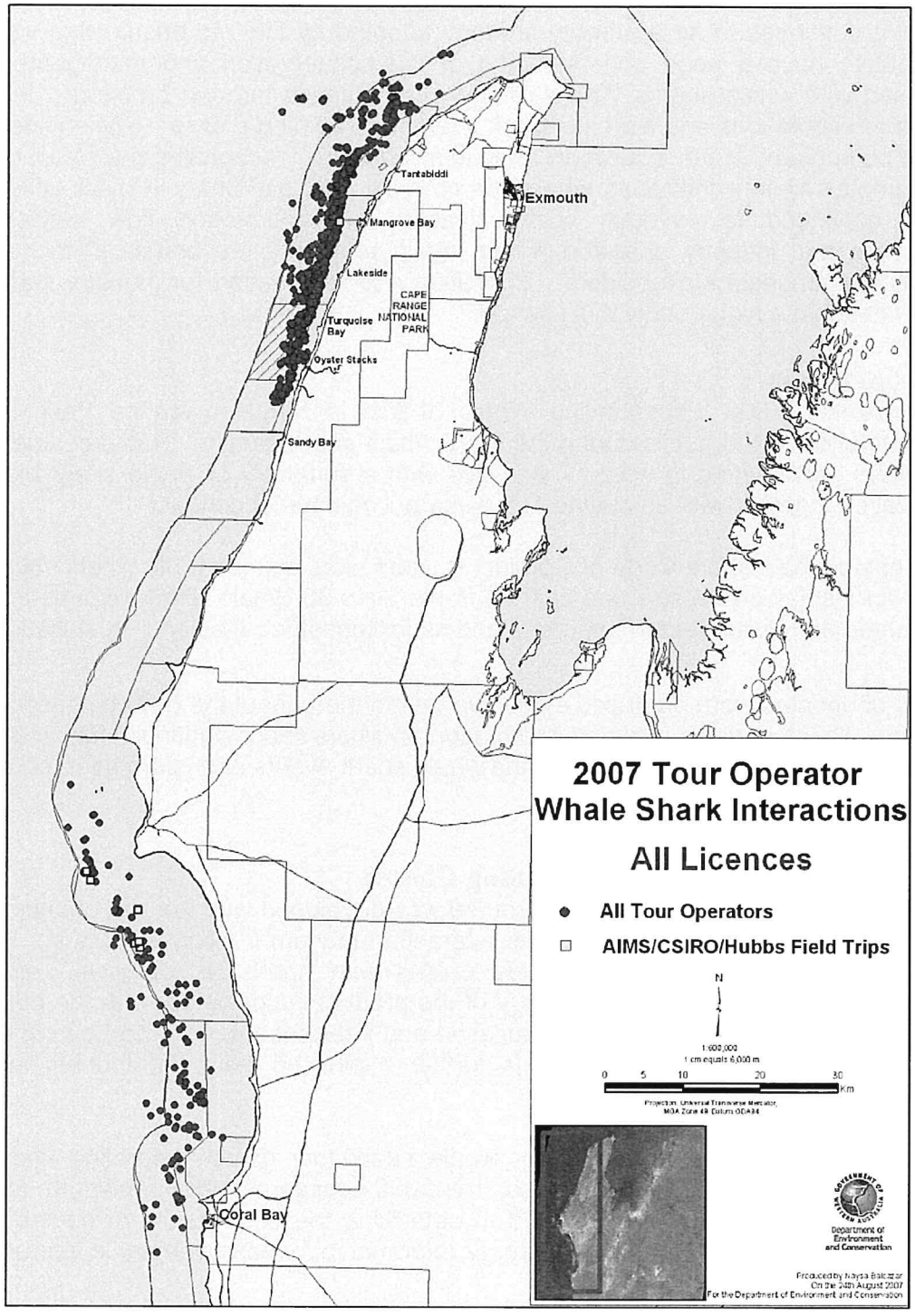

Figure 6: Location of reported whale shark interactions for the 2007 season

3 EDUCATION

Education continues to be a primary strategy adopted by DEC to ensure that visitors and stakeholders have a good understanding of the conservation and management issues associated with whale sharks. This strategy was achieved through brochures, interpretive material, presentations and a whale shark interaction training course. Stakeholders are an integral component in the education of visitors and DEC recognises the need to support and promote relevant initiatives whenever possible. Whale Shark Project Officer, Emily Wilson, continued to maintain communication and information flow between DEC, researchers and industry operators which again proved to be beneficial to maintaining relationships amongst stakeholders. Education and information for industry staff and the public was again a high priority this season.

3.1 Print media

Approximately 15,000 'Experiencing Whale Sharks in Ningaloo Marine Park' brochures were distributed to the public during the 2007 whale shark season. This brochure provides passengers participating in whale shark trips with 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 30 Whale Shark Experience posters were printed and distributed to operators and major tourist facilities and organisations.

A series of updates were produced every two weeks throughout the paying season for all operators. These updates included information on whale shark sightings, size and sex; passenger numbers, current research and whale shark events and information of relevance (Attachment A).

3.2 Whale Shark Interaction Training Course

The Whale Shark Interaction Training Course was developed with the aim of improving and streamlining the delivery of whale shark interaction tourism in Ningaloo Marine Park. The purpose of the course was to provide guides with hands-on, practical training in a consistent manner to ensure the delivery of the product is consistent with the principles of eco-tourism, to increase the level of education and interpretation provided during tours and to ensure impacts on whale sharks is further minimised from the tourism industry in Ningaloo Marine Park.

The course was designed to cater for whale shark tour guides operating under CALM Whale Shark Commercial Tour Licences. The 2006 season provided a platform for the trial of this course which enabled DEC staff to determine the best means of course structure and delivery and to allow guides to feedback information for improvement in future seasons.

In 2006 the course was conducted during a weekend workshop which consisted of one day theory based, and the second day boat based. Following feedback from the industry the course was modified for the 2007 season to be shorter, more flexible for operators and easier to deliver.

The course had the following objectives for the 2007 season:

- To improve whale shark guide knowledge of whale sharks and their occurrence at Ningaloo Reef
- To improve the implementation of whale shark interaction tours so as to minimise potential adverse impacts on whale sharks
- To increase compliance with licence conditions and the completion of log books
- To improve relationships between DEC and industry by conducting training sessions individually to each operator
- To create an environment for issues and concerns to be raised

There were a total of 48 participants representing eight whale shark licences. These included Three Islands Marine, Ningaloo Blue, Ningaloo Reef Dreaming, Coral Bay Adventures, Ningaloo Reef Dive and Exmouth Dive centre (three licences).

Following recommendations from the 2006 season to provide more visual aids and improve the delivery of the course, a whale shark interaction training DVD was produced. The aim of the DVD was to provide the practical hands on aspect of the course that was previously covered during the boat based day of the 2006 training course.

A whale shark interaction CD Rom was also produced this season for all participants which included course notes, season report, information sheets, relevant legislation, course presentation and useful web links.

Overall the feedback received from the operators and participants was positive, operators liked the flexibility of when and where to have the course and that the course was delivered individually for operators so all staff could attend. Industry staff all agreed the course should be held prior to the start of the season as once the season was underway they had little time other than evenings, however conducting the course at night was tiring as staff had been working all day.

Considering the increase in participants from 9 in 2006 to 48 in 2007 the course was successful in its objectives and operators showed huge support for the project. The changes to course length, structure and flexibility are likely reasons for this increase in participation. This development in course design should be maintained and improved on in 2008 for the course to evolve further.

Recommendation 1: Conduct Whale Shark Interaction Training Course prior to the start of the season.

3.3 Whale Shark Festival

The 2007 whale shark festival was held on the 4th – 6th May at Talanjee Oval, Exmouth. DEC was pleased to be able to support the event again this year as Gold Sponsors. Following feedback from the 2006 festival, the Ningaloo Whale Shark Festival Committee approached DEC in regards to organising a Whale Shark Discovery Centre as a main feature of the festival. This was to ensure the festival had a greater focus on whale shark education and information.

The Discovery Centre (Figure 7) was housed in a 20m x 10m marquee, with banners and signs erected at the entry point. Once inside, the marquee was divided into several sections each containing specific information about whale sharks including:

- whale shark biology and ecology;
- the reason whale sharks come to Ningaloo Marine Park;
- the size of whale shark populations;
- where whale sharks go once they leave Ningaloo Marine Park;
- where else whale sharks are recorded; and
- whale shark threats, conservation and management.

Presentations were given throughout the day with representatives from whale shark management, tourism and research. Visitors were provided with the opportunity to take in a whale shark documentary in the Cinema Corner. Readings of the popular children's book Jinormous Jack by Josephine Barry were conducted throughout the day. A competition was held in which visitors could win a digital camera and underwater housing kindly donated by Fuji.

The Discovery Centre proved to be a huge success with over 1000 people passing through the marquee between 11am and 5pm on the main day of the festival.

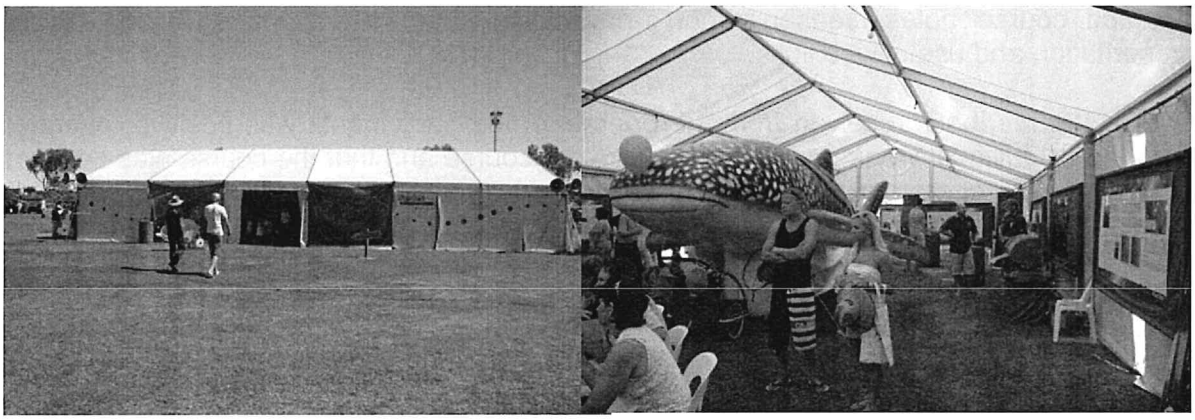

Figure 7: DEC Whale Shark Discovery Centre at the 2007 Whale Shark Festival

Of those visitors who submitted competition forms (500), the greatest proportion of people through the Discovery Centre were from the Exmouth area (approximately 45%). Roughly another 12% were from regional Western Australia, including 5% from the north-west of the State. Visitors from the Perth Metropolitan Area comprised 11%, interstate visitors roughly 11%, and international visitors approximately 2%. Around 14% of the entry forms didn't contain sufficient contact details to determine the origin of the person who submitted the form.

On the day of the Festival, a large team of DEC and ECOCEAN staff assisted with setting up the marquee, greeting visitors, manning displays, handing out giveaways, conducting story times, overseeing competition forms, and pulling down and packing up the displays. Without their assistance, the Whale Shark Discovery Centre would not have been possible.

The Whale Shark Discovery Centre achieved its goal of providing the festival with a greater focus on whale shark education and information. The Centre proved to be an important component of the whale shark festival bringing together all aspects of the unique whale shark aggregation at Ningaloo, tourism, management, research and conservation.

3.4 Presentations

Two whale shark specific talks were conducted at Milyering Visitors Centre this season, one during the Easter holidays and one during the July mid year break. These talks were attended by approximately 20 people each time and covered information on whale shark biology, ecology, distribution, research and threats. Local whale shark information was given along with the latest international research and conservation projects.

Evening weekly whale shark talks were conducted again in Exmouth, throughout the 2007 season, as part of DEC's education strategy. The talks proved to be a great success and over the 10 nights, 348 people attended the talks averaging at 35 people a night. This is a huge increase from the average of 12 people a night in 2006 indicating that an increasing amount of visitors are seeking out additional whale shark information to enhance their experience.

The talks were popular with tourists and locals and proved successful in increasing public awareness. Talks were held every Monday night throughout the season at the Pot Shot Resort by Whale Shark Project Officer Emily Wilson (DEC). The aim of the talks was to give the public the opportunity to learn all the latest whale shark information from around the world along with what we know about the whale sharks at Ningaloo. The majority of people attending the talks had either been, or were planning to go on a whale shark experience tour.

3.5 Whale Shark Conference Articles

Two publications have now been completed from the first ever International Whale Shark Conference which was held in Perth, Western Australia in 2005. Firstly, a selection of papers was published in a special issue of the journal *Fisheries Research.*

> T.R. Irvine and J.K. Keesing (Eds.) (2007) *Whale Sharks: Science, Conservation and Management. Proceedings of the First International Whale Shark Conference, 9-12 May 2005 Australia. Fisheries Research* 84(1) special issue.

These are available online at www.sciencedirect.com

A supplementary proceedings consisting of a second selection of papers and summaries of the conference and workshops, including outcomes since the conference, was published by CSIRO, Australia:

> T.R Irvine and J.K. Keesing (Eds.) (2007). *The First International Whale Shark Conference: Promoting International Collaboration in Whale Shark Conservation, Science and Management. Conference Overview, Abstracts and Supplementary Proceedings.* CSIRO Marine and Atmospheric Research, Australia. 98p.

This supplementary proceedings can be downloaded at http://www.srfme.org.au/ (PDF 2.5MB)

Marine Parks Coordinator Roland Mau presented a paper at the conference (Attachment B) which can be found in the supplementary proceedings:

Mau, R. & Wilson. E. (2007). *Industry Trends and Whale Shark Ecology based on Tourism Operator Logbooks at Ningaloo Marine Park. The First International Whale Shark Conference: Promoting International Collaboration in Whale Shark Conservation, Science and Management. Conference Overview, Abstracts and Supplementary Proceedings.* CSIRO Marine and Atmospheric Research, Australia. 45-52p.

4 RESEARCH AND MONITORING

4.1 Whale Shark Interaction Logbook Analysis

The Whale Shark Interaction Logbook completed by operators is an important component in the monitoring of whale shark and swimmer interaction. By recording such information the industry can assist in the collection of useful observational and management data (Colman, 1997). Log book records have limitations in deriving valid scientific data due to the subjective nature of the data collection process, the collection of data by untrained observers and variation in the quality of the data recorded (Colman, 1997), however the data can provide information on the status of the industry, seasonal fluctuations and also provides essential feedback for the commercial operators (Colman, 1997). In 2002 the Logbook was reviewed to improve the quality and usefulness of the data (Chapman, 2002) and subsequently changes were made. A review of all logbook data is pending, in order to refine the data collected by operators and to remove data fields that are currently not providing any useful data or that can be collected by alternative methods.

4.1.1 Response to swimmers

Observations of behaviours recorded on log sheets can assist management by identifying any long term changes in the reactions of whale sharks when approached by vessels and swimmers. However, this data has been of limited use in management and research so far and is currently being reviewed to establish if it is suitable for monitoring whale shark and swimmer interactions and to determine whether collection of this behavioural response data should be maintained, modified or discontinued. Aerial surveys were conducted this season to trial whether this information could be more accurately collected by air.

4.1.2 Contact with whale sharks

The total number of whale shark contacts during the paying season has decreased by 8% from 493 in 2006 to 455 in 2007 (Figure 8). The total number of whale shark contacts during the full season has increased by 36% from 709 in 2006 to 1105 in 2007. Of the 1105 contacts in 2007, 650 were outside of the paying season. This indicates an intra seasonal variation similar to that seen in 2003 when a large proportion of sightings were recorded outside of the paying season.

The average number of interactions per tour has also decreased from 1.4 to 1 during the paying season and 1.7 to 1.5 during the full season. These figures appear to indicate that whale sharks may have been less available for interaction this year compared with previous years.

From a management perspective abundance needs to be determined in order to assess fluctuations in whale shark numbers and to determine if detrimental effects are occurring to the Ningaloo population. Photo identification (Section 4.5) and aerial survey analysis (Section 4.3) is helping DEC to achieve this. It is also important to consider the unit search effort each season (e.g. flying hours of spotter planes) when assessing possible causes for fluctuations in abundance and interactions (Section 4.2).

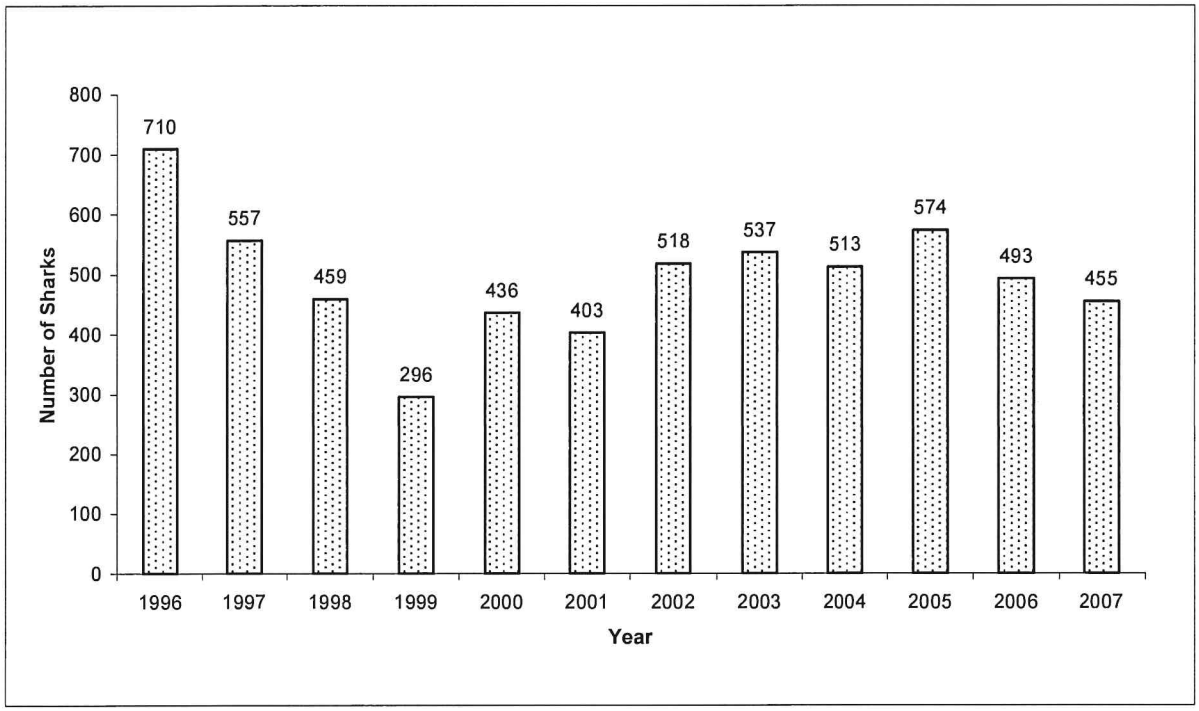

Figure 8: Total number of contacts with whale sharks during the paying season from 1996 - 2007.

4.1.3 Whale shark logbook size and gender data

Size of whale sharks and the possible 'shrinking in size' continues to be a much publicised issue and accurate lengths of whale sharks need to be recorded in order to confirm this declining trend. Length has always been estimated by industry staff and therefore analysis of size data must be treated with caution as recording of data has several potential sources of error. Logbook records show a high level of inter-observer variability for length of the same sharks encountered. This data also represents the total number of encounters, as it does not take into account multiple encounters with the same shark by different vessels, either on the same day or on different days.

Gender data also has the same potential sources of error but added to this the possibility of mis-identifiaction of immature males for females whose claspers are very small and may be missed by less experienced guides which may explain the inter-observer variability of sexes. It is thought sexual maturity in both sexes may not occur until the sharks are between eight and nine metres in length (Colman, 1997; Norman, 1999) therefore the majority of whale sharks encountered at Ningaloo are likely to be immature. Since 1996 the majority of whale sharks encountered have been male (Figure 9) with a sex ratio ranging from around 2:1 to 4:1.

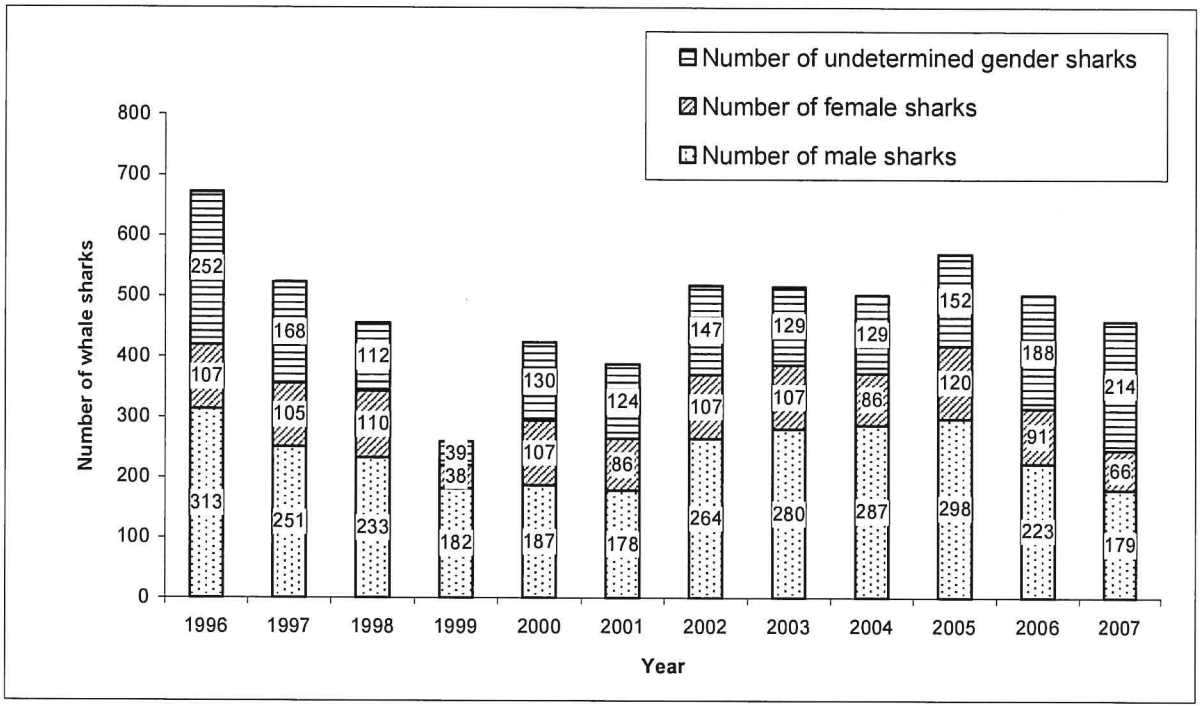

Figure 9: Total number of male, female and undetermined whale sharks during the paying season from 1996 – 2007

Average length of whale sharks appears to have levelled off in 2007 at 5.3 metres (Figure 10). However average length is still almost two metres less than it was in 1996. Interestingly male and female average lengths follow differing trends, with male average length decreasing by half a metre and female average length increasing by half a metre (Figure 10). There appears to have been an increasing proportion of smaller individuals encountered at Ningaloo over the last couple of years with reports of individuals being as small as two metres. The largest shark measured by industry staff this season estimated at 13 metres. Several large females were recorded this season and if they remained in the area to be recorded more than once this may have skewed the results and caused the increase in average length of females.

Hunting still continues in other parts of the world and it is feared that this practice may be responsible for the removal of larger individuals from the population. However, it may just be that larger individuals visit different areas for mating or birthing and that Ningaloo Reef is simply an aggregation site for juvenile whale sharks. It is also possible that the larger sharks may be in the area but remaining at depth and/or further offshore where they remain undetected. Larger individuals have been reported from Taiwan, India, the Galapagos Islands and Mexico, perhaps these are areas where larger individuals aggregate. In order to determine population dynamics and movements on a local and global scale further research through photo identification, genetics and tagging must be undertaken to ensure

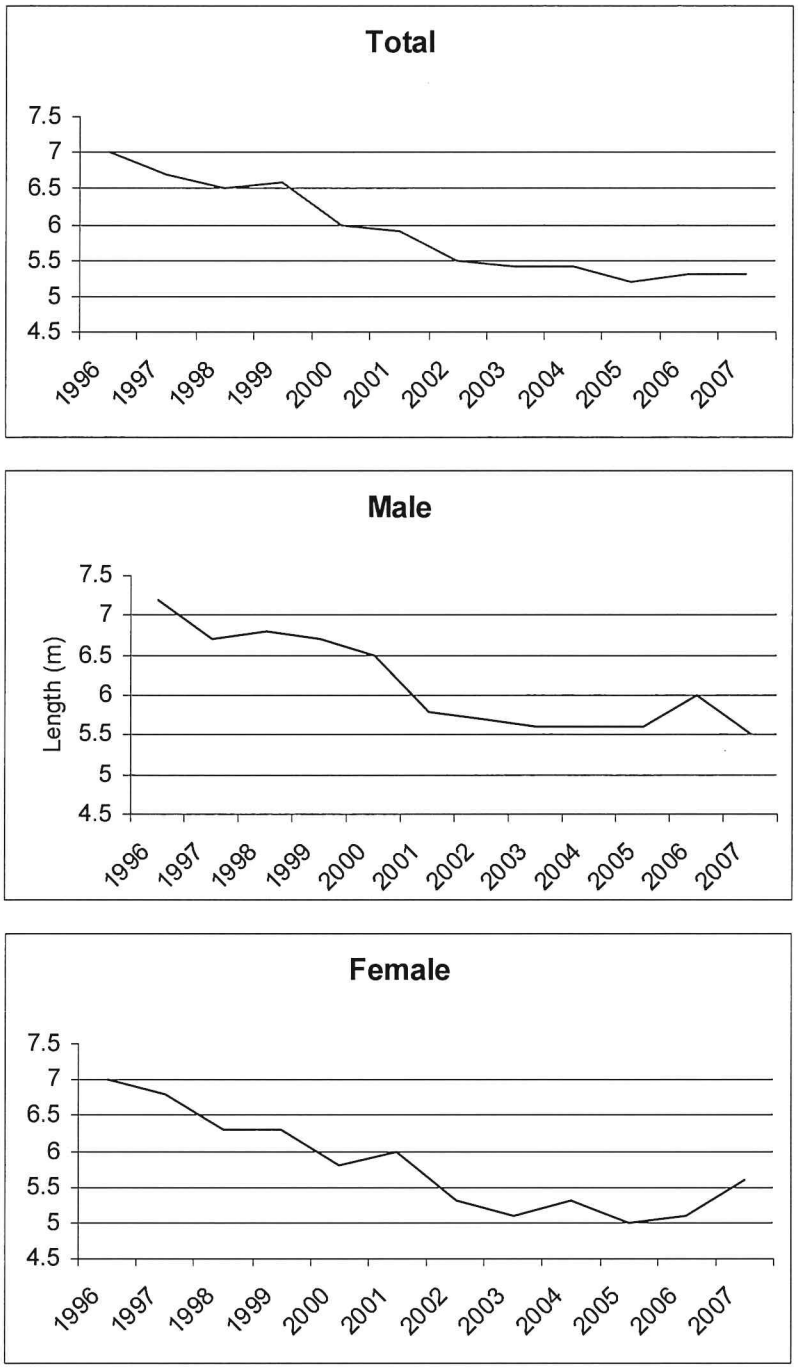

Figure 10: Average whale shark size from 1995 to 2007 from Industry Logbook data

whale shark abundance can be monitored, and if a decline in larger individuals is occurring, measures can be established to counteract such trends. Conservation initiatives and global campaigns are assisting in decreasing targeted fisheries and raising public awareness of the plight of whale sharks around the world, and assisting in efforts to further support international protection of the species.

4.1.4 Direction of Travel

Clear trends become apparent when the logbook data for direction of travel of whale sharks is plotted and compared across years 2001-2007. There has been a consistently strong trend for direction of travel along the north-south gradient. This year showed a greater northward bound favour as in previous years (Figure 11).

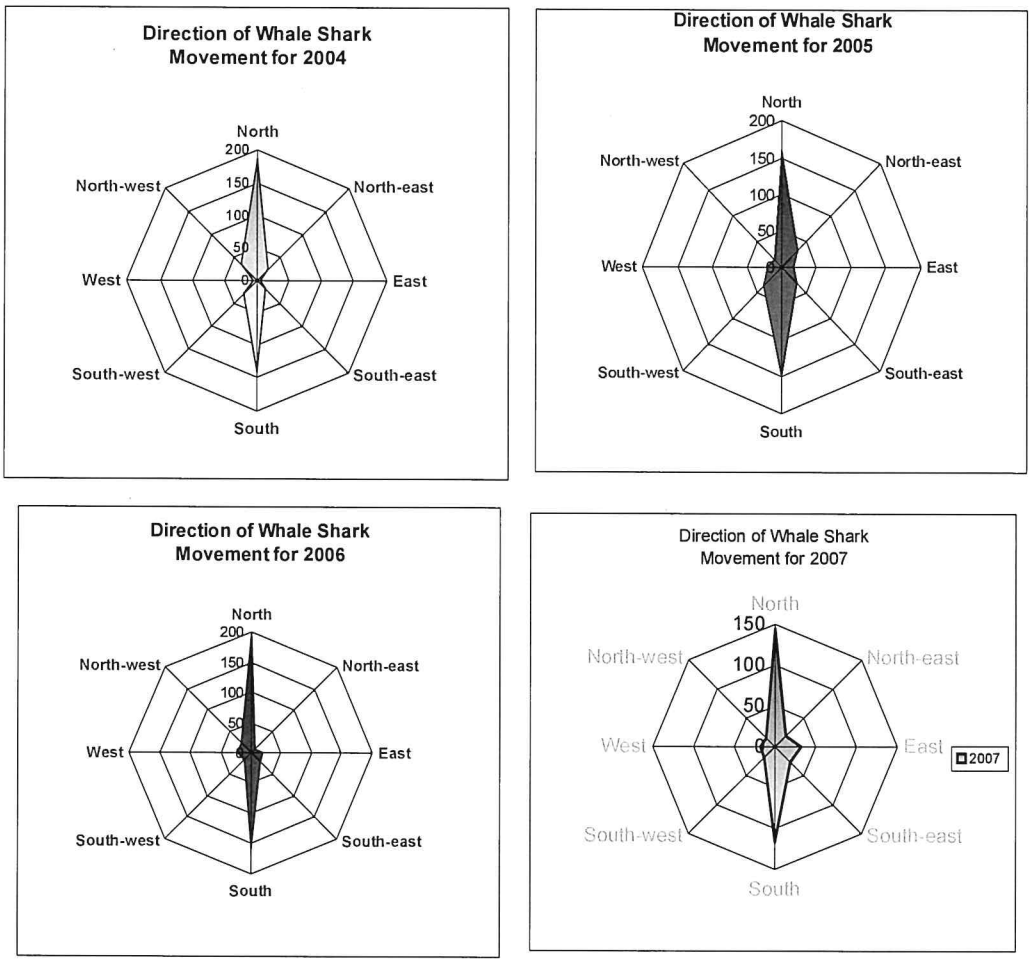

Figure 11: Webs depicting the pre-dominant direction of travel of whale sharks (2004-2007)

Whale sharks are likely to follow currents running along the back of the reef in search for food. We now know that whale sharks travel between Tantabiddi, Exmouth and Coral Bay as individuals have been matched through photo identification (Section 4.5). It is thought that as the season progresses, whale sharks travel and aggregate further north along the Ningaloo Reef before heading offshore to other waters.

4.2 Whale shark search effort

The ratio of sharks sighted in relation to the time spent searching (i.e. search effort) is an important factor in monitoring whale shark populations, as increases or decreases in search effort over years may indicate interannual variation in abundance and assist in determining if whale shark populations are being subjected to an unacceptable level of disturbance. It

was highlighted by Wilson *et al,* in 2005 that search effort must be calculated using spotter plane flying hours as they are actively searching for whale sharks. 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.

Table 1: Comparison of search effort (flight time per sighting) from Exmouth and Coral Bay

Location	Exmouth	Exmouth	Coral Bay	Coral Bay
Year	Full Season (hours:minutes)	Paying season (hours:minutes)	Full Season (hours:minutes)	Paying season (hours:minutes)
2002	02:20	02:15	No data	No data
2003	01:40	03:30	No data	No data
2004	01:25	01:40	No data	No data
2005	01:00	01:10	02:50	02:35
2006	01:35	01:55	02:50	02:55
2007	01:30	03:15	02:20	02:30

NB: Data rounded to nearest 5 minute interval

4.2.1 Northern Region, Tantabiddi, Exmouth

Search effort over the full season in 2007 has decreased slightly since 2006 and when comparing with data since 2003 has remained relatively constant with the exception of 2005 when search effort decreased to one hour, indicating whale sharks were more abundant or available than in other years (Table 1). Search effort during the paying season has increased in 2007, highlighting that an intra-seasonal difference has occurred similar to that seen in 2003 when a large proportion of sightings were recorded outside of the paying season.

Full season search effort data is important for determining changes in whale shark abundance as intra seasonal differences may occur, however comparing full season search effort data with that recorded for the paying season is a good way to determine if any intra-seasonal differences have occurred. Whenever analysing logbook data for inter-seasonal trends in whale shark abundance, intra-seasonal geographical distribution and/or an intra-seasonal temporal abundance variation must be considered.

The reduction in search effort recorded in some years may mean that whale sharks were less abundant than in previous years, however it may be that whale sharks spent less time at or near the surface and therefore were less available for spotting this season than in previous years. There could be many factors that would influence the time whale sharks spend at the surface, one being the distribution of food throughout the water column. Whale sharks are actively seeking food whilst at Ningaloo and therefore if the food source is distributed at depth, there is no reason why whale sharks would have to come to the surface as they have no physiological requirement to do so.

4.2.2 Southern Region, Coral Bay

Search effort data for Coral Bay over the full season has decreased since 2006 indicating that whale sharks were more abundant and available for interactions in 2007 than in previous years (Table 1). Search effort data during the paying season shows the same trend. Overall the search effort data is similar both during the paying and full seasons and

this is likely to be due to the fact that the whale shark season has ended shortly after the end of May (end of paying season). In 2007 whale sharks were sighted up to and including the 11th June.

Before changes in abundance can be determined, daily whale shark dive patterns and behavioural responses need to be better understood. By understanding dive patterns it would be possible to determine the proportion of time whale sharks spend at the surface, i.e. the 'spottable' whale sharks, and this along with understanding behavioural responses to oceanographic features and food availability, may explain the perceived fluctuations in abundance or in other words the variation in 'spottable' whale sharks. This emphasizes the need for research into Pop off Archival Tagging (PAT) and tracking studies (section 4.3.2) and also understanding oceanographic processes and how they may influence whale shark behaviour.

4.3 Aerial surveys

Dedicated scientifically designed aerial surveys are used regularly to estimate the size and distributions of populations of marine wildlife around the world (Patton & Marsh, 2005). Aerial surveys of whale sharks at Ningaloo Reef have been conducted since 1990, but are of limited use because of variations in survey design. None of these surveys have produced absolute abundance estimates for whale sharks at Ningaloo Reef. Instead they provide limited data on the seasonal occurrence and relative abundance of whale sharks, and suggest possible aggregations of sharks during at least part of the whale shark season at Ningaloo (Hodgson & Marsh, 2006). DEC recognises the importance of aerial survey data in assisting with efforts to determine the abundance and distribution of whale sharks at Ningaloo Reef and has tried to adopt a standardised and consistent approach as part of the management program. The dedicated aerial survey report, following the dedicated aerial surveys, recommends that methods other than dedicated aerial surveys may be more cost effective.

4.3.1 Spotter Plane data collection

DEC continued with its collection of GPS and track data through the cooperation of spotter plane pilots from NorWest Airworks. Spotter pilots record GPS positions for all whale sharks sighted throughout the season. These positions along with track log data and the data pilots record for company records, provides us with information such as the total number of sharks sighted and distribution throughout a season. The spotter plane aerial data also allows us to calculate 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 abundance (Section 4.2). Furthermore, the collection of this data may assist in determining the natural variation in whale shark appearance. Having pilots collect GPS data for all whale sharks sighted and comparing that with vessel data, allows us to determine the proportion of the population that are subject to human interaction.

Collection of aerial track data allows the search area to be determined. From flight tracks recorded in previous years, areas of interest that had subsequently not be surveyed, were identified. To create a wider picture of whale shark distribution, recommendations were made to conduct targetted aerial surveys to be used in conjunction with spotter plane data. This would allow search effort for certain areas within Ningaloo Marine Park to be calculated and comparisons made intra-annually and inter-annually to determine seasonal

geographical distribution. Following these recommendations DEC conducted aerial surveys in the area between Turquoise Bay and Black Rock, which has been identified as an area that is not covered by spotter planes or industry vessels, in order to improve our understanding of whale shark distribution along the entire Ningaloo coast.

Spotter plane data has proved to be a valuable part of the whale shark management program and would not be possible without the assistance of NorWest Airworks and spotter pilots. Data from the 2007 season is currently being analysed as part of the full aerial survey program (dedicated and spotter surveys) and will be presented at a later stage in a separate report.

4.3.2 Dedicated aerial surveys

In 2006 a post-doctorate student, Amanda Hodgson under the supervision of Helene Marsh (Professor of Environmental Science), was funded by DEC to design an aerial survey methodology to determine the distribution, density and behaviour of whale sharks in the Ningaloo Reef region. Nine surveys were conducted in 2006 between April and August. The data has been analysed and it was determined that because of the low number of whale sharks sighted during surveys, it was not appropriate to estimate the whale shark population for the Ningaloo area on the basis of these surveys. For the full report see (Attachment C). Because of this the dedicated aerial surveys were not continued in 2007.

4.4 Movement and behaviour studies

In 2007, DEC continued support of a collaborative study involving Dr Steve Wilson (University of New Hampshire), Dr Brent Stewart (Hubbs-SeaWorld Research Institute, CA), Jeffrey Polovina (NOAA Fisheries, USA), Dr Mark Meekan (Australian Institute of Marine Science) and Dr John Stevens (CSIRO Marine Research). The project, initiated in 2003, aims to document the movements and behaviour of whale sharks that aggregate seasonally at Ningaloo Reef. A progress report from the 2007 data is attached (Attachment D).

In summary, seven tags were deployed, one Pop-up Archival Satellite Transmitter tag (PAT tag), four SPLASH® tags (towed satellite tags) and two fin mounted satellite tags, in the vicinity of Black Rock and Norwegian Bay, Ningaloo Marine Park. An animal borne video camera and data recording system (VDAP) was also deployed on a shark during the field trip. The function of the camera is to get a glimpse of what the whale shark can see when it is diving and also to determine its three-dimensional dive path. Field work occurred from the 23rd April – 3rd May, 29th May – 3rd June and 29th – 30th June.

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 five to eight month intervals. Towed satellite tags are programmed to sample and store measurements of hydrostatic pressure, water temperature, and ambient light levels every 60 seconds and to transmit data on maximum dive depth, dive duration, time at depth and time at temperature to satellites when the transmitter float was at the surface (Figure 12). Fin mounted satellite tags are the latest satellite tags that have been designed to overcome the issue of towed SAT tags getting snagged or caught up in floating weed as was

observed in 2005 (Figure 12). They are attached using the same method as the towed SAT tags but the transmitter is attached directly to the D-pin which is attached to the leading edge of the dorsal fin. The aerial should then break the surface once a whale shark comes to the surface allowing data to be transmitted to orbiting satellites.

One towed satellite tag detached prematurely this season but was located and recovered in Shark Bay. One of the fin mounted tags is not responding due to a design failure whereby the antenna was not upright and therefore unable to clear the surface to transmit to satellites. This highlights the difficulties involved in conducting tagging on this species. Satellite tags are expensive and have a high failure rate therefore require constant improvements and advances in technology.

A number of reports of whale sharks with tags or tag remnants have been given to DEC from industry spotters who have resighted them through the season. All reports and any photos obtained are of great value in assessing tag condition and may suggest reasons for tag failure.

Tagging and tracking studies provide valuable information on whale shark migration, dive profiles and behaviour. This information allows us to gain a better understanding of whale shark abundance and distribution which is necessary if we are to appropriately manage whale shark interactions at Ningaloo. All tagging undertaken by AIMS is carried out under permit and within animal ethics guidelines. Although the tagging is invasive, it is carried out with the intention of determining where Ningaloo sharks go once they leave the area and if and where they may be hunted (M. Meekan, pers. Comm.).

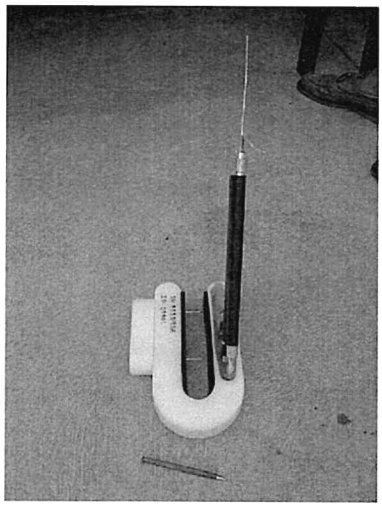

Figure 12: Fin Mounted Satellite Tag

4.5 Whale shark photo identification

Photo Identification is an extremely effective tool to establish estimates on whale shark numbers, their migration patterns, and morphological changes of individuals over time, by using whale shark spot pattern recognition. The 2007 Season has seen an increased focus on the capability and capacity of photo identification of whale sharks as a research and monitoring tool, due to it being non-invasive and universally accessible (web based). A

collaborative approach has been adopted by DEC to aid the advancement of photo ID in order to assist in the management of whale shark interactions at Ningaloo Reef. Industry staff, who have the capability to photograph every shark encountered during the season, are working with DEC by providing footage which is used to facilitate photo ID projects in Australia. 2007 has seen the continuation of a photo ID monitoring program, through ECOCEAN and Earthwatch, utilising international volunteers to collect, process and analyse images in order to collect baseline data on whale sharks at Ningaloo Marine Park. Two papers have been published this year in regards to photo ID (Attachment E & Attachment F).

4.5.1 DEC whale shark photo ID

In 2007 DEC continued with the whale shark photo ID program in which whale shark videographers/operators could enter into an agreement with DEC, in conjunction with their film permit, to provide whale shark footage for the sole purpose of assisting with photo ID efforts. The aim of the project was to work in conjunction with industry to photograph every shark encountered throughout the season to determine the following:

- reliable and accurate predictions of the actual number of individuals encountered in the season,
- the number of individuals sighted in the marine park that have not previously been recorded,
- an estimate of the number of individuals that are returning to the marine park.

This information would allow DEC to monitor fluctuations in abundance of whale sharks at Ningaloo Marine Park and allow for better management of whale shark interactions.

This analysis would not be possible without the efforts of industry staff and DEC greatly appreciates their assistance. Industry as a whole, have the capability to photograph every shark encountered as they are in the field on a daily basis. Eight permit holders provided copies of footage this season.

Volunteers Melanie Stock and Olli Bourdon assisted DEC by processing the footage supplied, taking stills from the footage using frame grab software, cataloguing and naming images to support existing photo ID libraries, and collating information to assist with determining the aims of the project. Copyright remains with the image provider.

The 2007 season data is still being analyzed and will be presented at a later date. Efforts need to be made to improve the program in order to ensure the 'best' photos are obtained and all sharks encountered are captured.

Recommendation 2: DEC to continue working collaboratively with industry and researchers to improve image standards for use in photo ID programs and to ensure as many sharks as possible are captured during a season.

4.5.2 Ecocean whale shark Photo ID Library

The ECOCEAN photo ID library (www.ecocean.org) established in 2002 by Brad Norman, continued to be populated by ecotourists and industry personnel throughout the 2007

season. In 2007 83 individual sharks were identified visiting Ningaloo Reef within the season. Many sharks were seen on only one occasion throughout the season, while others were sighted regularly (e.g. A-390: first recorded at NMP in 2007; sighted on 8 separate days both at North Ningaloo and South Ningaloo; initial sighting was 11/4/07 and the last sighting was 22/06/07). There were several sharks sighted at NMP in 2007 that were regular visitors (e.g. A-047: first recorded at NMP in 1996; sighted on 14 different days at NMP in 2007; initial sighting at NMP in 2007 was 02/04/07 and the last sighting was 20/06/07) (Norman, pers. Comm.).

Photo ID allows population estimates and movements to be monitored in order to develop an understanding on whether whale shark numbers in Australia are increasing, decreasing or stable. Working collaboratively with industry and researchers to capture as many whale sharks encountered in a season will allow relative abundance or trends in the number of whale sharks that appear at Ningaloo to be investigated. These trends may indicate the health of the Ningaloo population. These monitoring are being implemented to other whale shark 'hot spots' in order to determine the level of pressure that the whale shark is being subjected to on a global scale.

4.6 Baseline data collection on the whale sharks at Ningaloo Marine Park

The collaborative study with ECOCEAN and Earthwatch, managed by Brad Norman, was continued in 2007 with the aim of developing a set of robust baseline data on the whale sharks at Ningaloo Marine Park. The project aims to collect accurate data on length and sex; to increase the level of public awareness for whale shark conservation; to continue collecting and processing images within the ECOCEAN library; and to take faecal samples to establish prey types. In order to do this Earthwatch Institute volunteers were enlisted to join commercial whale shark watching tours throughout the 2007 season (April-July) and, under the supervision of Brad Norman and trained Earthwatch staff, conducted the sampling to collect baseline data (Norman, 2006). The Earthwatch Institute is an international environmental not-for-profit organisation which is committed to conserving biodiversity and habitat for current and future generations.

4.7 Genetics

DEC was only able to collect one tissue sample from Ningaloo whale sharks this season which was provided to Dr Jennifer Schmidt from the University of Illinois in Chicago, USA. The aim of her study is to determine whether whale sharks have distinctive breeding populations or whether there is a world-wide genetic population of whale sharks. She is doing this by using genetic profiles to elucidate the social structure and breeding habits of the species to provide better information for conservation and management plans. More specifically, the project aims to develop a DNA microsatellite panel for the study of whale shark genetics and population biology. Early genetic studies are indicating a single global population of whale sharks, with movement between groups and interbreeding likely. Tissue samples are required from whale sharks around the world to obtain this genetic information and to support early findings.

Recommendation 3: DEC to finalise collection of tissue samples in the 2008 season in order to assist Professor Jennifer Schmidt's global genetic study to determine whale shark population dynamics.

4.8 Mandu Returns

Mandu, a 7.3 metre male whale shark was tagged in 2002 through a co-operative effort between the CSIRO, DEC (formerly CALM) Exmouth District and the Ningaloo Marine Park whale shark ecotourism industry. The project was funded by Woodside Energy Ltd, CSIRO, the Australian Institute of Marine Science and CALM, with assistance from ECOCEAN. On the 8th June 2007 Mandu was resighted at Ningaloo by an image that was submitted to the ECOCEAN photo ID library.

5 MANAGEMENT MATTERS

5.1 Operations

As in previous years, DEC continued with its operational program which is a combination of boat ramp inspections, boat patrols, industry vessel placement, and aerial surveillance (Table 2). Operational effort decreased by 11 days from 2006 due to staff changes and insufficient time available due to competing work requirements.

Recommendation 4: DEC to prepare a compliance works program for the 2008 season

Table 2: Comparison breakdown of operational field effort over season (2000-2007)

Primary Task	NUMBER OF DAYS						
	2000	2001	2003	2004	2005	2006	2007
Field Research	8	8	18	10	11	18	22
Aerial Surveillance	4	2	2	4	4	5	1
On Industry vessels	7	5	8	8	11	10	5
Boat Ramp Inspections	36	42	22	21	10	3	4
Compliance Monitoring in DEC vessel	12	9	0	14	14	10	3
TOTAL	67	68	50	57	50	46	35

5.1.1 Industry Operations

From a management perspective the season ran smoothly with no major compliance issues. Overall performance by most operators was good. Operators worked well together and industry staff were always friendly and helpful. DEC received no public complaints this season in regards to operations.

5.1.2 Wildlife Officer reports

There were a few incidents this season including two breach reports being submitted, one resulting in the suspension of a license. Two caution notices were issued and a number of verbal cautions were given to skippers and licensees.

Recommendation 5: DEC to increase its on-water presence during the 2008 whale shark season.

5.1.3 Exclusive contact zone

The procedure known as contact transition (handballing) has been practised by the industry since operators began sharing spotter planes and sharks. Contact transition involves allowing a second vessel within the 250m exclusion zone during handover of the shark between vessels. This procedure, under licence condition 10.2 of the WCA Regulation 15 licence, is currently not allowed although supported by DEC Exmouth and visiting Wildlife Officers. Changes to this licence condition, to reflect contact transition, has been recommended, discussed with industry and is in the process of being amended. District Wildlife Officer, Brad Daw, issued a written direction to all licensees regarding the temporary suspension of the 250m exclusive contact zone to allow the smooth transition of contact between vessels. This direction specified conditions and required a certain protocol to be followed for two vessels to be allowed into the contact zone at one time. Changes to licence condition 10.2 of the WCA Regulation 15 licence, to incorporate contact transition, are still being reviewed with the aim of having the condition in place for the 2008 season.

5.1.4 In water safety

Wildlife officer reports during the 2006 season highlighted concerns regarding in water safety and complacency amongst some operators in regards to safety issues. In water safety concerns and recommendations for action were presented to whale Shark operators at the beginning of the 2007 season. During all on vessel assessments that were conducted, in water safety management and swimmer counting systems were found to be very good. It should be remembered that keeping of records of all swimmer counts during the day need to be retained in files for 12 months.

5.1.5 Licensing of videographers

All videographers/photographers filming on DEC lands (and waters) for commercial gain require a commercial filming permit and this includes whale shark interaction videographers. Film permits were held by either the operator or the videographer during the 2007 season, depending on whether operators use their own staff as videographers or utilise freelance videographers. Permits can be applied for at the Exmouth DEC office. For further information contact Michelle Goodlet (Leasing and Licensing Officer for the Pilbara Region) on 9947 8122 or at michelle.goodlet@dec.wa.gov.au

On applying for a film permit, applicants can enter into an agreement with DEC to provide whale shark footage for the sole purpose of assisting with photo ID efforts. Photo ID is an effective way to establish estimates on whale shark numbers, their migration patterns, and morphological changes of individuals over time (Section 4.5). By working with the industry DEC has the greatest ability to collect photographs of every shark encountered throughout a season to determine the actual number of individuals visiting Ningaloo Reef each year and to monitor fluctuations in abundance.

DEC greatly appreciates the assistance of participating operators and videographers and will provide feedback on photo ID data on a regular basis.

5.1.6 Licensing of film crews and documentary makers

All film crews and documentary makers filming on DEC lands (and waters) for commercial gain require a commercial filming permit. These can be obtained via the DEC website www.naturbase.net or from the DEC Exmouth office. Film permits take time to process and therefore should be applied for at least one month in advance of the start date of the planned filming trip. This season it was bought to our attention that several film crews were filming on DEC lands without a film permit. DEC requests that should film crews be planning to go out with operators that they remind them of the requirement to hold a film permit through DEC before arriving in Exmouth or Coral Bay.

DEC requests that all film crews make an appointment to meet with licensing staff from DEC Exmouth before filming begins, to receive the correct information and background for interacting with whale sharks within the Ningaloo Marine Park. For further information regarding this issue Michelle Goodlet on 9947 8122 or at michelle.goodlet@dec.wa.gov.au

5.1.7 Recreational boaters

There were no reports to DEC of non-compliance of recreational boaters with the Wildlife Conservation (Closed Season for Whale Sharks) Notice. It appears that this remains a minor compliance issue to be dealt with on an as-needed basis.

5.2 Industry Logbooks

Industry logbook data is required to be submitted to DEC every fortnight during the full whale shark season. During the paying season logsheets need to be completed for every day whether a tour was conducted or not. This season showed a great improvement in the completion of logsheets with all operators providing logsheets for each day of the paying season. Outside of the paying season logsheets need only be filled in for days when tours were conducted. Regularity of submissions was still an issue with DEC staff having to remind and chase up several operators. Regular collection allows DEC to monitor logbook data entry and ensure mistakes are picked up and rectified quickly in order to ensure data quality is maintained. Fortnightly summaries are also produced throughout the season from logbook data for industry interest and these are delayed if logsheets are not submitted.

The quality of data is also still an issue with many logsheets being submitted incomplete. Data quality again decreased towards the end of the season, indicating that some operators/staff may feel it is not important to continue with data collection as the season nears its end. This information is crucial if DEC is to fully understand the dynamics of whale shark populations at Ningaloo in order to manage whale shark interactions as per statutory requirements.

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

- Data fields are often missed out, including whale shark position, start time, finish time, depth, passenger numbers and ticket numbers. All data is required to maintain data quality standards.
- 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 and length of the 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.
- 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.
- Data quality deteriorates after the paying season and data fields are regularly missed.

It is apparent from these issues that some operators still need to ensure that their staff correctly fill in logbooks and that more time must be spent by DEC District personnel to ensure that data quality is maintained. The whale shark guiding course was designed to assist in training industry staff with licence requirements and operations and operators should take advantage of this opportunity. Staff briefings and training can be offered to operators or their staff before the start of the season and at any time throughout the season, although in the past operators have not thought it necessary, continual errors in data recording show there is a need for extra assistance and the participation by all operators in the whale shark guiding course.

Recommendation 6: DEC to conduct a logbook training session during the whale shark interaction course to improve data quality.

5.3 Industry Ticket Books

Industry ticket books or whale shark experience passes must be issued to all paying participants on boarding a vessel throughout the paying season. Whale shark tickets are an auditable item and therefore ticket numbers issued should match logbook records. A number of operators seemed to have discrepancies between the number of adults and children recorded in ticket book and logbook records. On investigation this seemed to arise from FOC's being included in the headcount for paying passengers in logbook records or from tickets being issued incorrectly. In order for licence fees to be charged correctly operators need to ensure they have systems in place whereby staff provide manifest details to ticket book and logbook records.

A new numbering system was introduced this season in order to ensure ticket books issued under a licence could not be used under a different licence as previously this had caused errors and discrepancies in ticket book and logbook records. The numbering system had unique identifying numbers which were allocated to specific licencees.

It is a licence requirement that tickets be issued to all paying passengers during the paying season. If operators are running low they should contact the DEC Exmouth office. Operators should ensure they have enough tickets left to cover them during the weekends. In an emergency they can contact the duty officer who will be assigned at the start of the season.

Some other issues arose this season regarding the use of tickets including the following:

- Tickets should be issued during the paying season only.
- Tickets should not be issued to repeaters (FOC's).
- Ticket book stubs and unused ticket books must be returned to DEC Exmouth by the end of the paying season.
- Operators are accountable for lost ticket books.
- Tickets are non transferable and non refundable.

Once again it is apparent from these issues that operators need to ensure their staff correctly use and issue tickets. By participating on the whale shark guiding course industry staff will receive the correct information in regards to licensing requirements and operations and these issues will hopefully be eliminated.

5.4 Licence specific assessments

Licence specific assessments are undertaken on an annual basis following a meeting between Whale Shark Western Australia (WSWA) representatives Dave Hall (Exmouth Dive Centre), John Jenkin (consultant), Jim Sharp, Director, Parks and Visitor Services and Rod Quartermain from DEC in February 2004. Each individual licence holder's performance is reviewed at the end of each season and operators are provided with feedback in regards to their operations. This allows all parties involved to ensure compliance with licence conditions are met and maintained in future years by following up on any issues at the end of each season.

5.5 Department of Premier

The $5million allocated by the State Government to Western Australian Marine Science Institute (WAMSI), a collaboration between CSIRO, the Australian Institute of Marine Science (AIMS) and WA universities, for research in the Ningaloo Reef region, has advanced significantly since 2006 with money being allocated to various research programs and field work already underway on several projects.

A Ningaloo Marine Park Symposium was held in Perth over the 24th and 25th July in order to bring together the broad spectrum of researchers working in Ningaloo Marine Park and to promote integration, linkages and opportunities between individuals, research projects and institutions. Presentations were given including two in relation to whale shark research being conducted at Ningaloo Marine Park. These were entitled 'Multi-level research approach to assist whale shark conservation' by Brad Norman and 'Population biology of whale sharks at Ningaloo Reef: current and future research' by Mark Meekan. Information on the symposium can be found at the following site www.cmar.csiro.au/xwiki/bin/view/Main/

5.6 Carry-over actions from 2006 Season Report

The following items from the 2006 progress report still require action:

1. DEC to review whale shark logbook records on behavioural response during interaction for 2002-2007.
2. Season logbooks need to be modified to enable recording to which vessel a whale shark was handballed

3. To aid increased public awareness of interacting with whale sharks, DEC Exmouth should investigate the erection of signage at Tantabiddi Boat Ramp and Coral Bay.
4. DEC 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.

5.7 Financial Statement

All licensed whale shark operators are charged a levy for each client participating in the whale shark experience during the paying season (1st April – 31st May). 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 DEC are used for whale shark conservation and industry management purposes. Adult participants are charged $20 and children $10. These funds have allowed DEC 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 2007 whale shark season is shown in (Table 3).

Table 3: Levy Income and Expenditure for 2005 whale shark season

Management Strategy	Specifics	Credit	Debit
2007 Management levy		$ 101,175	
Research	➢ Hubbs Sea World Project (Tagging) ➢ ECOCEAN/Earthwatch ➢ Jennifer Schmidt DNA sampling		$12,023
Monitoring	➢ Dedicated aerial survey project ➢ Spotter plane data collection project ➢ Logbook data analysis ➢ Photo-ID		$67,280
Compliance	➢ Surveillance and patrols (vessels, flights, vehicles, additional staff); Investigations		$10,902
Education	➢ Posters, brochures, ticket books, logbooks, Whale shark Festival, Display, Ecocean Brochures, Powerpoint presentations ➢ Whale Shark Guiding Course		$42,725
Administration	➢ Licensing, meetings, EOI, Progress Report		$29,583
Total		$ 162,513	$162,513
BALANCE			$0

6 REFERENCES

Colman 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.

Hodgson, A. & Marsh, H. (2006). *Whale Shark Aerial Surveys.* Report to the Department of Conservation and Land Management, WA.

Meekan, Dr Mark, pers. Comm., Australian Institute of Marine Science

Meekan, M. G., Bradshaw, C. J. A., Press, M., McLean, C., Richards, A., Quasnichka, S. & Taylor, J. G. (2006). *Population size and structure of whale sharks Rhincodon typus at Ningaloo Reef, Western Australia*. Marine Ecology Progress Series 319:275-285

Norman, B. M. (1999) *Aspects of the Biology and Ecotourism Industry of the Whale Shark Rhincodon typus in north-western Australia.* Masters thesis B.Sc. Murdoch University, WA.

Norman, B. M. (2006). *Baseline data collection on the whale sharks at Ningaloo Marine Park.* Progress Report for Department of Environment and Conservation, WA.

Norman, B. M., pers. Comm., ECOCEAN

Patton, S. & Marsh, H. (2005). *Assessing the Potential for Logbook Data Collected in Ningaloo Marine Park by Spotter Pilots and Tour Boat Operators to Provide Robust Whale Shark Monitoring Information.* Report to the Department of Conservation and Land Management, WA.

Wilson, E., Mau, R. & Hughes, M. (2005). *Whale Shark Interaction Management: Progress Report 2005.* Progress report for the Department of Conservation and Land Management. Wildlife Management Program No. 27.

Attachment A: DEC Whale Shark Season Updates 2007

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Attachment B: Industry Trends and Whale Shark Ecology based on Tourism Operator Logbooks at NMP – Mau & Wilson, 2007

Attachment C: An evaluation of whale shark aerial surveys for monitoring whale shark abundance and distribution: future options – Report to DEC

Attachment D: 2007 Hubbs Sea World Progress Report

Attachment E: Speed *et al.*, 2007. Spot the Match – Wildlife photo-identification using information theory

Attachment F: Bradshaw *et al.*, 2007. Inferring population trends for the world's largest fish from mark-recapture estimates of survival.