

MONITORING WHALE SHARK TOURISM IN DONSOL, PHILIPPINES



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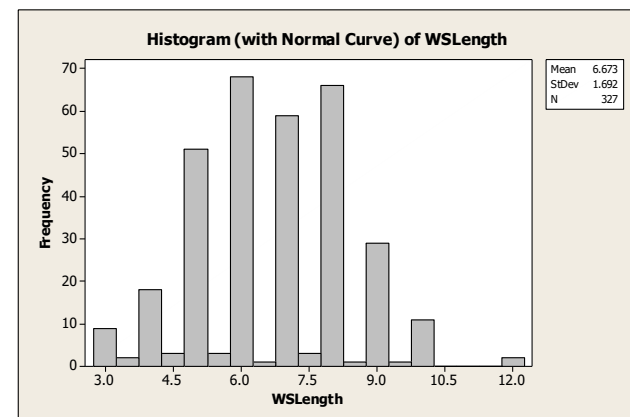
I. INTRODUCTION

Whale shark tourism all over the world is a highly lucrative industry based on an ecologically vulnerable species. In the Philippines, Donsol is a popular destination for whale shark tourism. In March through May 2004 and 2005, the Whale Shark Research and Monitoring Team observed the Donsol whale shark tourism industry. The team was composed of 20 volunteers led by Angela Quiros, a master's student at Yale University's School of Forestry and Environmental Studies. This booklet summarizes the findings of the two-year study and recommends that the industry consider the lessons discussed below.

II. WHALE SHARKS IN DONSOL

The team observed whale sharks between 6 and 7 meters long (range of 2 – 12).

Whale Shark length in meters



Of the seventy-one whale sharks assessed for gender in 2004, 52% were male. In 2005, 20% of 163 sharks were male. In 2005, 40% of 577 whale sharks had injuries. Whale sharks were observed feeding 13% of the time in 2004, and 36% of the time in 2005.

III. INTERACTIONS IN DONSOL

Each year, there are 7 - 8 interactions per boat trip in March and April, and 4 - 5 in May. An interaction occurs when swimmers enters the water to see a whale shark and ends when the whale shark disappears from the swimmers' view. The length of each trip is approximately 3 hours; and the average interaction length is 3 minutes. Most whale sharks are sighted between 9:30am – 12noon.

Boat trips and swimmer interactions

	2004 (min. – max.)	2005 (min. – max.)	Average
Boat trip length	March: 1hr. – 7hrs. April: 1hr. – 6hrs. May: 2hr. – 6hrs.	March: 1hr. - 4hrs. April: 1hr. – 4hrs. May: 2hrs. – 4hrs.	3 hr boat trip
Interaction length	March: 4 sec. – 35 min. April: 1 sec. – 16 min. May: 2 sec. – 12 min.	March: 10 sec. – 24 min. April: 7 sec. – 36 min. May: 28 sec. – 15 min.	3 min. interaction
Number of interactions per boat trip	March: 7.67 April: 8.65 May: 4.11	March: 8.64 April: 8.25 May: 5.60	7 interactions

IV. TOURIST COMPLIANCE TO REGULATIONS

The following table shows the percentage compliance to the Code of Conduct by 929 swimmers in '04 and '05.

	Regulations	Who is accountable
Rule # 1	Do not touch or ride the whale shark <u>2004 Season:</u> 84% compliance <u>2005 Season:</u> 80% compliance	Tourists, operators
Rule # 2	Do not restrict the movement of the shark or impede its natural path <u>2004 Season:</u> 96% compliance <u>2005 Season:</u> 69% compliance	Tourists, operators
Rule # 3	Keep a distance of 3 meters from the head and 4 meters from the tail <u>2004 Season:</u> 68% compliance <u>2005 Season:</u> 19% compliance	Tourists, operators
Rule # 4	Do not undertake flash photography <u>2004 Season:</u> 99% compliance <u>2005 Season:</u> 97% compliance	Tourists, operators
Rule # 5	Do not use SCUBA, scooters, jet-skis <u>2004 Season:</u> 99.9% compliance <u>2005 Season:</u> 100% compliance	Tourists, operators
Rule # 6	A maximum of 6 swimmers per shark <u>2004 Season:</u> 80% compliance <u>2005 Season:</u> 84% compliance	Operators
Rule # 7	Only one boat per shark <u>2004 Season:</u> 84% compliance <u>2005 Season:</u> 94% compliance	Operators

Most of the time, visitors followed the 6 swimmers per shark rule. We observed an average of 5 swimmers per whale shark at a time, though there could be as many as 16 swimmers per shark. Forty-three percent of the time swimmers dive towards the shark, with as many as 6 dives per interaction. Swimmers obstructed the path of the whale shark 34% of the time, with as many as 4 times per interaction.

For the most part, visitors followed the no touch rule, but not the 3 meters minimum distance rule. In '04 we observed 97 touch incidents and in '05, 125 touch incidents. Both years we found touch incidents approximately 20% of the time, with up to 4 touches per interaction. The average proximity between swimmer and whale shark was 2.03 meters in 2004 and 1.64 in 2005.



Photo by Roche Cuyco

Swimmer diving to touch whale shark

V. EFFECTS OF TOURISM ON WHALE SHARK BEHAVIOR

Challenges to successful tourism originate from the unique biology of whale sharks and from the breakdown of local tourist management. We studied the effects of the industry on three categories of disturbance behavior: change in direction, dive response, and violent shudder*.

Disturbance behavior occurs when the whale shark actively avoids swimmers. Tour operator variables include: boat number, approach, path obstruction, and crowding, as well as number of swimmers. Tourist variables include: touching, flash photography, path obstruction, and proximity to the whale shark.

Whale Shark change in direction and dive behaviors

Change in Direction	Dive Response
<p>Banking: Angling the body left or right to show its thick-skinned back to swimmer.</p>	<p>Instant dive: Diving less than 30 seconds after the start of the interaction.</p>
<p>Abrupt change: Turning 90 to 180 degrees, in less than two seconds.</p>	<p>Steep dive: Steep dives approximately 45 to 90 degree angles.</p>
<p>Gradual change: Slowly turning left or right.</p>	<p>Gradual dive: This parameter refers to the shallow, slow dive when the whale shark disappears from the observer's view.</p>
<p>Swimming in circles: Repeatedly swimming in a circular direction or in a figure eight.</p>	<p>Parabola dive: Diving up and down at regular intervals. The shark dives down one minute or less, re-surfaces, and dives back down for the same length of time.</p>

Two distinct categories of behaviors

Hypothesized Neutral Behavior	Hypothesized Avoidance Behavior
Feeding	Dive response
Swimming in circles	Change in direction
Parabola dive	Banking
	Violent shudder*

* Violent shudder is a behavior that cannot be categorized as a direction or dive change. It is a shaking or shuddering of the head or back, which can intensify to a full body writhing. During 'violent shudder' incidents, the flailing tail can hit swimmers.



Photo by Roche Cuyco

Swimmers obstructing shark's path

VI. RESULTS OF STATISTICAL ANALYSIS

Regression analyses show that path obstruction and swimmer proximity increases the odds the whale shark will change direction. Also, first-time sighting and feeding increases the odds of a whale shark dive. Touching increases the probability that the whale shark will dive. These findings suggest that habituation may affect shark behavior, and that repeated swims with the same shark encourage dive behavior. Dive response behavior should be minimized while sharks feed so energy is not diverted from feeding activities.

Predictors of disturbance behavior

<u>Change in Direction:</u>	<u>Dive Response:</u>	<u>Violent Shudder:</u>
Path Obstruction	First-time sighting	Touch
Proximity	Feeding	

Principal component analyses (PCA) show that certain whale shark behavior and characteristics are likely to be related. In the first PCA, I found two distinct groups of behavior. Group 1 consisted of neutral whale shark behavior, and Group 2 consisted of disturbed whale shark behavior. This analysis shows that whale sharks exhibiting gradual dive behavior are likely to be injured; sharks that do instant dives also do steep dives. If the whale shark is not injured, it will more likely have a steep dive.

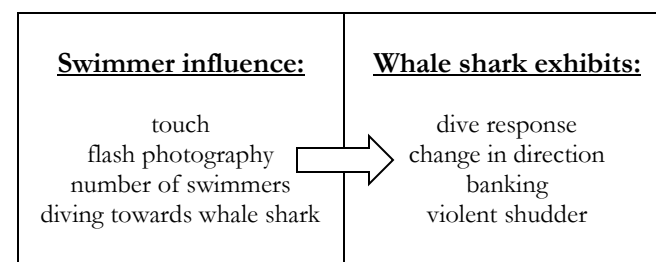
Grouping whale shark behavior & characteristics

Group 1: <i>Hypothesized neutral behavior</i>	Group 2: <i>Hypothesized disturbance behavior</i>
gradual dive injured whale shark feeding parabola dive gradual change in direction swimming in circles	steep dive instant dive abrupt change in direction violent shudder banking

The second PCA has only one group. Group 3 shows that if a whale shark is feeding, it is likely to shudder, make abrupt changes, or bank in response to swimmers. The analyses suggest that injured whale sharks are less 'skittish' than non-injured sharks; and injured sharks dive less frequently. Feeding whale sharks are more likely to exhibit change in direction than dive behavior, indicating that feeding whale sharks change direction in search of prey.

Group 3:
feeding violent shudder abrupt change in direction parabola dives banking

A Generalized Linear Model was used to analyze whale sharks that exhibited a dive response or change in direction. These whale sharks are hypothesized to be disturbed.



The magnitude of disturbance to whale sharks is significantly affected by touch incident, flash photography, swimmer count, and swimmer diving.

VII. CONCLUSIONS

Whale sharks' sensitive nature, seasonal aggregation at specific times of the year, slow maturation rate, and migratory behavior make them susceptible to human impacts. Local government and tourism managers need to work to find a balance between high quality tourist experience and disturbance prevention. Two ways to minimize negative effects are to regulate the number of industry entrants and the participant behavior.

The Code of Conduct for interactions is the main line of defense against negative human impacts. The Code of Conduct is effective in distinguishing types of human behavior that significantly affect whale shark behavior, but it is not entirely successful because swimmers do not comply and enforcement is lax. Some rules are not followed because participants think that breaking the rules has no detrimental effect. Unfortunately, many swimmer behaviors increase the likelihood of whale shark disturbance behavior. One hundred percent compliance to regulations is necessary to minimize impacts.

The Code of Conduct does not always control all swimmer behavior. The odds of disturbance behavior increases when swimmers dive towards the shark. An unspoken rule in Ningaloo Reef, Australia is to avoid diving towards skittish whale sharks to minimize disturbance.

Also, boat and swimmer crowding threaten visitor safety. Crowding affects visitor experience and frightens whale sharks. Boat crowding is defined as more than one boat swimming with a whale shark at one time. Swimmer crowding is more than 6 swimmers per shark. Boat crowding in '04 increased from an average of 2 incidents a day in March (2 boats per incident), to 5 incidents a day in May (7 boats per incident). Crowding incidents aggravate boat captains and force inappropriate boat approach and speed.

Whale shark tourism sites in Australia and Belize have addressed crowding by limiting the number of boats in the whale shark zone at one time. The whale shark zone in Gladden Spit, Belize covers a very small area, so managers assign time slots to limit the amount of time boats spend in the whale shark zone.

Management that includes impact monitoring is essential for the industry's sustainability. In Ningaloo Reef, Australia, the industry has been prospering since the early 1990s, due to proper monitoring and adequate financing. Whale shark tourism in Belize began in 1997 and tourism managers are employing adaptive management techniques to improve the industry each year. The results of this two-year monitoring study can benefit Donsol's whale shark tourism industry provided that the lessons learned are applied.

This booklet is dedicated to the BIOS and BOAs who work hard to bring the whale shark experience to visitors of Donsol.

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