

Supplementary material

Aerial survey standard operating procedure

NINGALOO MARINE PARK



STANDARD OPERATING PROCEDURES



Aerial Whale Shark Interaction Behavioural Response Pilot-Program

PURPOSE

To determine whether significant changes in whale shark behaviour result from commercial tourism interactions operating under the existing Code of Conduct.

OBJECTIVE

Primary Objectives of Behavioural Flights

- To compare the interaction data collected with the data collected from the Whale Shark Interaction Log Book.
- To obtain adequate behavioural data on a whale shark before and during interaction with commercial tour operators (CTOs) (preferred).
- To obtain behavioural data on whale sharks without interaction from CTOs (control sharks).

- To obtain behavioural data on whale sharks during interaction from CTOs (‘interaction sharks’) when data before interaction is unavailable.
- To obtain data on non-compliance with whale shark interaction Code of Conduct.

Secondary Objectives of Behavioural Flights

- To survey the area not covered by industry spotter planes from Turquoise Bay to Black Rock to obtain a more accurate portrayal of the whale shark distribution along the Ningaloo reef front throughout the season.

METHODS

Organising Flights

- To organise the flights call Norwest Air Works on (08) 9949 2888 and clearly state that you would like to conduct a whale shark behavioural flight and that you are from the Parks and Wildlife. Book the flights as early as possible, the previous week is preferred.
- Flights should be booked to depart the light air strip by 09:30 am located approximately 10 minutes south of Exmouth. Aim to be there by 09:20 am.
- Two Parks and Wildlife staff members are required to conduct the behavioural study. One person will call out the whale shark behaviour and interaction while the other will record the observations. Try to keep the staff members conducting the behavioural observations consistent to reduce error as a result of unfamiliarity with the methods. A third seat will most likely be available and should be made accessible to other staff members/volunteers that have a work related purpose for the flight. Notify supervisors of the vacancy so they can discuss staff participation opportunities. If no one can be found then it should still be offered to everyone.

- **Note:** If a volunteer goes on a flight make sure they have filled out a volunteer agreement form.

Equipment Checklist

The following items are located in the 'Aerial Survey Equipment' case and must be maintained and taken on each of the flights:

- Lowrance iFinder H2O GPS system with SD memory card
- spare AA batteries for GPS
- Flight Com IISx voice-activated intercom
- spare 9v battery for intercom
- audio recording device
- spare blank tapes/disks
- connection cable for Audio recording device and Intercom System
- stop watch
- 2 x folders each containing:
 - 1) whale shark behaviour logs x 20
 - 2) whale shark behaviour codes x 1
 - 3) scales for environmental data x 1
 - 4) pens attached x 1
- spare pens
- watch (personal)

It is recommended that personal items such as water, snacks and air sickness bags be taken on flights.

Pre-Flight Procedures

- Check the contents of ‘Aerial Survey Equipment’ case and replace any items if necessary.
Check the batteries of the GPS.
- Set up the GPS system to record a trail of your movements before you leave the office.
Please see ‘Operating procedures for collecting, transferring and exporting whale shark spotter plane data’ for setting up a trail on the Lowrance iFinder GPS. Name the trail in the format DDMMYY-WSBS (Whale Shark Behavioural Study). Once the trail is set up on the GPS turn the system off until boarding the aircraft.
- Arrive at the Light Air Strip at least 10 min before scheduled flight time. Allow 10 min travel time.
- Once arriving at the airport and prior to takeoff the following needs to be explained clearly to the pilot that will be taking your flight:
 1. As a preference to fly at 1000 ft.
 2. Initially to go where the industry and whale sharks have been interacting more frequently.
 3. Preferably like to locate and circle a shark prior to C.T.O.’s interacting with it (as much time before as possible). If not then,
 4. locate and circle either a control shark with no interaction or a shark already currently being interacted with
 5. Keep you informed of what the other spotter planes are currently observing.
 6. At some time during the flight you will advise them to fly down to Black Rock and return.
 7. Once you, other Parks and Wildlife member or the pilot locate a whale shark to circle it so you do not lose visual. State that you will let them know when you are finished

collecting data on the shark and will give them further instructions on where to go next, e.g. find another whale shark or fly down to Black Rock.

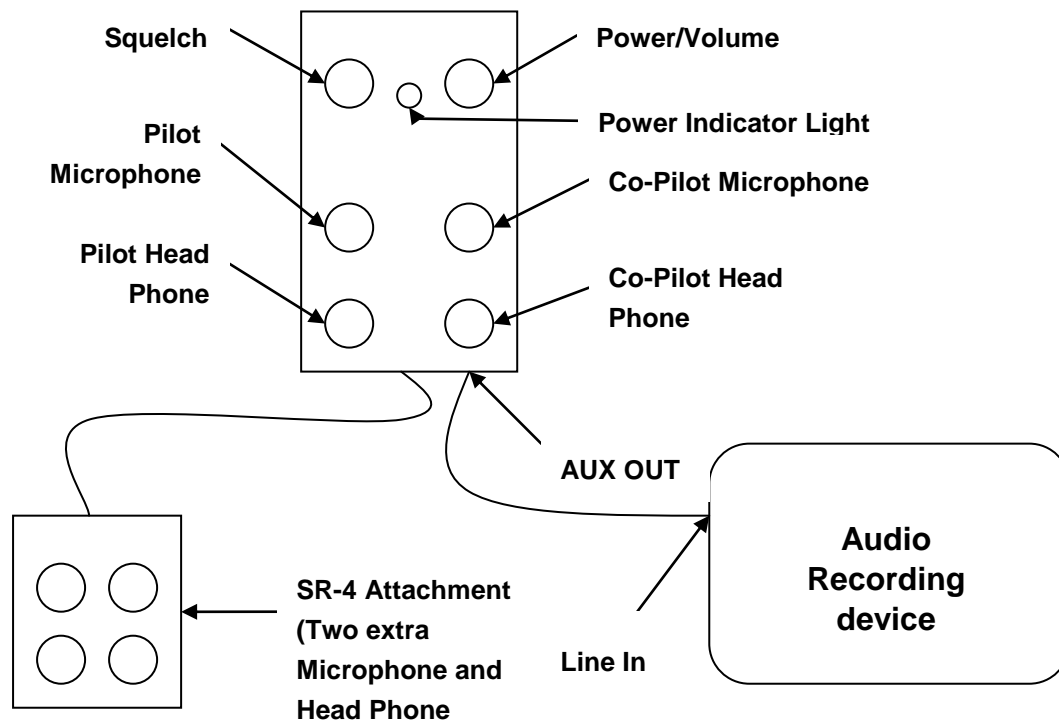
8. You will let them know when to head back to the Light Air Strip.

- The pilot will run through the pre-flight safety check

Organise Personnel and Equipment in Aircraft

IIsx Voice-Activated Intercom and Audio Recording Device

- Set up the voice-activated intercom and audio recording device as follows:



- This set up will allow you to talk uninterrupted without hindering the pilot's communication as well as allowing you to record observations made.
- Norwest Air Works will supply headsets for each passenger.
- Only attach the SR-4 attachment when there are more than 2 passengers.
- To activate turn the volume dial to the desired volume level.

- Adjust the squelch dial until the system gives continuous communication while speaking. Too little squelch and communication will be broken up, too much squelch and communication will be activated constantly with increased background noise.
- To locate the battery for replacement remove the back panel.

Lowrance iFinder H2O GPS Set up

- Set up the GPS to record your flight track (please see attached SOP for GPS set up).
- Turn on prior to takeoff.
- If you find it difficult to obtain a signal place either on the dash board of the aircraft or position it beneath the rear windows so that it has a clear line of site with the satellites.

Observer Roles and Equipment

- Should sit directly behind the pilot. This will aid in keeping a visual on the shark as the pilot circles.
- Have one folder open with the whale shark behaviour codes and log sheet open to aid in calling out whale shark behaviour and interaction.
- Is in charge of the audio recording device by pressing record when observations begin and pressing stop when the observations finish.

Recorder Roles and Equipment

- Can sit next to the observer or at the front of the aircraft.
- The second folder ready for recording the observations.

- Have easy access to GPS system to record the set up trail and mark the whale sharks spotted. If there is a third person give them the task of marking the whale sharks spotted on the GPS. Mark every whale shark spotted.
- Stop watch to record the elapsed and progressive time the observation took place.
- Watch to record the initial and final time the observations took place. **Note:** Most GPS systems and aircraft contain a watch.

In Flight Procedures

- Before locating a whale shark the recorder should fill out the top section of a whale shark behaviour log, including the:
 1. date
 2. observer names
 3. pilot name
 4. start time
 5. height
 6. wind strength (use the scales for environmental data)
 7. surface conditions (use the scales for environmental data).
- At first all personnel on the aircraft should be spotting for whale sharks.
- When a whale shark is spotted:
 1. If the pilot and/or observer has not located the whale shark let them know the location so they can change the orientation of the plane so that the shark is located on the pilots/observers side allowing the pilot to circle the shark and the observer can start making observations.
 2. The observer must:
 - i. Press record the audio recording device.

- ii. State the whale shark number for that day, e.g. the first whale shark with behavioural data collected is whale shark 1 (helps when listening to audio recording).
- iii. State the initial heading and behaviour of the whale shark (use the coastline to obtain an estimated heading).
- iv. State any interaction that may be taking place.
- v. Give a progressive update on the whale sharks:
 - a) heading
 - b) vertical water position
 - c) behaviour
 - d) interaction.

Approximately every 30 sec to 1 min or when a behavioural change or something of interest is observed (please see the sections on whale shark observations and interactions).

- vi. If you lose visual of the whale shark due to glare, the whale shark diving or just lost visual then state that visual has been lost so that it is recorded.
 - vii. State an estimated size of the whale shark during the observations. You can use vessels to approximate the length.
3. The recorder must:
- i. Mark the waypoint on the GPS system and note the waypoint number on the whale shark behaviour log. This is used to obtain the position of the whale shark when entering the data.
 - ii. Start the stop watch.
 - iii. Enter the initial time of the observation.
 - iv. Enter the initial whale shark bearing and behaviour.

- v. Progressively record the observations made by the observer noting also the elapsed time after the initial observation (stop watch). Try to capture all the information observed. If you miss any data then ask the observer to repeat it. If that is not possible then do not be alarmed as the audio recorder will catch anything you miss.
- vi. If possible obtain a minimum of 15 min total observation time for each whale shark. This will depend on the individual whale shark and the interactions taking place. Once you feel that adequate behavioural data has been collected move on to the next whale shark.
- vii. If the whale shark dives still continue to circle for a period of time (approximately 5–10 min) and continue to make behavioural observations as it may resurface. If you are uncertain whether or not it is the same whale shark you were previously recording that resurfaced then start a new whale shark behaviour log.

Whale Shark Observations Elaborated

Whale Shark Heading

The whale shark heading is taken in respect to the coastline and is an estimated heading. The heading is given simply as “The whale shark is heading.....”:

- North (N)
- North East (NE)
- East (E)
- South East (SE)
- South (S)
- South West (SW)

- West (W)
- North West (NW)

Whale Shark Vertical Water Position

Swimming at the Surface (SS):

The whale shark is swimming at or within a few metres of the surface.

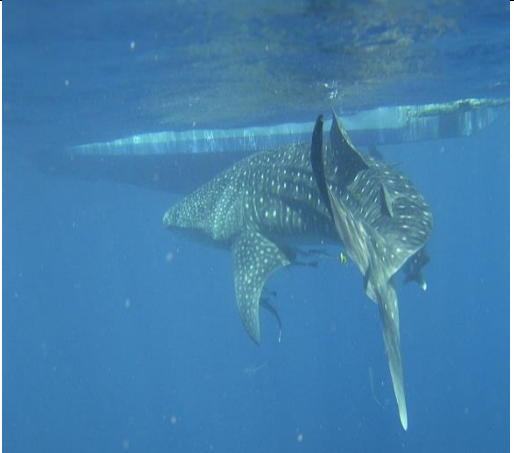
Swimming at Depth (SD):




The whale shark is swimming a few metres or more below the surface but is still visible.



Dived Deep (DD):

The whale shark has dived out of view and is no longer visible.

Whale Shark Behaviours

Behaviour	Description	Photo
Changed direction (CD)	The whale shark changed direction from its previous recorded heading. Record the new heading.	

<p>Circled (CR)</p>	<p>The whale shark is swimming around in a circle.</p>	
<p>Dived deep (DD)</p>	<p>The whale shark has dived out of view and is no longer visible.</p>	
<p>Resurfaced (RS)</p>	<p>The whale shark has returned to the surface after diving.</p>	<p>(no photo available)</p>
<p>Investigated (IN)</p>	<p>The whale shark showed interest, attracted to something, inquisitive.</p>	

No reaction (NO)	The whale shark continued as before showing no interest, taking no notice.	
Decreased speed (DS)	The whale shark slowed down.	(no photo available)
Increased speed (IS)	The whale shark increased speed.	(no photo available)
Swam at depth (SD)	The whale shark swam a few metres below the surface but is still visible.	

Note: The whale shark may show more than one behavioural reaction at a time. Note down all behavioural reactions that are observed. Also while recording use the short hand shown in the brackets.

- Example 1: As the whale shark approaches a group of swimmers it changes direction and begins to swim at depth (CD, SD).

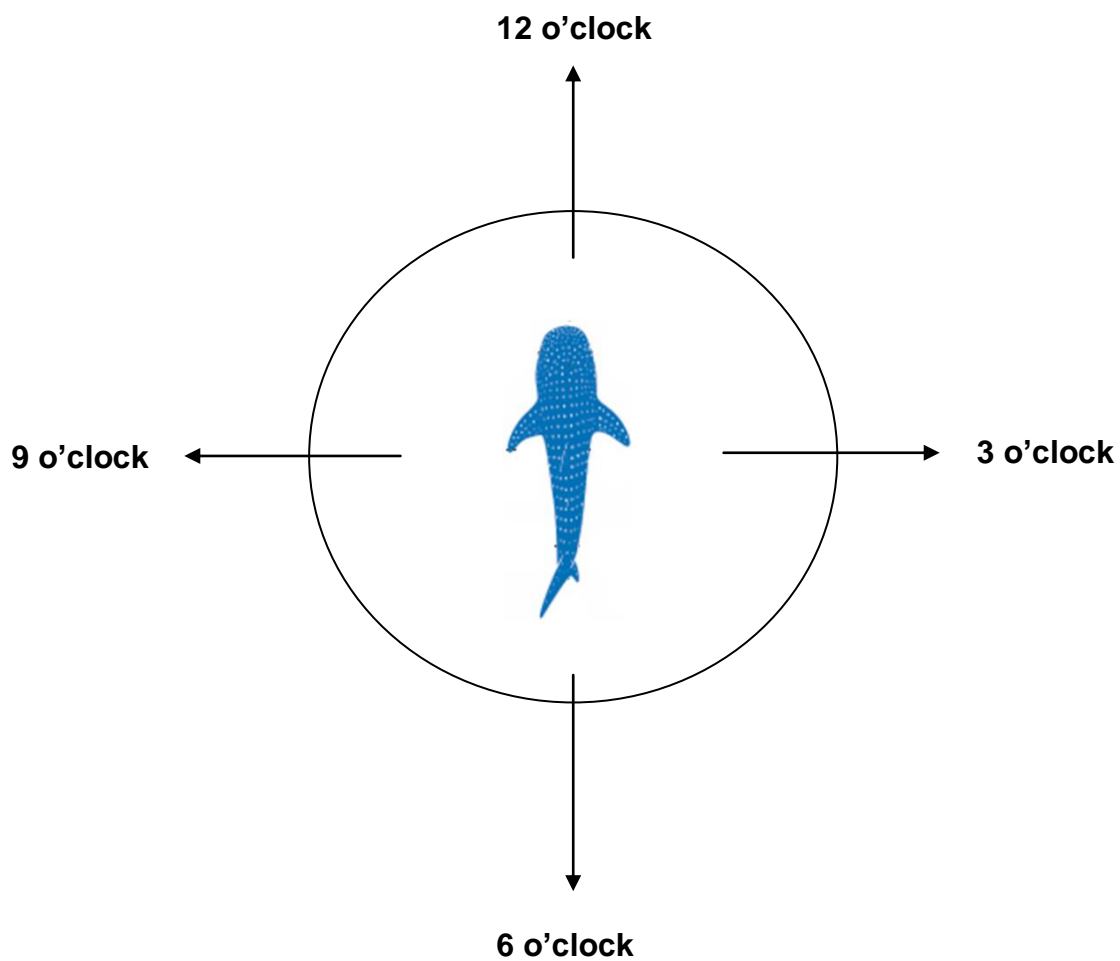
OR

- Example 2: As the whale shark approaches the group of swimmers it decreases its speed and begins to circle around them and becoming very inquisitive toward the swimmers (DS, CR, IN).

Whale Shark Interaction

Vessel

- If possible identify the vessel. If unsure ask the pilot.
- State the vessel/s position according to the whale shark. For example, if the vessel is directly in front of the whale shark the vessel will be at the shark's 12 o'clock. If the vessel is directly behind the whale shark the vessel will be at the shark's 6 o'clock.



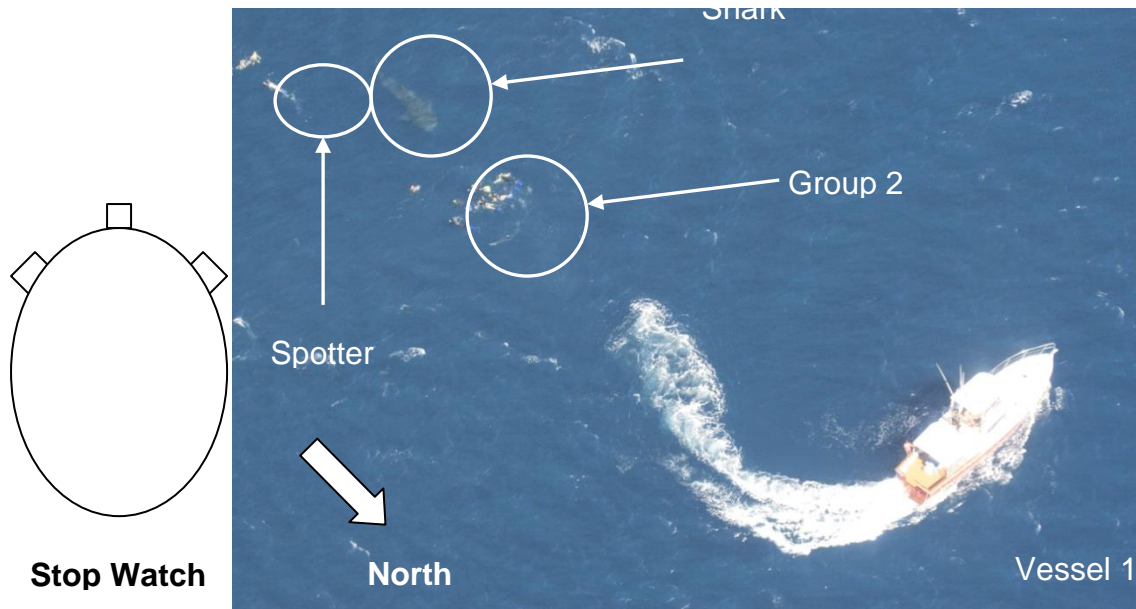
- State the vessel/s approximate distance from the whale shark in boat lengths. Only state a vessel as interacting if it is within 250 m (approximately 15 boat lengths).
- State the vessel/s status, i.e. whether it is
 - a) making way (MW) – vessel is moving through the water (in gear) or,
 - b) under way (UW) vessel is stationary (not in gear).

Swimmers

- When observing swimmers state:
 - a) Initially what vessel they entered the water from (Vessel 1, Vessel 2, etc.).
 - b) Initially what group number they are, each vessel should only have two groups (G1 and G2).
 - c) When they have entered the water or in water and not yet in contact (IW).
 - d) When they are in contact/swimming with the whale shark (C).
 - e) When they are off the whale shark and no longer in contact (Off Shark or X).
 - f) When the spotter is the only swimmer interacting with the whale shark.
Usually swimming with one arm in the air (SPOTTER).

Example Observation Photographs

EXAMPLE 1



Observer:

“The whale shark is swimming at the surface heading north. Vessel 1 is making way to the shark’s 11 o’clock at approximately three boat lengths. Group 1 is off the shark but the spotter is still in contact. Group 2 is currently in water not yet in contact.”

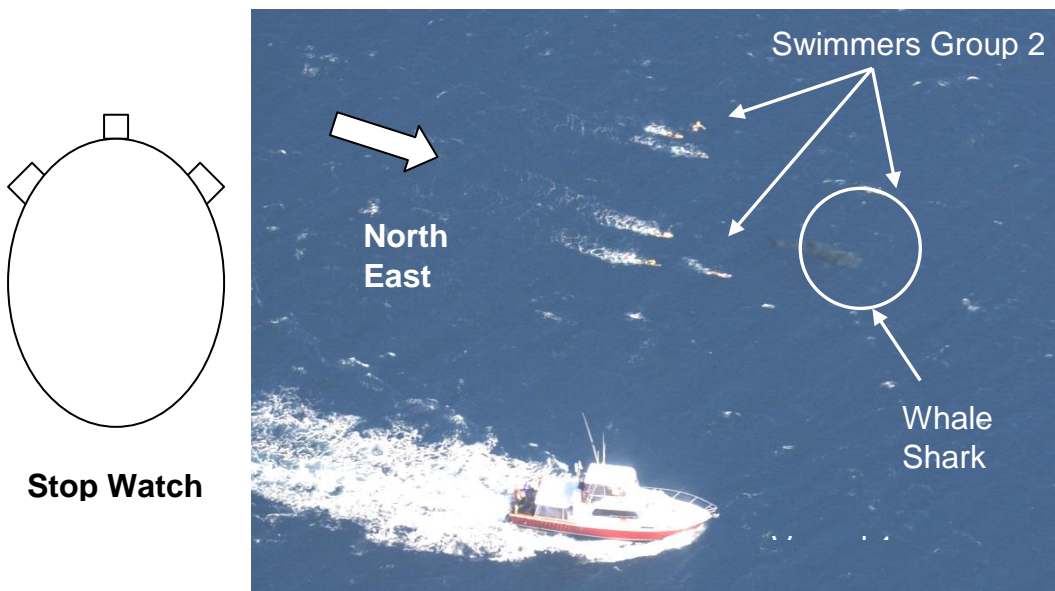
Recorder:

Time	Heading	Behaviour	Vessel 1 Distance	Position	Vessel Status	Swimmer Group
1:45	N	SS, NO	3	11	MW	SPOTTER, G1 X, G2 IW

Comments:

The whale shark is currently not showing any kind of behavioural change and is about to come into contact with the second group of swimmers. Due to the position of the swimmers to the whale shark and its current heading the whale shark will more than likely show a behavioural reaction to the swimmers when it comes into contact.

EXAMPLE 2



Observer:

“The shark is swimming at the surface heading north east. It looks like it has increased its speed. Vessel 1 is making way to the shark’s 3 o’clock at one and a half boat lengths.

Swimmers are starting to drop off the shark but some are still in contact.”

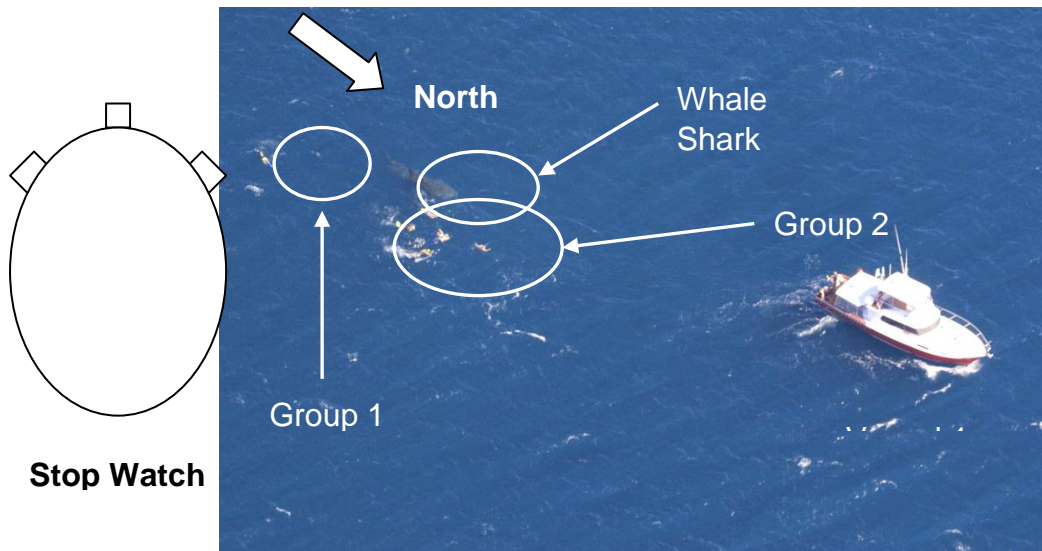
Recorder:

Time	Heading	Behaviour	Vessel 1 Distance	Position	Vessel Status	Swimmer Group
9:25	NE	SS, IS	1.5	3	MW	C

Comments:

It is hard to judge when a shark increases its speed, it is easier when there is a group swimming with it. Although swimmers have started to drop off there are still swimmers in contact with the shark, therefore the group is still in contact.

EXAMPLE 3



Observer:

“The shark has changed direction toward the swimmers heading north and swimming at the surface. The vessel is under way to the shark’s 12 o’clock at two and a half boat lengths. Group 1 is off the shark and group 2 has just come into contact with the shark. It really looked like it was interested in the swimmers”

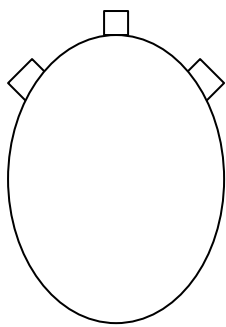
Recorder:

Time	Heading	Behaviour	Vessel 1 Distance	Position	Vessel Status	Swimmer Group
22:57	NE	SS, CD, IN	2.5	12	UW	G1 X, G2 C

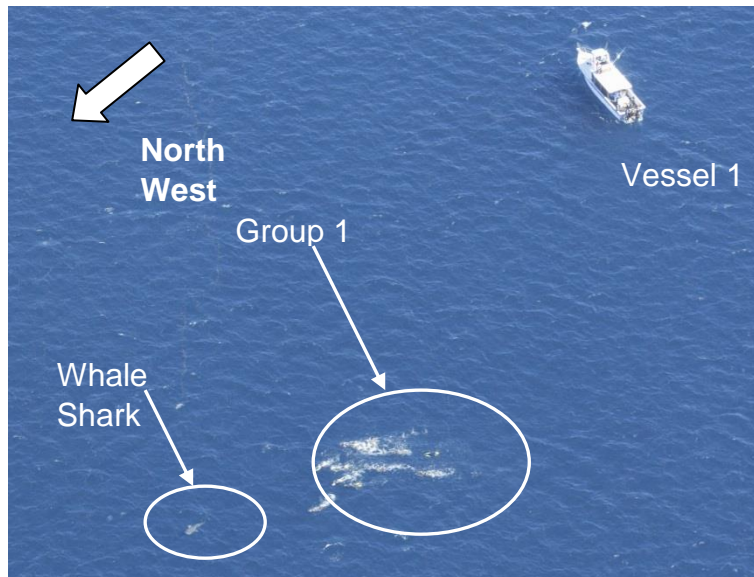
Comments:

If there is not enough room in the cells to write all observations then write in the comments section, clearly showing which observation you link that comment with. Make sure you get all behaviours recorded.

EXAMPLE 4



Stop Watch



Observer:

“The whale shark has just resurfaced now heading north west. The vessel is under way at the shark’s 6 o’clock, six boat lengths. The swimmers are now off the shark but still swimming.”

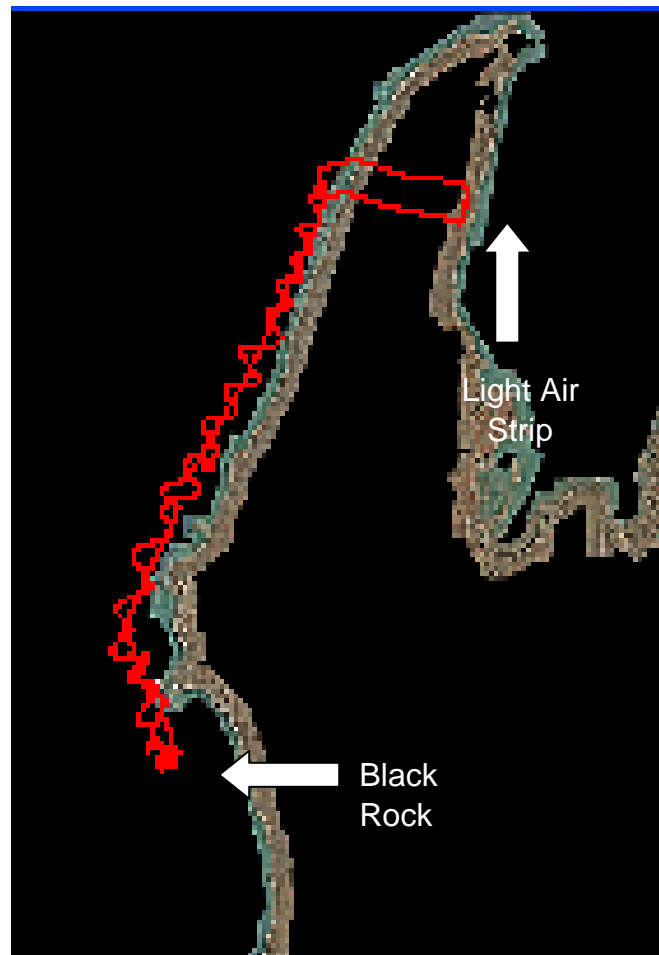
Recorder:

Time	Heading	Behaviour	Vessel 1 Distance	Position	Vessel Status	Swimmer Group
15:14	NW	SS, RS, CD	6	6	UW	G1 OFF SHARK

Comments:

Even if the shark dives keep circling as it may resurface. If the swimmers are still swimming they may still have a visual on the shark. If they stop most likely they will no longer have a visual.

Example Flight Trail



Post Flight Procedures

- After landing:
 - a) Turn off the GPS.
 - b) Record the finish time on the whale shark behavioural log.
 - c) Disassemble equipment and return into the Aerial Survey Equipment case.
- After returning to the office:
 - a) Remove the tape/disk from the audio recording device and label with the correct date.

- b) Place the audio recording device on charge.
- c) Remove and replace any used whale shark behaviour log sheets, place in order according to shark number, staple them together and file away in a file allocated to the whale shark behavioural flights.
- d) Transfer, sort and save GPS data. Please see 'Operating procedures for collecting, transferring and exporting whale shark spotter plane data'. The folder location for saving the data is 'T:\422-Operations (District)\Shared Data\11 NATURE CONS\1114 Whale Shark Research and Monitoring\2007\Aerial Behaviour Study\Behaviour Study GPS waypoints and routes' for the behavioural study. The folder layout is the same as the SOP above.
- e) The data and analysis for the 2007 season is saved at the location: T:\422-Operations (District)\Shared Data\11 NATURE CONS\1114 Whale Shark Research and Monitoring\2007\Aerial Behaviour Study\Behavioural Data 2007. Enter the data into the spreadsheet regularly as it is a time consuming process and spare blank tapes need to be made available for future flights. The entry and analysis is still currently being developed; however, it was found to be easier and more accurate to enter the data into the spreadsheet while listening to the audio recording from the flight. To obtain the progressive time of the observations the stop watch was used by starting it at the same time that the first whale shark observation was made on the audio recording and progressively entering the data into the spreadsheet and cross-referencing the data entered with the log sheets. Using both the data log sheets and the audio recording ensured that any observations made were not missed.
- f) Once the data has been entered the audio recording can be deleted from the mini disc.
To erase the discs:
 - 1. Enter into the menu.

2. Select 'Edit'.
3. Select 'Erase', it will come up with the message "All track erase OK?"
4. Select 'Yes'. 'System file writing' will appear on the display.
5. When completed 'Blank disc' will appear on the display.

As there are limited spare mini discs and none available for purchase the mini disc recordings must be entered and erased on a regular basis.

- g) The data and analysis for the comparison between the observations made on the behavioural flights and the data collected from whale shark log sheets, filled out by the operators, can be found at the location T:\422-Operations (District)\Shared Data\11 NATURE CONS\1114 Whale Shark Research and Monitoring\2007\Aerial Behaviour Study\Behavioural Data 2007\Comparison Behavioural Data with Log Sheet Data. It is a simple process of finding which behavioural flight dates have vessels that have been identified and locating the corresponding whale shark log sheets for that operator. In the analysis, the whale shark position, heading, behaviours, estimated length, interaction time, contact minutes and whether or not the shark was handballed were compared and found to be a 'match', 'no match' or 'n/a' depending on the data available. A confidence level was also included that refers to the confidence level that it is the same shark between the behavioural flight (BF) and the whale shark log sheets (WSL).