Human-Whale Shark Interaction: An Inquiry into Standard Operational Procedure (SOP) for Tourist in Papua and East Java

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Abstract. The provision of the whale shark (Rhincodon typus) protection status imposed us to formulate an effective interception Standard Operational Procedure (SOP) for the visitor as an effort to manage sustainable fisheries resources. The research was conducted using visual underwater survey (VUS) method and direct observation. The SOP formulation was effectively applied in Kwatisore (Papua) and Probolinggo (East Java) beach. However, the SOP was made differently due to the differences in the behavior of whale sharks and also the differences in the water conditions in both places. The groups of whale sharks in Kwatisore frequently interacted with humans. Besides, Kwatisore has also a clear beach that allows the visitor for diving and snorkeling while the Probolinggo beach has turbid water. As a result of those differences, the content of the SOP also was made distinctively. The SOP in Kwatisore summarized the procedure of touching prohibitions, using flash, making noise and safe distance for swimming with the whale shark, whereas the SOP in Probolinggo was made to control the number and speed of boats also the distance between the boat and the whale sharks while the visitor observes them.

Keyword: Whale shark, human, interaction. standard operational procedure, fishery resources

1. Introduction
The growth of nature-based tourism in the Indonesian marine sector - such as snorkeling and scuba diving has increased over time. In some countries, the tour with the whale shark (Rhincodon typus) becomes one of the most intense recreations today [1], this because of the people’s perspective on symbolizing the whale sharks as a marine tourism’s attractions [2]. These tame fishes have the ability to migrate with a wide range of territory [3]. These sharks migrate in tropical oceans and warm seas [1,4,5].

The direction of whale shark movements tends to swim in shallow water [6]. In general, the range is between 30° north latitude and 35° south latitude [7]. These fishes were tracked visiting the waters of more than 130 countries [8], including Indonesia. Whale sharks have slow growth and late maturity, low productivity and long life [1,2,7]. These natural characteristics make them susceptible to be exploited, and the recovery process of over-exploiting whale sharks takes a long time [1,2,4].
Whale sharks can be easily found in some beaches in Indonesia [9] and almost everywhere where these animals are found, the tourism sector particularly interacting with whale sharks would grow up. Nevertheless, indirectly it can impair the comfort of whale sharks and in the short term can change the behavior of whale sharks such as patterns of movement, population dynamics and others [1]. The examples of this case are the tendency of whale sharks to be benign and lose their instincts as wild animals if humans feed whale sharks perpetually [10]. Therefore, the conservation of whale sharks is urgently needed.

Few researchers have addressed the provisions of standard operating procedures (SOP) related to the interaction with whale sharks [11], better still an SOP are made for the operation to proceed appropriately and conduct an activity appropriately. Referring to Ministerial Decree No. KP. 18/2013 on the Establishment of Whale Shark Protection Status (*Rhincodon typus*), it is necessary to create the SOP of interactions between human and whale sharks. Regulating the SOP is considered as the most effective way or effort to manage sustainable fisheries resources, particularly for whale watchers.

Two beaches had not been made the SOP regarding interaction with whale sharks were the beach of Kwatisore (Papua) and Probolinggo (East Java). Those two beaches have different environmental conditions and have different populations of whale sharks [12,13]. Based on these conditions, the SOP of interaction with the whale sharks in those two areas should be applied effectively due to the survival of whale sharks, especially in Indonesia, can be maintained.

## 2. Methods

### 2.1. Time and Location of Research

As mentioned above, the location of research was conducted in the two Indonesian beaches, namely Kwatisore beach, Papua and Probolinggo beach, East Java. The details are listed in Table 1.

| No | Time of research          | Location of research          |
|----|---------------------------|--------------------------------|
| 1  | September 2016 - December 2017 | Kwatisore Water, Nabire, Papua |
| 2  | March 2017 - May 2017       | Pantai Bentar, Probolinggo, Jawa Timur |

### 2.2. Devices and materials

During the research, there were several devices and materials were utilized to support the research. The devices and materials that have been employed in this study are listed in Table 2.

| No | Name of tool       | Specification          | Function                  |
|----|--------------------|------------------------|---------------------------|
| 1  | Underwater camera  | Action camera Go Pro Hero 5 | Documented underneath the water |
| 2  | Camera             | Canon 60D              | Documented on terrestrial  |
| 3  | Basic tool for diving | Amscud blue ed.        | Snorkeling                |

### 2.3. Types and Methods of Data Retrieval

Two types of data were taken in this study, namely primary data and secondary data. The data referred to in Table 3. The observation of the interaction between humans and whale sharks was stimulated to be guidance in formulizing the effective SOP in both of Kwatisore and Probolinggo beach. These interactions comprised snorkeling, touching whale sharks, photographing with flash, being noisy and feeding. The turbid condition in Probolinggo impeded the researcher to snorkeling in the spot; thus, the observation was only conducted above the boat. All such activities were administered in Visual Underwater Survey (VUS) technique which yielding an effective method for this research [1].
Table 3. Type of research data

| No | Data component                      | Type of data | Data retrieval techniques and data resources           |
|----|-------------------------------------|--------------|--------------------------------------------------------|
| A  | Kwatisore and Probolinggo Water     |              |                                                        |
| 1  | Number of tourists                  | Secondary    | Interview / BBTNTC                                     |
| 2  | Permissions                         | Secondary    | Interview / BBTNTC                                     |
| 3  | Demographics of tourists            | Primer       | Direct interview                                       |
| 4  | Types of interaction                | Primer       | Direct observation (VUS)                               |
|    | - Snorkeling                        | Prime        | Direct observation (VUS)                               |
|    | - Diving                            | Prime        | Direct observation (VUS)                               |
|    | - Touching                          | Prime        | Direct observation (VUS)                               |
|    | - Using flash                       | Prime        | Direct observation (VUS)                               |
|    | - Making a noise                    | Prime        | Direct observation (VUS)                               |
|    | - Feeding                           | Prime        | Direct observation (VUS)                               |
| 5  | Response of whale shark             | Prime        | Direct observation (VUS)                               |
|    | - Approaching                       | Prime        | Direct observation (VUS)                               |
|    | - Chasing                           | Prime        | Direct observation (VUS)                               |
|    | - Move away                         | Prime        | Direct observation (VUS)                               |
|    | - Rebellious (movement suddenly)    | Prime        | Direct observation (VUS)                               |

3. Results and Discussion

3.1. Kwatisore Beach, Nabire

3.1.1. Tourist Data
The data related to tourists should be scrutinized out as a monitoring effort. Based on data collected during the study period at Kwatisore Beach has identified the origin of tourists and their license in touring.

3.1.1.1. Tourist Type
In this study period, there were recorded 237 tourists consisting of 174 foreign tourists (Figure 1. blue) and 63 local tourists (red). Foreign tourists commonly came from Australia, USA, and European countries, while local tourists deployed from Sumatra to Papua.
3.1.1.2. Licensing

Based on the collected data, it has investigated 273 tourists have no SIMAKSI (Surat Izin Kawasan Observasi) – a consent letter. This case reckoned as an illegal action because the Kwatisore region belongs to the Cenderawasih Bay National Park area which obligating every visitor to have the SIMAKSI. Alternatively, if the visitor has no SIMAKSI, they should require consent and register to the National Park tourist office. Thus, they can interact with the whale sharks. As a result, we made the license SOP which was portrayed into a poster (Figure 2).
3.1.2. Analysis of interaction, Whale Sharks response and SOP Formulation

Standard Operational Procedure (SOP) is a document or guide related to procedures that performed systematically to complete a job [14]. The rule aims to control operational activity to be appropriately administered and has a persistent way to act. SOP in the wild animal’s conservation has various types, and one of them is an SOP that concern with interacting with the animal itself, which in this case is whale sharks. This SOP is crucial to be reformed, since in the last five years, tourist arrivals have been increased by approximately 600%, since 2011-2016 who came from an equal number between domestic tourists and foreign tourists.

Through this project, there were several experiments had been conducted to formulate an effective SOP. This attempt was assisted by several tourists from Australia, Germany, England, France, Spain, and Indonesia. Several experiments had been conducted to do some interactions such as touching, photographing with a flash, being rowdy and feeding activities. Afterward, the given responses of the whale sharks were observed and noted. The yielded responses were categorized into five responses: approaching, chasing, moving away, sudden and rebellious movements. The details of the results are profoundly conveyed in the explanation below.

3.1.2.1. Touching the whale sharks

The touching activity was conducted on the small spot of whale shark's body. From the 120 trials, whale sharks reacted to different responses (Figure 3).

![Figure 3. Response to whale sharks touched](image)

Figure 3 portrayed some responses of whale sharks while they were touched. The majority of them were moved away avoiding the visitor and followed by rapid movement afterward. This response indicated a negative response. It might be concluded from this, the whale sharks seemed uncomfortable to be touched or in other words touching them will potentially scare fishes, thus in return, they would give an unexpected response. Even though the whale sharks are the plankton eaters, they are substantial and powerful. Furthermore, by touching whale shark too often, would shift the behavior of whale sharks and whale sharks will often "contact" with bacteria in humans, which may affect to the health of the whale's shark itself. The effect of touching the whale shark not only disturbing the whale shark itself but also would potentially injure the tourist. The previous study conveyed dangerous things such as incidental injury could happen due to the tail slapping, yet there has not been found the actual data recording the human injuries because of whale-sharks [15,16]. In consequence of this matter, the SOP for this matter was formulated in Figure 4.
Figure 4. The SOP of the ban of touching on whale sharks

Based on Figure 4, whale shark body is protected by scales such as teeth or tooth-like scales or also called dermal denticles [17]. This characteristic is what tourists need to pay attention to since touching the fish may hurt the tourist’s hand.

3.1.2.2. Documentation whale shark with blitz

Flash on the camera serves as a light source that can make a photographed object brighter. Capturing the photograph using flash was frequently done by tourists while photographing whale sharks under water. To know the effect of this common tourist action also the whale shark response, we conducted the experiment for 60 times. The result illustrated in Figure 5.

Whale sharks showed three responses which indicated the negative responses: move away, rebelling, and sudden movement. Among those three responses, the whale sharks more often made a sudden movement, which was 41 times. This response is presumably given due to the whale sharks feel surprised by the light that leads that movement. Therefore, this kind of interaction needs to be taken as a granted because the touch, swimmer dive, and flash photography have the effects on a whale shark's change in direction, dive response and violent shudder [11]. An appropriate SOP description of this interaction is summarized in Figure 6.
Figure 5. The response of whale shark when photographed with flash

![Image of a whale shark with a caution sign indicating that the camera flash should be switched off, as it can cause the whale shark to lose its balance.]

**Caution!!**
Please switch off the camera blitz, it will cause the whale sharks lose their balance.

Figure 6. The SOP of the prohibition on the use of flash

3.1.2.3. **Being Rowdy**
This project also investigated a tourist interaction that was rowdy around the whale shark, such as screaming and doing splashes of water. These actions could be yielded by anyone, especially for beginner swimmers who have no knowledge about the whale shark. To find out the response shown by whale sharks, this kind of interaction has been tested 60 times and the result is showed in Figure 7.

Figure 7 shows two different responses that move away (negative) or approach (positive). Approaching whale sharks with the noise would fear them. Besides, they will also threaten the safety of the swimmers due to the whale shark may make a sudden movement which potentially will be a dangerous reaction. Despite the whale sharks are categorized as a passive animal, they will response a dangerous thing to the swimmer if they are disturbed by noise. The formulated SOP for third interaction (noisy) is shown in Figure 8.
Approach  Move away  Move suddenly  Ret

13
29
11

Figure 7. The response of whale sharks when swimmers were rowdy.

3.1.2.4. Feeding

Feeding activity is the fourth interaction that has been tested. This feeding activity was comprised of a frequent action of people to any animal. This action could be reflected as affection from the people and an attempt to habituate the animal; thus, they become tame [18].
Figure 9. Response to whale sharks when the swimmer is rowdy

According to Figure 9, it is known that from 60 times of experiments, feeding on whale sharks got them approach and chase. It means that they tend to react positively. This was a natural phenomenon because every living thing needs food as a source of energy. However, feeding the animals that live in the wild will be dangerous because in this case - whale sharks - will turn to benign and habituated; and as a result, their instinct to find the food by themselves will be lost. These assumptions are underpinned from the discourse that the behavior of animals is not only influenced by genetic, but also environment [19].

Figure 10. SOP Prohibition of feeding whale sharks.

Furthermore, when whale sharks migrate and interact with humans, it is easy to be caught. Throughout the year 2011-2013, whale sharks in the TNTC region were found several times trapped in the chart net. Although not a catch target, usually whale sharks are left in the net from morning until late afternoon until the charts are ready to be lowered to start the catching activity. The WWF team and several partners have already freed whale sharks trapped in the charts and, according to field observations, the trapped whale sharks appear to be weak. The interaction of whale sharks with charts (crashing charts, related hook, rubbing nylon, driven by sharp objects by skipper fishermen) and
boat/boat (hit) sometimes inflict injuries, either permanent or not on some whale sharks [20]. The appropriate SOP for the interaction to prevent it happens further is drawn in Figure 10.

The feeding interaction with the whale sharks can alter the whale shark’s migration patterns which it can impulse an alteration of the breeding process of whale sharks, and the long-term effect of it will cause the alteration of instincts to survive [21]. According to the Figure 10, the behavior changes over time, whale sharks depended on the food provided by humans [22]. The given food was used to have the same nutrients with nutrients from plankton. The other possible effect is the whale sharks will also spend a lot of time pursuing "feeding boats", and their nutritional needs are not sufficient as well as eating in the aquatic environment that rich of plankton. Moreover, whale sharks will lose a lot of energy by focusing on "feeder", and they are not eating properly [23]. Furthermore, when they are disturbed while eating, they will become easier to catch [1,24].

3.1.2.5. Safe distance swimming with whale sharks

Keeping a distance with whale sharks needs to be taken as a granted for the sake of human safety. This because the swish tail whale sharks – the response while they are disturbed- can hurt the divers. With a large body that can reach tens of tons will produce great strength as well. This is in accordance with Newton's second law, where force (F) is directly proportional to mass (m) and acceleration (a). Davis and Tisdell recommended the distance between the swimmer and the shark three meters for maximum [25]. In detail, they specify the requirement distance one meter from body or head of the whale-shark and four meters from the tails. Assuming this, the SOP for swimming activity around the whale sharks was made in Figure 11.

Figure 11. The SOP of Safe distance swimming with whale sharks.

3.2. Bentar Beach, Probolinggo

The findings of this project during the research period in Pantai Bentar Probolinggo comprised three key points: composition of tourists (origin of tourists, gender, average age); tourist activities (include observation and swimming); and the response of whale sharks also the average distance of the ship to the whale shark's body. The details will be presented further.
3.2.1. Tourist Type
On the one side, based on the figures 12, during the study period in Probolinggo, there were 127 tourists consisting of 6 foreign tourists and 121 local tourists. The foreign tourists came from Switzerland, Singapore, and Korea, while the local tourists deployed from Sumatra to Papua. On the other side, Figure 13 showed that there 40 men and 87 women, scattered by age ranging from 5 to 64 years.

![Figure 12. Origin of tourist in Bentar Beach](image)

![Figure 13. Tourist identities](image)

3.2.2. Tourist Activities
Tour manager at Bentar Beach, Probolinggo provides the option to swim with whale sharks or observe from the available boats. Among many observed tourists, only 11 people who chose to swim and interact directly with whale sharks.
3.2.3. Accommodation

The tourists were only able to see the whale sharks by using the boat. The snorkeling activities cannot be conducted due to the turbid water conditions. The findings of this study showed that there were 12 boats observed during the study period. The distance between the boat and the whale shark has been measured and the result presented in Figure 14. A preliminary study conducted by Pierce et al. suggested that observing whale shark using boat should not be less than 5 meters [26]. Besides, they also conveyed that the machine of the boat should be turned off and the capacity of boats in a single trip is 2 boats in maximum. This due to minimum possibility of collision with a whale shark, especially when doing a sudden movement. The formulated SOP for boat accommodation at Bentar Beach, Probolinggo was illustrated in Figure 15.

![Distance of boat/Trip](image1)

**Figure 14.** The average distance of a ship from a whale shark body.

![SOP of distance of a ship from a whale shark body](image2)

**Figure 15.** The SOP of the distance of a ship from a whale shark body.
4. Conclusion
This visual underwater survey (VUS) research has been administered to formulate feasible SOP’s to be applied in each place either in Kwatisore or Bentar Beach, Probolinggo. Kwatisore beach - the water is clear – allows the visitors to snorkel with whale sharks easily, but the SOP has been made that visitor must have a diving license and must be aware with the swimming distance with the whale shark – no more than three meters. The visitor should not touch the fish, taking photos with the blitz, and feeding whale sharks. The Probolinggo beach’s condition, on the other hand, which does not support snorkeling activities make SOP compiled only just a safe distance boat – no less than 5 meters- with whale sharks and there only two boats will be permitted in a single trip. The SOP has been prepared to be applied immediately and socialized to all elements of both the manager of the tourist area to the tourists for the sake of recreation survival with whale sharks.

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