REPORT

SURVEY OF DUGONG BIOECOLOGY AND BEHAVIOR IN SAP OF PANTAR STRAIT AND SURROUNDINGS SEA

ALOR REGENCY, EAST NUSA TENGGARA

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PREFACE

Praise and gratitude to The Might One God for all the graces so the survey report "Survey of Dugong Bioecology, Behavior, and Voice Characterization in Kabola Village, SAP waters Pantar Strait and Surroundings Sea" can be arranged completly. We also remember to say a lot of gratitude for the help of those who contributed by offering both materials and minds.

We hope that this report can be useful and beneficial, especially for Indonesia's dugong and seagrass conservation.

Apart from all that, we are fully aware that there are still imperfection both from sentence arragement and grammar. Therefore we accept all his suggestions and criticisms, to makes this report perfect.

Jakarta, January 2018

Writer

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INTRODUCTION

Background

Dugong (*Dugong dugon*) or known as mermaid is one of the 35 marine mammals that encountered in Indonesia sea. One od the water area that inhabited by this mammals is Alor Regency waters, East Nusa Tenggara that has been officially included in the Nature Conservation Area of the Waters (SAP Pantar Strait). In its development, WWF-Indonesia has conducted a preliminary study in last July 2016 that generated initial findings about the existence of dugong, that is, 1 dugong is found in Kabola Village waters.

Currently dugong has become one of the attractions of tourism with the increasing number of visits of local and international communities. But on the other hand, dugong whose existence becomes an indicator of the health of marine and seagrass ecosystem as a whole can be threatened due to uncontrolled and irresponsible tourism activities. Another threat facing dugongs in SAP Pantar Strait is the potential for being caught unintentionally / bycatch and hunting is still to be taken for tears, fangs, bones, and even the flesh. Coupled with the natural condition of dugongs that have a slow reproductive period as it reaches 10 years to mature and takes 14 months to give birth to a new individual at 2.5 – years intervals.

In order to maintain the sustainability of dugong and its habitat, program of *Dugong and Seagrass Conservation Project* (DSCP) Indonesia took the initiative to participate in dugong protection efforts in several areas in Indonesia, including Alor Regency, East Nusa Tenggara Province. The effort is done through strengthening the supervision and management aspects of dugong which include the regulatory and institutionalization among the community of local people.

Mali Beach, Kabola Village is one of the dugong's habitat and seagrass ecosystem in KKP SAP Pantar Strait and surroundings sea. Initial survey have been done by WWF-Indonesia and support from Udayana University, Association of Conservation Area of Kupang National Waters, Association of Coastal and Sea Resources Management in Kupang Area, Bogor Agricultural University, and Marine and Fisheries Agency Alor Regency in June – July 2016. Through the survey, information about the presence of dugong and seagrass habitat in waters of Mali was obtained. A total of 1 dugong seen to move everyday in the seagrass ecosystem in that water.

Up until now there have been two community groups and other fishing community that conduct activities around the dugong habitat. Two groups have been doing tourism activities interact with dugong as well as have a system of surveillance against existing tourists. So far there have been non-formal rules governing how tourist visitors should behave when interacting with dugongs.

Uncontrolled tourism activities both in terms of the number of visits and interactions that occur between humans and biota, is a very avoidable thing. Therefore, WWF-Indonesia has facilitated a series of discussion sessions at the community level as well as at the government level. One of the agreements that built is the need for a guide (code of conduct) that regulates interaction limit with dugong biota that allowed so as not to disturb the scientific insticts and biological properties it possesses.

Another things that required is the follow-up information about how the biota behaviors are performed each day, identifying the frequency range of dugong sounds, their reactions to sounds (boats and other types of sound) and how they react when interacting with local fishermen, divers, and snorkeler.

Conducted information and study are expected to support the basis of policy making and mutual agreement in dugong management. By knowing the condition of dugong bio-ecology in depth, furthermore can be done further study about how much pressure from human activity that can be tolerated by the rare biota and its habitat.

Aims

1. Identify dugong behavior in Mali beach waters, Kabola Village
2. Identify frequency of dugong's voice, and its reaction towards sounds
3. Reviewing the interaction between dugong and local fishermen and also tourists
4. Knowing local people's perception about dugong and its habitat (follow-up survey)

Outcome

1. There is follow-up information on dugong's bioecology and its reaction towards sounds and human behavior
2. There is follow-up information on people's perception about dugong and its habitat

3. There is recommendation about good interaction practices with dugong and another marine biota in Mali beach waters, Kabola Village

METHOD

a. Place and Time

This research is conducted in 30 October – 2 November 2017, in Mali beach, Alor Village, East Nusa Tenggara.

b. Dugong behavior observation

Dugong behavior observation was done to know dugong activity in a waters, in this observation the adlibitum method that was performed, which is recording every activity and time from observed dugong. In this observation Binoculars tools, DSLR camera (Tele lens), SCUBA, underwater camera, Drone, and stationary was needed.

The advantage of this method is to record the activities that are rare or unusual, but it is very important in explaining an event descriptively. This method makes it easier for observers to describe events in detail.

Data taken in this observation are :

a. All the dugong's activity at the surface.
b. Photo/video of dugong at the surface, underwater activities, and photos / videos using drone.
c. Dugong behavior when meeting fishing boats.
d. Dugong behavior when meeting with snorkeler and divers.

c. Dugong's voice characteristic while on activity and when interacting with boats and or human

Bioacustic surveby passive acoustic monitoring method were conducted using hydrophone device that consists of two hydrophone units that connected to an amplifier (sound signal controller) and recorder. Batteries can be used as source of energy. The hydrophone device is arranged with schematic in Figure 1.

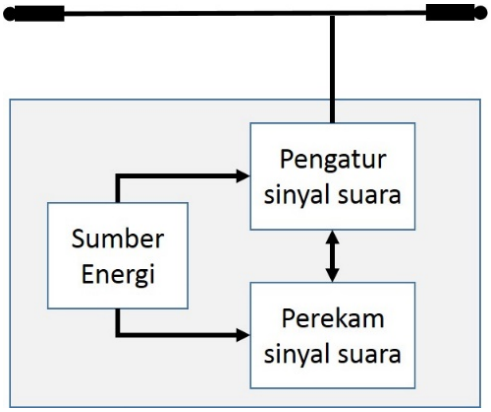


Figure 1 Scheme of Hydrophone Device Adopted from Ichikawa (2006)

The hydorphone that was used is a omnidirectional hydrophone type that capable of capturing sound from various direction around the hydrophone. In addition, it also has the ability to capture sound in the dugong frequency range (500 – 2200 Hz). If the hydrophone frequency range is large enough it can be controlled using an amplifier. The use of two hydrophones aims to produce stereo sound. This hydrophone device is placed on a relatively flat water base at depth and location that safe and representative. This devices can recording 24 hours full with replacement of the battery and memory everyday.

The method that was used in measurement is using Floating Stationary Survey scheme where an omnidirectional hydrophone that was connected to recorder above the ship. This hydrophone device is inserted into the water with the help of wood up to a depth of at least 1 meter from the water surface. The Floating Stationary Survey Scheme is shown in Figure2.

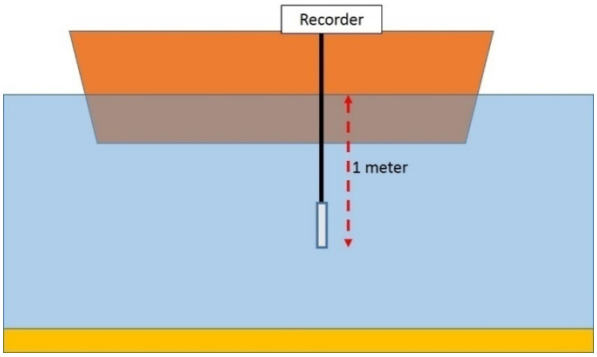


Figure 2 Recording Scheme by Floating Stationary Survey Method.

d. People's perception about dugong and its habitat

Participatory survey was conducted by interview using questionnaires about the existence of dugong and seagrass and people's perception. The questionnaires is summarized in the Booklet guide of National Qustionnaire Survey DSCP-ID3, a development of questionnaire survey about rare animals beruaray jauh (migratory species). Data retrieval was done using AKVOFlow that contain the data set that has been uploaded into the system. Target respondents are fishermen and local residents who live and do activities in the sea.

RESULTS AND DISCUSSION

Dugong Behavior Observation

Observations of dugong behavior were conducted within four days, which is started from Monday 30 October to Thursday 2 November 2017 in Mali Waters, Kabola Village (Figure 3). There were four scenarios in this observation, on the first day the team do observation using one boat (Mr. Onesimus Laa's Boat) and did not do any treatment to the dugong, only take notes all the activities that dugong do, recorded the activity using drone and underwater camera and do voice recording. On the second day observation still done with one ship but tried to drop the person who is snorkeling. On the third and fourth day observations were made using two ships (Mr. Onesimus Laa and Mr. Musa) as in Figure 4.

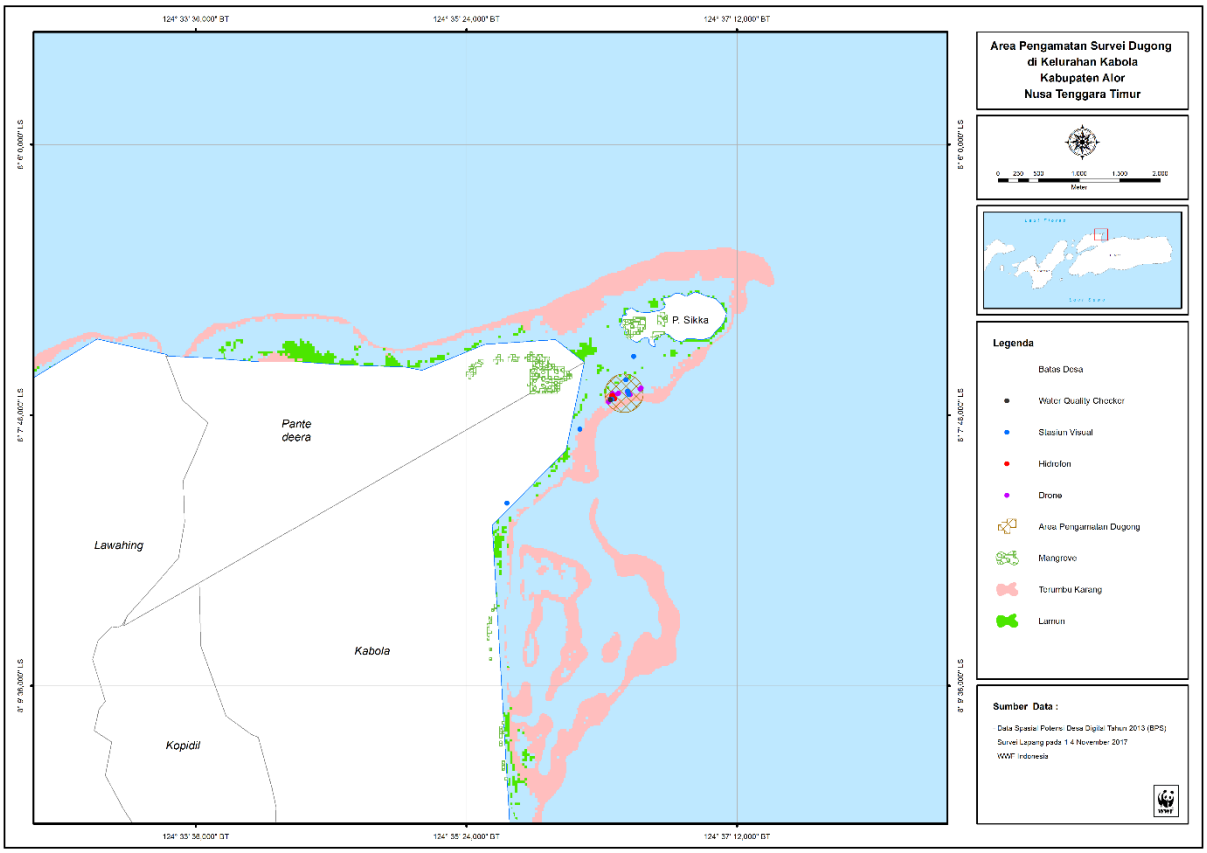


Figure 3 Map of Observation Location of Dugong Behavior in Mali Waters

Figure 4 Dugong Behavior in Mali Waters Survey Boat

Observation Day 1

The first day observation was done with one ship and there was no interaction whatsoever with the dugong, this was done to find out the natural activity of dugong when meeting the boat. The observation began at 10.17 WITA with fairly calm waters condition, when Mr. Onesimus Laa's ship approached the location of the dugong habitat, dugong go straight to the boat and circling as if observing the coming ship

Tabel 1 Dugong's Activities Obeservation Day 1

No	Activity	Percentage (%)
1	**Breathing**	**38.68**
2	**Swimming Circling The Boat**	**4.94**
3	**Playing The Wheel**	**3.29**
4	Hug The Boat	1.23
5	Play Below The Boat	1.23
6	Rubbing Genitals To Boat	1.23
7	Crashing Body To Boat	1.65
8	Swimming at base	0.82
9	**Swimming at surface**	**37.04**
10	Swim at column water	1.23
11	Rest at The Base	0.41
12	Showing Its Back	0.41
13	Stroll	0.82
14	Met Sea Turtles	0.41
15	Eat	0.41
16	Dive	0.41
17	**Took Penis Out**	**5.76**

Sumber: Data Primer (Berdasarkan Frekuensi Aktivitas)

During the first day of observation (Table 1), the most often activity that dugong do is swim on surface and breathe. Dugong swims on the surface of water around the ship, the distance between dugong and boat is not too far (1 – 3 meters). Dugong is a marine mammal that breathes using the lungs, dugong can not take advantage of dissolve oxygen in seawater, but oxygen in the free air. The activity of breathing has a fairly high percentage value, is because when dugong swim on the surface it's very often it do while taking a breath (Figure 5).

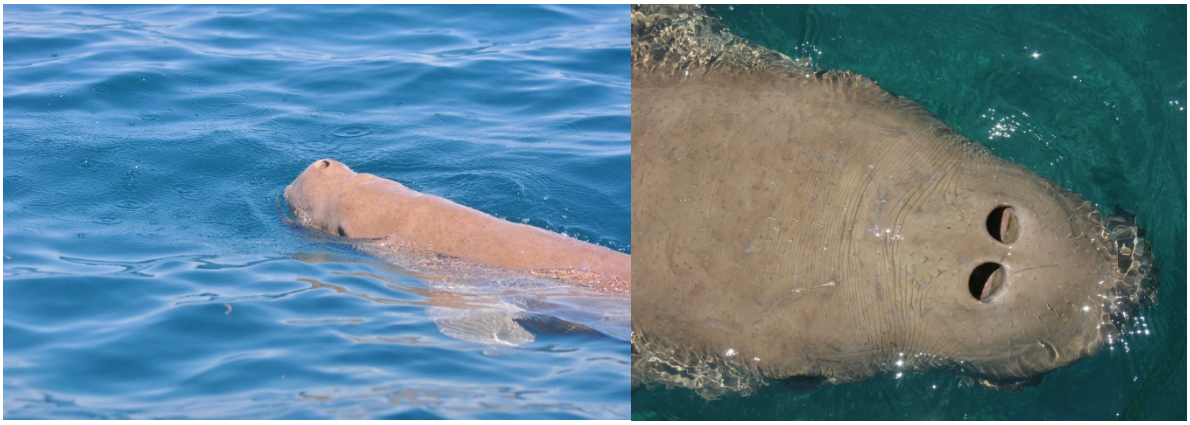


Figure 5 Dugong's Nose When Take a Breath

Another activity that is often done by dugong in Mali waters is pulling out his penis (Figure 6), dugong often pull out his penis and rubbing it into the boat. This activity was done by dugong repeatedly, but according to Mr One (Mali waters conservation activist, Kabola Village) he never saw the dugong taking out its penis and rub it into the boat.

Dugong in Mali water is a male, where male dugong genitals is not like other land mammals. The genital is in the body and will come out if there is something that stimulates it. Dugong in the Mali water has a length of $\pm$ 2,5 meters and is a juvenile dugong approaching adulthood, at this age usually dugong will try to find a female to marry. Dugong in Mali water lives alone without male nor female dugong that lives in that water, which resulted in dugong trying to vent his lust on other objects, such as to boats and humans. This incident is not the first time happened to sea mammals, dolphins also when sexually aroused will take its penis out and rub it on any object.

Figure 6 Dugong Hugged The Boat and Male Dugong Genitals Were Seen

At the time of observation there were also sea turtles coming to the boat, the presenve of the sea turtles does not make dugong move to play with sea turtles, as in observation in 2016, but dugong still stay close to the boat. On the observation also seen that dugong dive into the bottom of the waters then swim in column and eat seagrass at the base of water.

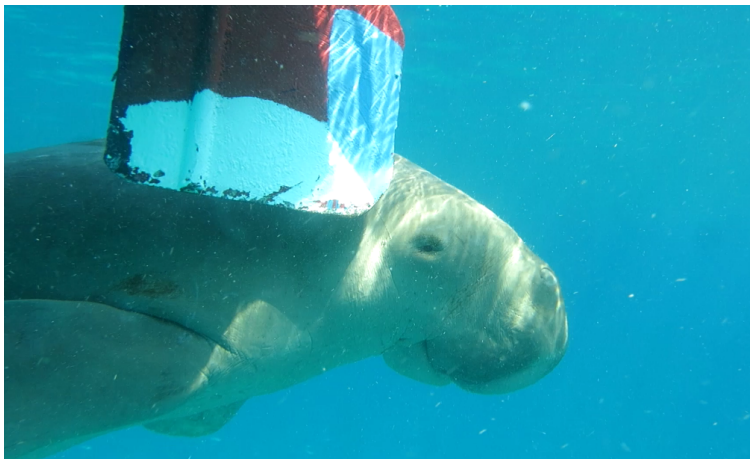


Figure 7 Dugong Playing in Boat's Wheel

At the end of observation at 16.40, the dugong began to steer saway from the ship slowly to the north of the Sikka Island, based on observation by drone, it was seen dugong occasionally diving into the bottom waters to eat seagrass and rest in the seagrass.

Observation Day 2

The second day observation was conducted with one ship and tried to drop 4 people (3 male and 1 female) in the morning and 1 person (male) in the afternoon to snorkel around the boat, this is done to know how dugong response to people that snorkeling around the boat. The observation started at 09.21 WITA with the water condition is quite calm and not wavy. As in the observation on the first day does not take a long time to see dugong, because when the ship move closer to the habitat, dugong move directly around the boat. When the anchor begins to be lowered the dugong has started playing around the helm of the boat (Figure 7), he played the wheel by rubbing his back and stomach. Dugong's quite high sound was heard on hydrophone, as if the dugong invited to communicate.

Tabel 2 Dugong's Activities Obeservation Day 2

No	Activity	Percentage (%)
1	**Breathing**	**42.34**
2	Crashing Body to Boat	0.90
3	Play The Wheel	0.45
4	**Swim Circling The Boat Swiftly**	**3.15**
5	**Swim at The Surface**	**40.54**
6	Play The Hydrophone	0.45
7	Play The Camera	0.45
8	**Hugged Khaifin**	**1.80**
9	Hugged Izaak	0.45
10	**Hugged Alexa**	**1.35**
11	**Hugged Juraij**	**2.25**
12	Hugged Mahfud	0.45
13	**Stroll**	**1.35**
14	Stroll	0.45
15	**Rubbing Genital to Boat**	**1.35**
16	Showing Its Back	0.90
17	Swim at The Base	0.45
18	Rubbing Body to Boat	0.45
19	Rest	0.45

Sumber: Data Primer (Berdasarkan Frekuensi Aktivitas)

At 09.50 WITA, the first person (male) get off the boat to snorkeling, his positon is at the front end to the right of the outrigger of the boat, less than 1 minute the dugong approached him directly and tried to embrace him (Appendix 4), it also seen that the dugong's penis was took out and tried to rubbed it on the person's body, the hugging activity is done by dugong ± 10 seconds. After that the dugong showed its back and dive to

the bottom of the water to eat. Dugong will show its back when going into the deeper water, this activity is done to give repulsion on its body to get into the water.

Hugging the first person was repeated by the dugong at 09.57 WITA, a four minute break from the first activity. The second hug is was performed by the dugong more forcefully, so the fins that the person use are slipping off his feet and drowning.

At 09.57 the second man (male) got off the boat to snoerkeling. His position was at the rear end of the left of the outrigger. Dugong tried to get closer, but did not hug him, just rubbing dugong's body and spinning around him. Dugong rather closer to the first person and occasionally dive down to the bottom of the water to eat.

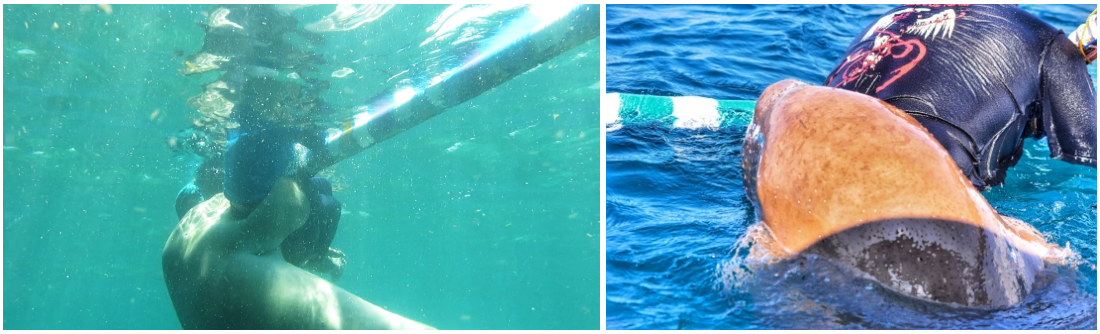


Figure 8 Dugong Hugged Human

At 10.00 WITA third person (female) got off the boat for snorkeling, her position was at the rear of the right of the outrigger. By the tim she was down, the dugong could not be seen from the observation for ± 4 menit. Then suddenly dugong appeared from the right side of the ship with the condition of the penis has come out of his body and tried to hug the first person bac, but dugong can not reach him, because the person tried to avoid by climbing outrigger. Because dugong can not get the first person, dugong swim around to the third personand tried to hug the third person (female) for about 10 seconds. Dugong's behavior that embraced the third person not only once, during the observation it was recorded that dugong hugged and tried to pulled her for three times.

At 10.21 WITA the fourth person (male) get off the boat to snoerkeling, his positioni was at the rear end of the left of the outrigger. By the time the person got off the boat, the dugong did not approached him, just strolled around the ship and occasionally approached the first and third persons.

In morning observation, dugong was seen more often approaching the first and third person, this is suspected because the position of the first and third persons is the same as the position of Mr One that often interacted with dugong when bringing guests for dugong tour. Therefore dugong think that the same person with the previous person who often interacted with it. In addition, out of the four persons who got off the boat, the dugong more often approached the third person (female). This is probably because the veromon hormone that comes out of women more attract male dugong to hug her.

Figure 9 Dugong Rise To The Surface

This dugong behavior hugging human is not a common behavior that other wild dugong do. This behavior is classified as aggressive, because it will be dangerous on humans who do snorkeling and diving tour activity in Mali water. As mentioned on first day observation this dugong is in puberty and sexually aroused. The morning observation ended at 11.05 WITA and continued at 14.14 WITA.

In the afternoon observation there was one person who dropped off to snorkeling around the boat, just after the person got off, dugong immediately approached and hugged the person tightly, dugong rubbed its head and mouth into the person's body, its genital was rubbed, and its tail was bent so the person was locked and can not go. The dugong tried so hard to pull the person to take him down, it was seen the dugong pull its head, to get its best position. The hug of dugong felt so tight and made the person that were pulled overwhelmed to hold it. Dugong's effort was not done only once, within 5 minutes dugong

tried to pull the person for 25 seconds as much as 5 times. Occasionally dugong also raised its face above sea level (Figure 9).

After the last person boarded the boat, the dugong just played around the boat, then went down to eat and swim away from the boat to the north of Sika Island. The observation of the second day ended at 17.00 WITA

Observation Day 3

The third day observation was conducted with two ships, which are the boat of Mr Onesimus Laa and Mr. Musa. The purpose of the use of these two boats is to know the preferences of dugong when interacting with the coming ship. On this third day oberservation there were no interaction whatsoever from humans, only camera and hydrophone that immersed in the water.

Tabel 3 Dugong's Activities Obeservation Day 3

No	Activity	Percentage (%)
1	**Breathing**	**42.94**
2	**Showing Its Back**	**3.68**
3	**Swim Circling The Boat**	**5.83**
4	Play The Hydrophone	0.31
5	Make Loud Noises	0.61
6	Play The Camera	0.31
7	**Swim at The Surface**	**40.80**
8	Crashing Body to Boat	0.92
9	Play The Anchor	0.31
10	Rest at The Base	0.92
11	Swim To Depth	0.92
12	Eat	0.31
13	Rolling on Sand	0.31
14	**Swimming Sideways**	**1.84**

Sumber: Data Primer (Berdasarkan Frekuensi Aktivitas)

Observation began at 10. 04 WITA, the first boat to the location is the ship of Mr. Musa (Figure 11). When the boat arrived in the location, dugong was immediately approaching the boat. When dugong arrived at the boat, dugong swam around the boat with occasional breath, and also heard pretty quite often the sound of dugong.dugong turned around to and rubbed his lower body into the boat, its genital was seen out of its body (Figure 10). Dugong swimming motion is very quiet not as aggressive as the previous days. Dugong is also seen showing its back and dive deeper into the bottom water to eat.

Figure 10 Dugong Hugging Boat and Rubbing His Penis

At 11.58 WITA, Mr. Onesimus Laa's boat moved to dugong habitat, when the boat was ± 1 km from Mr. Musa's boat, it as if that dugong already know it and immediately trying to find the source of the boat's voice. Dugong swam quickly toward the source of the boat's voice, when it was seen that the boat belongs to Mr. One, the dugong immediately followed him from behind, to the extent that his body was almost hit by engine propellers. After Mr. Onesimus Laa's boat was shut down, the dugong began to move around the ship and did not return to the Mr. Musa's boat until the observation was over (Figure 12).

Figure 11 Dugong Observation in Mr. Musa's Boat

Previous research in Shark Bay, West Australia (Anderson 1981) showed that mermaids are sensitive to the approaching boat from a distance of 150 meters with a speed of 3 – 5 knott. It is also found in observations, that dugong in Mali water are very sensitive to the sonds heard around, besides being sensitive, dugong also always try to observed the

sound it heard. At the time dugong playing around Mr. Musa's boat, there is a small boat owned by fishermen passing by, dugong immediately tried to check the sound or what boat is passing, but dugong did not follow the boat. Unlike the arrival of Mr. Onesimus Laa's boat, when the boat is still far away, dugong already know and move very fast to come to it. Dugong is a mammal that capable to remember the sounds he used to hear.

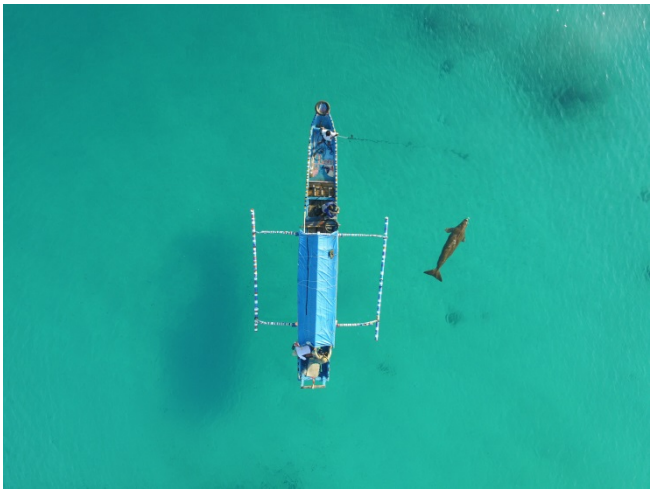


Figure 12 Dugong Activity in Mr. Onesimus Laa's Boat

Usually Mr. Onesimus Laa's boat passes and anchoring in the dugong habitat, making the animal familiar and able to recognize the shape, and sound characteristic of the boat. Besides that, the boat have the most distinctive characteristic in the waters of Mali, which is it have outrigger both on right and left sides. In the observation of Khalifa (personal communication 2011) at Seaworld Ancol, dugong was given several distinct sounds that were used as information that there would be divers who would feed them. Dugong able to remember the sound and sensitive to the sound given, this was seen by dugong behavior that approaching the sound source.

During observation on the third day, the activity that is often done by the dugong is to swam at the surface and breathe. Dugong swam in the water around the ship, with the distance that was not too far $\pm$ 1-3 meters. Dugong is a marine mammal that breathe by using the lungs, where dugong can not take advantage of dissolved oxygen in seawater, but oxygen in the free air. The activity of breathing has a fairly high percentage value, because when dugong swim on the surface very often while taking a breath.

At the end of the observation, the dugong shows different behaviors from previous days. When Mr. Onesimus Laa's boat had departed from the observation location, the dugong played behind Mr. Musa's boat (Figure 13), the boat began to be rowed into shallower water to avoid dugong when starting the engine, but dugong keep following he boat until reach the water with depth ± 1 meter. Dugong showed its pampered like fear of being abandoned by the boat, it rubbed its back to the boat and swam casually on the edge of the ship. Finally the ship is rowed into shallower waters again and the dugong begins to slowly move away, because if dugong keep on following, the animal will be stranded, then the boat's engine started.

Figure 13 Dugong Followed Boat in Shallow Waters

Observation Day 4

The fourth day observation was conducted with two ships, which are the boat of Mr Onesimus Laa and Mr. Musa. The purpose of the use of these two boats is to know the preferences of dugong when interacting with the coming ship. On this fourth day oberservation, the same to the third day observation, there were no interaction whatsoever from humans, only camera and hydrophone that immersed in the water, but only the two boats come together.

Tabel 4 Dugong's Activities Obeservation Day 4

No	Activity	Percentage (%)
1	**Swim at The Surface**	**35.34**
2	**Breathing**	**41.38**
3	Play The Camera	0.86

4	Scarp The Back to The Boat	0.86
5	Play The Wheel	0.86
6	Dive to Base	0.86
7	Rest at The Base	0.86
8	**Swim Circling The Boat Swiftly**	**1.72**
9	**Showing Its Back**	**13.79**
10	Eat	0.86
11	**Logging**	**1.72**
12	Play With Fish	0.86

Sumber: Data Primer (Berdasarkan Frekuensi Aktivitas)

When the boat was at the location, dugong was seen started to approach the boat from the north of Sika Island and directly to the Mr. Onesimus Laa's boat. Dugong begin its activities by swimming on the surface, breathing, playing the wheel, and occasionally showing its back (Figure 14) to dive into the base of water to eat and rest. Dugong is more often at th behind of the ship than any other position, this is because dugong is more interested in playing the wheel and rubbing its back or body parts on the steering wheel.

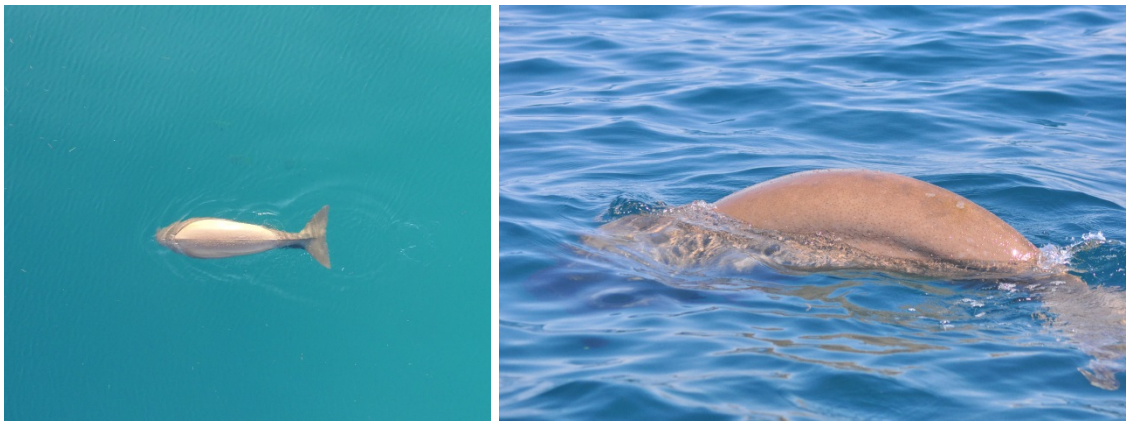


Figure 14 The Back of Dugong When Going to Dive

For almost 32 minutes dugong do activites in Mr. Onesimus Laa's boat, after that dugong started to go closer to Mr. Musa's boat that have the distance of ± 500 meters from Mr. Onesimus Laa's boat. And then dugong do activities as usual swam at the surface, breath, played the wheel, hugged the boa (Figure 15), and occasionally showed its back to dive to the base of waters to eat and rest. No strange behavior that showed by dugong in this fourth day observation, only once dugong seen to be playing with schooling fish in dugong habitat.

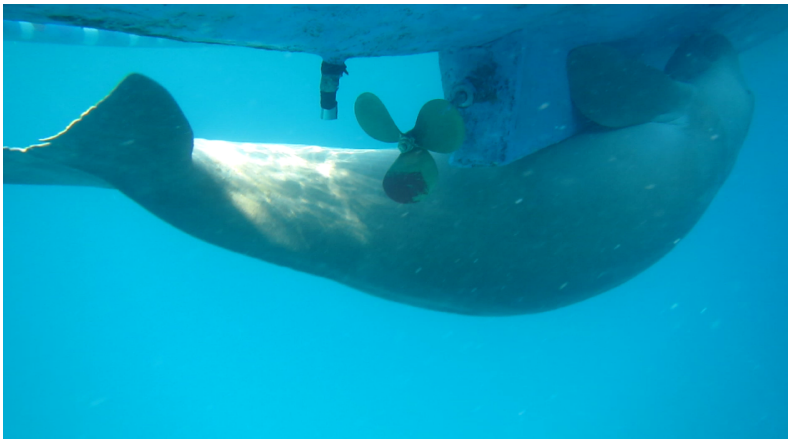


Figure 15 Dugong Hugged The Boat

Voice Characteristic and Types

In general, the classification of dugong sounds according to Andreason *et al* (1995) is grouped into three types of sounds: chirp-squeaks, barks, and trills. Chirp-squeaks have a short duration which is a modulated frequency signal. Chirp-squeak is a harmonization of two or five sounds produced by dugong that range up to 18 KHz sound frequency but if found only one sound, then it is called chirp. Barks is a broadband signal covering the frequency of 500-22,000 Hz with an average value about 1,200 Hz. The duration of barks itself ranges from 0.03 – 0.12 seconds. Meanwhile, for the type of trills sound, it sounds as a row of tones that increased with the duration of 100 – 2,200 ms. In the area of observation location in Kabola, there is an individual dugong male adult that became the object of the observation that routinely become one of the objects that visited by tourists frequently.

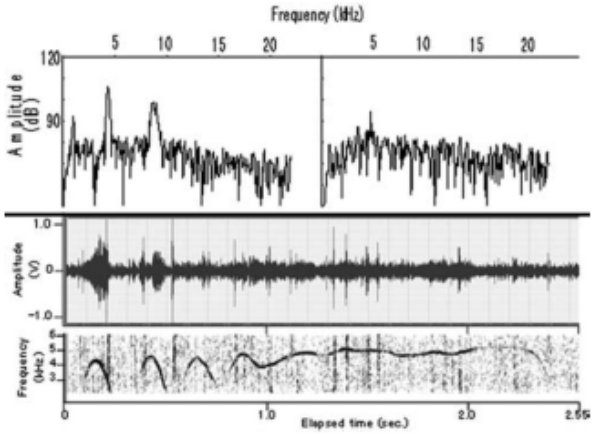


Figure 16 Sonogram (bottom) , waveform (middle) , and frequency (top) of dugong's voice that obtained in Thailand waters (Ichikawa *et al.*, 2003)

- **Sound Emergence:**

Sound observation was did with the duration of the entire recording for 10 hours 56 minutes 18 seconds (10.938 hours) with sound observation area is in Kabola Village, 11 sound files were obtained with dugong's sounds that detected were only detected in Kabola Village area. The dominant type of sound produced by dugong is barks as much as 130 times. The type of sound obtained in the observation can be seen in Figure 17.

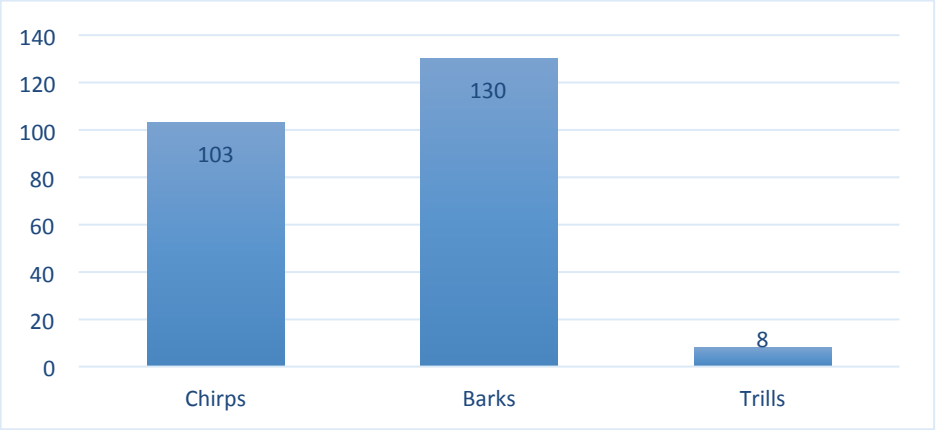


Figure 17 Distribution of dugong's voice type for 10,983 hours of observation

- **Chirp**:

Chirpis a type of dugong sound used for communication systems and echo-locations. Generaly used by dugong to identify the existence of another individual or show the existence of the individual itself. In this observation there were 103 types of chirp sounds that appear during this observation, this shows the interaction given by the dugong to the object located in the vicinity of observer's boat.

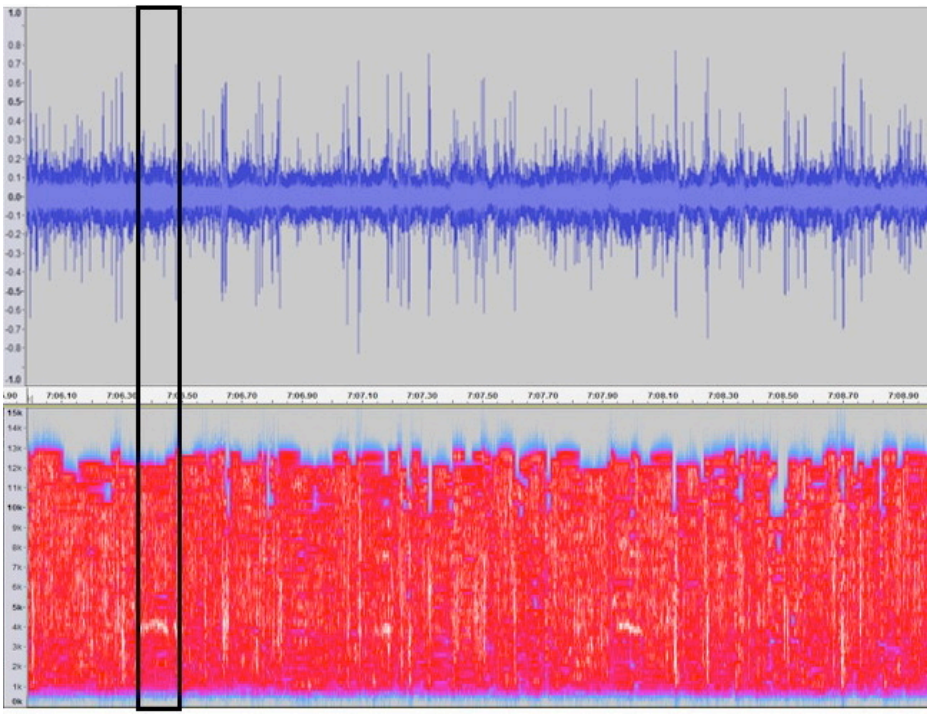


Figure 18 Sonogram (bottom) and waveform (top) from chirp that produced at the time of observation

The frequency range of the resulting chirps ranges from 1368 to 8538 Hz with a duration of sound between 0.046 – 0.185 seconds. The resulting frequency indicates that the sound produced by the dugong still has a range of sounds that can be heard by humans. However, the duration of sound released by each modulation is relatively fast, ie less than 1 second. The resulting sound intensity ranges from -38.0 – (-22.6) dB. Intensity can show how big the distance between the sound source with the hydrophone. The highest sound intensity is produced when the dugong approaches the hydrophone with value of -22.6 dB. Figure 18 shows one chirp generated from the observation, it appears that in the form of sound waves, chirp do not looked different from the other sounds. However, if shown with chart sonogram, the differences seem very visible where there is a crecent-shaped yellow color indicating the presence of sound modulated with a higher intensity value than other sounds.

- **Barks:**

Barks is the type of sound produced by dugong as a warning sound or as a marker of attack. Generally barks will not be issued by dugong but in certain

circumatances this sound will often be issued. Figure 19 shows sample results from sound graphs and sonogram of bark types. The blue waveform graphic of the bark has no difference with other sounds. However, on the sonogram graph there is a difference where there is a yellow color that shows the higher intensity produced by bark. It is seen that the colors that appear have different frequencies indicating that this type is the type of bark sound.

The measurement results of barks sound type was obtained average value of ranged frequency generated that is 5767 Hz ± 2058 Hz with duration of sound emergence between 0.079-0.463 seconds. The resulting frequency range is a broadband or a set of many simultaneously generated frequencies. So overall barks will produce sounds that have varying frequency values. The intensity of the resulting sound is higher than the sound produced by chirps that ranges between -35 to 19.9 dB.

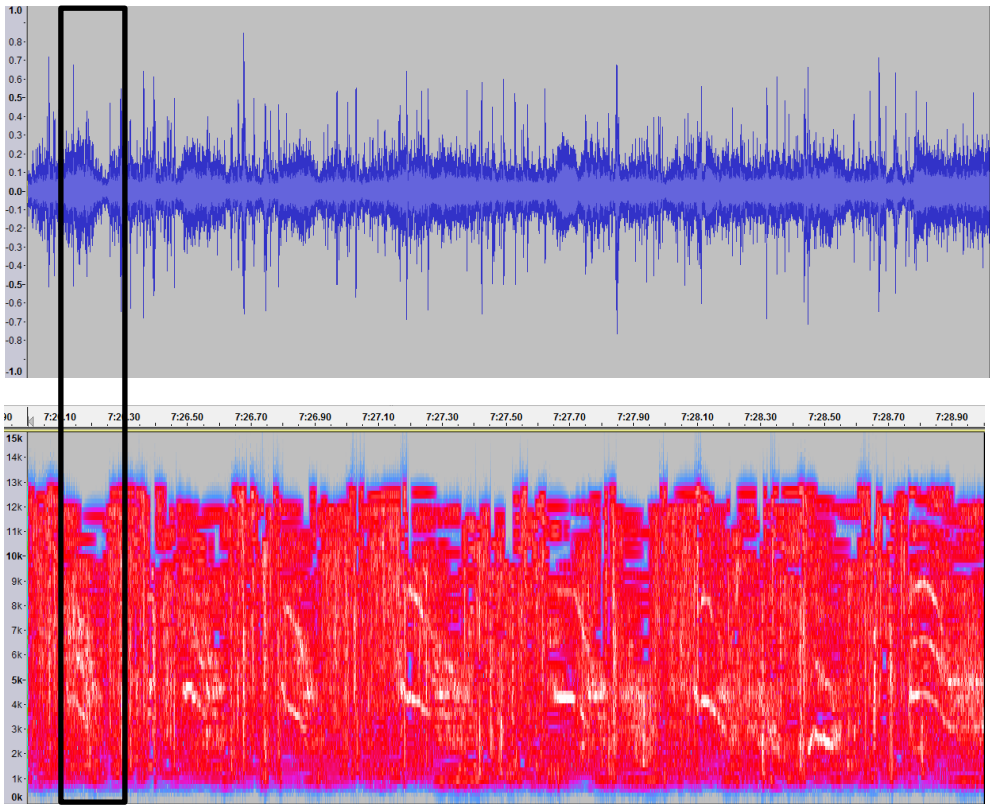


Figure 19 Sonogram (bottom) and waveform (top) from barks that produced at the time of observation

The sound of barks will show more to the condition than the dugong itself. At the time of observation the appearance of barks more often followed by the movement of dugong approaching and crashing into the body of the boat. Such behavior shows that the condition of dugong experience discomfort or experience certain conditions that make dugong become more aggressive.

- **Trills:**

Trills are the type of sound with the longest duration (long-duration) according to Anderson and Barclay 91995). Anderson *et al* (1995) mentioned that trills indicate non-aggressive actions. Conditions seen in the dugong that became observation where based on the results obtained, there are some sound trills generated by dugong. Figure 19 shows that trills if viewed from the sound form have differences from other sounds with the intensity and duration produced. The sonogram graph shows that in the trills sound type it appears that there is a polarization of the sound intensity produced with a long duration of 5 seconds. Analysis result obtained that trill's sound frequency ranges 3150 Hz ± 2100 Hz with duration 1.160 – 5.206 seconds. Sound intensity that produced ranges from -33.4 to -25.7 dB. When the observation was done, trills appear after dugong interact long enough with the boat and feel the existing conditions are not a threat to him.

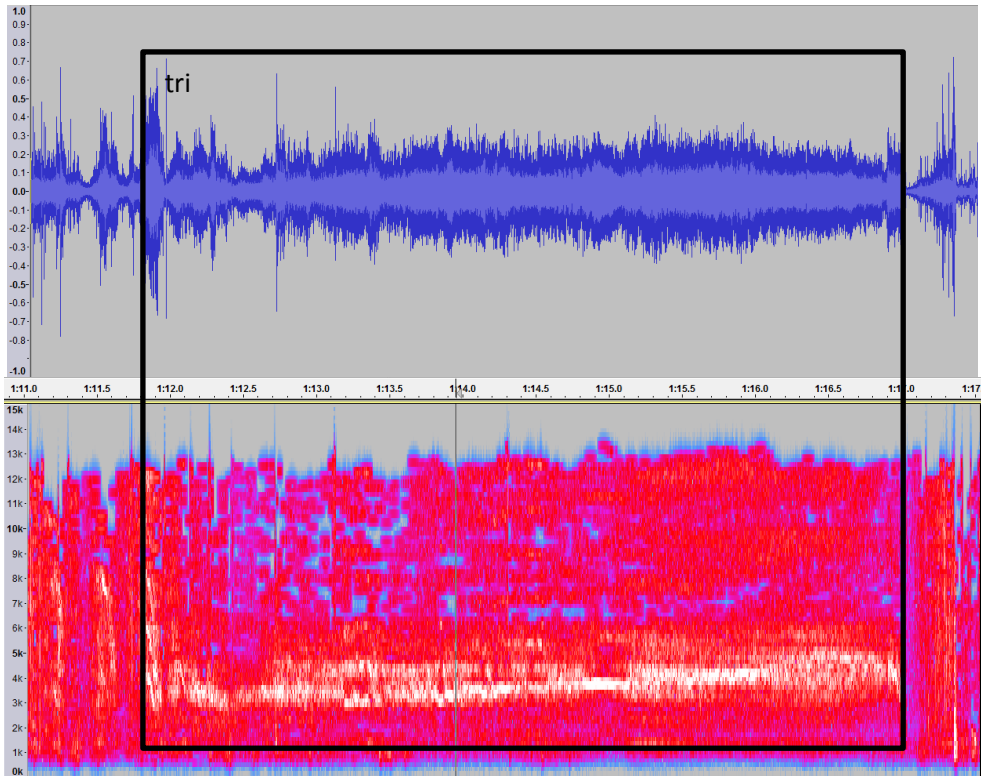


Figure 20 Sonogram (bottom) and waveform (top) from Trills that produced at the time of observation

Interaction of Dugong With Human

Dugong is a marine mammal that lives in shallow waters, its daily activity is done int the area around the seagrass beds, this is because dugong can not be far from seagrass as the main source of food. Based on surveys of 2016 and 2017, dugong in Mali water have activity everyday in between Sika Island and the edge of mainland Kabola Village, exactly at the end of airport runway of Mali. This location has 7 types of seagrass and 5 of them are dugong's favorite food, in addition to the availability of abundant food, this location is also not crowded by ships activity, only small boat owned by fisherman passing through the location. This causes the duguong tends to be safe and comfortable to live in the Mali waters.

During the observation, there were recorded behaviors performed by dugong, such as swimming on the surface, swimming at the bottom, eating, resting, breathing, playing the wheel, palying the cameras, playing hydrophones, socializing with sea turtles and fish, rubbing its body onto ships, rubbing its body onto wheel, took out its penis, rubbing its penis into boats and hugging human. Not all the behaviors above is a normal behavior that

dugong do in nature. Hodgson (2004) explained that, there are six daily behavior category that was done in Moerton Bay, which are : 1. Feeding, 2. Travelling, 3. Resting, 4 Socializing, 5. Rolling, and 6. Surfacing. If referring to that research, some of dugong behavior in Mali water such as : rubbing its penis to boat, rubbing its penis to human, and hugging human, is classified as abnormal behavior that was done by dugong. Those behavior tends to aggressive, because could put people that are travelling in Mali water in danger.

Dugong in Mali water is male sex with the length size of body ± 2,5 meters, if seen from the size of the body, dugong already in the changing phase from juvenile to adult, these phases that made dugong start puberty and have increase of hormone level that is high. Therefore, dugong tried to search female dugong with 2.5 meters length size of body, already in adult phase and have high level of tesotsteron hormone. Dugong in Moreton Bay, Australia is in increasing testosterone hormone production time at the months October – September or spring in the area. At those season, dugongs entering mating season phase and the enhancement of testosterone hormone increase four times higher than the other months.

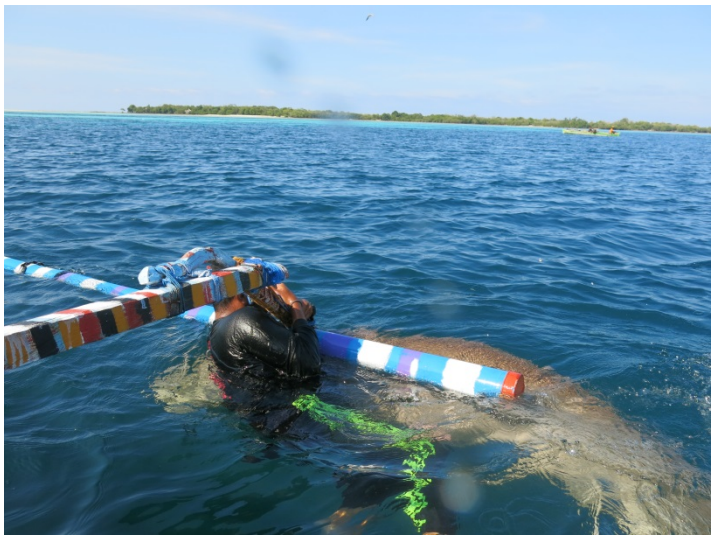


Figure 21 Dugong Tried to Hug Human

This incident of dugong hugging human have not happened before in Mali water, this incident is the first time to be found. Mr. One said he has interacted with this dugong for so long, from the dugong has 1,5 meters length up until now, but it is his first time seeing dugong behavior hugging human. Basically, natural behavior or character is avoiding human, only mermaid that often interacting with human that will be brave enough to do activities

around human. The danger that human will face if often interacted with dugong is there is no fear of human, and also the tendency of the animal to wreck its lust to human, and not to the other dugong.

The voices that produced by dugong give some signs about its existence and activity. When dugong saw ships or do acitivities around the ship, dugong will produce chirps sounds, but when interacting with human, dugong occasionally produce barks sound. The barks sound produced still appear not only when there were interaction with human and in this occasion is with treatment. But, the voices was still appear without the interaction with human, but will also appear when it feels the condition is uncomfortable or feel endangered. So barks could shows more aggressive pattern that dugong will do when face with condition that make it feels uncomfortable nor endangered.

Local people's perception about dugong and its habibat.

Follow up survey for dugong and seagrass habitat were conducted with the scope of digging people's perception about dugong and seagrass, and also dugong behavior observation. The digging of people's perception was conducted for 4 days, ie 1- 4 November 2017 in Kabola Village area, Pante Deere Village (west area of Kabola Village), and also Nurbenlelang Village and Lembut Barat Village (east area Kabola Village). These four areas were selected based on their proximity to the dugong habitat that located in Mali Beach water, Kabola Village, also to complete data collection on dugong and seagrass surveys in 2016.

Respondent's Background

The survey team interviewed 31 key informants (Table 1) who were residents in Kabola Village (22 persons), Lembur Barat (5 persons), Nurbenlelang (2 persons), Pante Dere (2 persons) and the majority of key informants are male (100%)

Tabel 5 Respondent's Data

No.	Name	Age	Sex	Occupation	Village
1	Adolf samasini	42	Male	Catch Fishermen	Kabola
2	Alexander Deel Bain	50	Male	Catch Fishermen	Kabola
3	Bahrudin Songge	41	Male	Catch Fishermen	Kabola
4	Bernabas Soares	52	Male	Catch Fishermen	Kabola
5	Dominggus hanaou	46	Male	Catch Fishermen	Kabola
6	Esau Bainlobang	33	Male	Other catch fishermen	Kabola
7	Huseiri Wildon	52	Male	Othes	Kabola
8	Jony Masiadang	30	Male	Catch Fishermen	Kabola
9	Justin Belmo	28	Male	Catch Fishermen	Kabola
10	Kader Kapu	55	Male	Catch Fishermen	Kabola
11	Kasim Rahman	44	Male	Catch Fishermen	Kabola
12	Lukas Palinata	45	Male	Catch Fishermen	Kabola
13	Osias Deel Tele	39	Male	Other catch fishermen	Kabola
14	Paris Penmani	38	Male	Catch Fishermen	Kabola
15	Ramadhan Nenu	47	Male	Catch Fishermen	Kabola
16	Sahid Kiko	53	Male	Catch Fishermen	Kabola
17	Salak Malimo	31	Male	Catch Fishermen	Kabola
18	Samanudin Kiko	643	Male	Catch Fishermen	Kabola
19	Sudirman Salale	40	Male	Catch Fishermen	Kabola
20	Timotius Kabolomo	35	Male	Catch Fishermen	Kabola
21	Yakob Hanaou	54	Male	Catch Fishermen	Kabola

No.	Name	Age	Sex	Occupation	Village
22	Yusuf Oujaha	55	Male	Catch Fishermen	Kabola
23	Abdulah Kasim	32	Male	Catch Fishermen	Lembur barat
24	Alimudin Hasan	42	Male	Catch Fishermen	Lembur barat
25	Kamis Abdul Kadir Maulani	55	Male	Catch Fishermen	Lembur barat
26	Rahmat Lanpada	52	Male	Catch Fishermen	Lembur barat
27	Syukur Karim	70	Male	Catch Fishermen	lembur barat
28	Ayub Atafani	40	Male	Catch Fishermen	Nurbenlelang
29	Yusup Atamau	27	Male	Other catch fishermen	Nurbenlelang
30	Imanuel Penlamuil	39	Male	Nelayan budidaya	Pante Deere
31	Noh Jahatang	58	Male	Catch Fishermen	Pante Deere

Twenty six key informants (84%) who worked as Capture fishermen and 1 key informant (3%) worked as cultivation fishermen, and 4 key informants (13%) worked as capture fishermen and have side jobs such as sea ojek, honorary worker in agricultural companies, selling mangrove's seedlings, and the army. Twenty one key informants (68%) had fishermen's background, and 10 key informants (32%) did not have fishermen's background.

Perceptions of dugong and its habitat

When asked about dugongs, nine key informants (61%) said they had seen dugong, while 12 informants (39%) had never seen dugong in the water territory where he lived. Six (19%) informants claimed to have seen dugong several times, 6 (19%) stated to have seen dugong daily, five (16%) stated to often seen dugong, 2 (7%) stated only once seen the dugong (Figure 22). From the information of the people, it was known that 17 informants (55%) that stated there is 1 dugong that lives in their area, 2 informants said there were a number of dugongs, less than 10 dugongs, and the rest (39%) could not estimate the number of dugong that lives there.

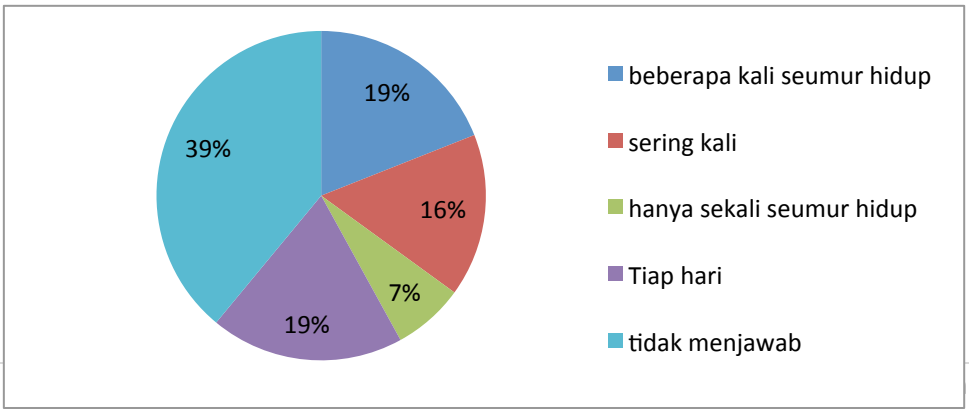


Figure 22 How often you see dugong?

Villagers of Kabola Village, Pante Dere Village, West Lembur Village, and Nurbenlelang Village stated that dugong is commonly seen in the waters around Sika Island. The kabola people stated that dugong location appears to be unchanged by time (41%) and 3% says the location of dugong changes over time. While the rest (56%) stated do not know whether the location is changed or not according to the time.

Two key informants (6%) said they had seen dugong infants in 2016 and May 2017 around Sika Island and 29 key informants (94%) said they had never seen a dugong baby. One informant (3%) said there were people or people from the other village who accidentally caught the baby dugong (trapped in the net) and 12 key informants (39%) saud no one from another village caught dugongs, and the rest (58%) does not know whether there were locals as well as from other villages that catch dugongs. A total of 19 informants (61%) said none of their villagers that have occupation as a dugong catcher and 20 informants who did not know whether there were a specialist on catching dugong in their vilage or not.

If there is a dugong caught unintentionally 1 informant (3%) answer that it will be sold and if dugong caught unintentionally then dugong usually would be discarded or released back to sea and 19 informants (61%) never find / hear about dugong that stranded on shore. Based on the interview, people said if there were stranded dugong incident, the people will report the incident to the Village Head. The pople will try to help by returning the dugong to the sea if dugong still alive. Nine key informants (3%) stated that when compared to the first time working as a fishermen, there was no change of the number of dugongs living in their area.

Dugong and Seagrass Ecosystem

From 31 respondents, 22 key informants (71%) said they had seen seagrass beds and 9 key informants (29%) never saw or knew about seagrass beds.

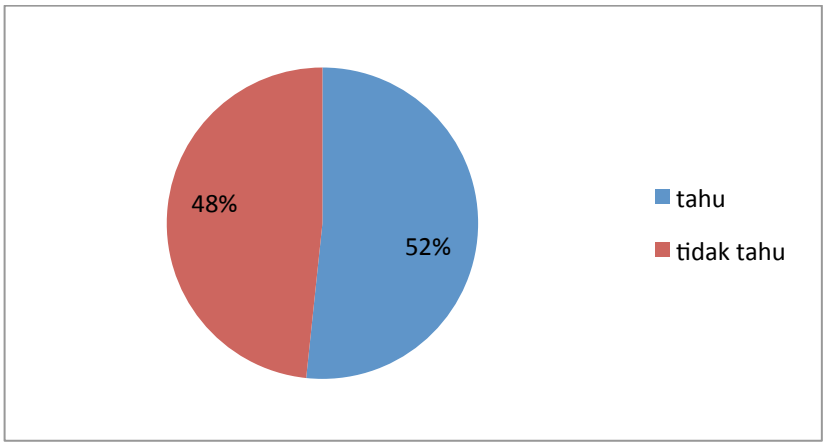


Figure 23 Do you know about seagrass?

Nineteen key informants (61%) said there is seagrass in their area. Regular poeple call seagrass as seaweed. As much as 16 key informants found it in 0 – 5 meters deep below the sea level, while 3 informants found it in 5 – 10 meter deep.

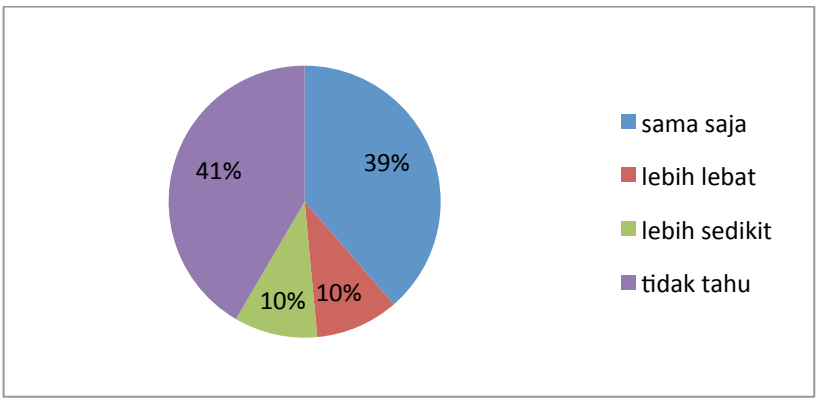


Figure 24 Perception about changes of seagrass beds

The seagrass condition stated by 39% key informants did not change over time, while 3 key informants (10%) stated the seagrass is currently less than before, 3 informants (10%) stated the seagrass is more dense now, while the remaining 13 key informants (42%) do not know the differences between the current and the past seagrass condition (Figure 24). When asked further, 61% of informants stated that the existence of seagrass plants is important for the life of dugong because it acts as a habitat and as well as feed. Three key informants (10%) stated that the existence of seagrass is not important for the life of dugong, while the rest (29%) do not know (Figure 25).

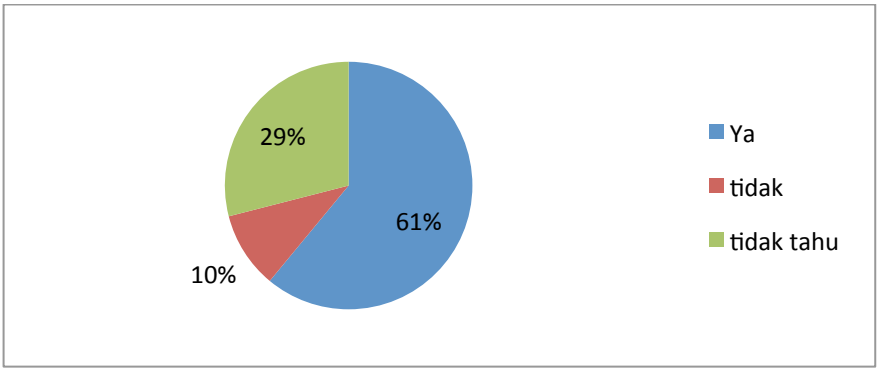


Figure 25 Is seagrass important to dugong's life?

Perception and Understanding of The People About Dugong

As much as 18 key informants (58%) know that dugong is protected and 12 key informants (39%) do not know that dugong is protected, and 1 informant (3%) said that dugong is not protected.

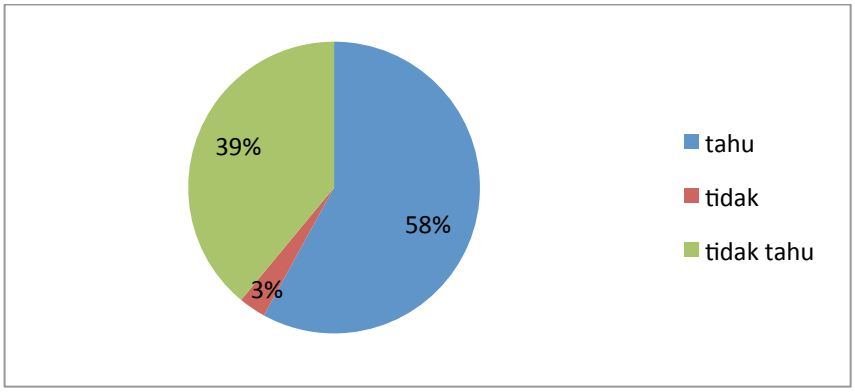


Figure 26 Perception about dugong conservation's status

Eighteen key informants (58%) said that killing dugong deliberately is illegal and the rest (42%) does not know that killing dugong deliberately is illegal. While 4 key informants (13%) said killing dugong unintentionally is illegal, and 6 key informants 919%) said that killing dugong unintentionally is not illegal, the rest (68%) said do not know. Nineteen key informants (61%) said that they will report dugong that caught unintentionally to authorities such as the Village Chief, the government and the local people.

According to two key informants (6%) there is often regular supervisory / patrol activity in the waters of the area, ie from water police, fisheries, and *pokmaswas*; 12 key informants (39%) said that there were rarely routine supervisory / patrol activities in regional waters,

while 14 key informants (45%) stated that there was never a regular supervisory / patrol activity in regional waters (Figure 27).

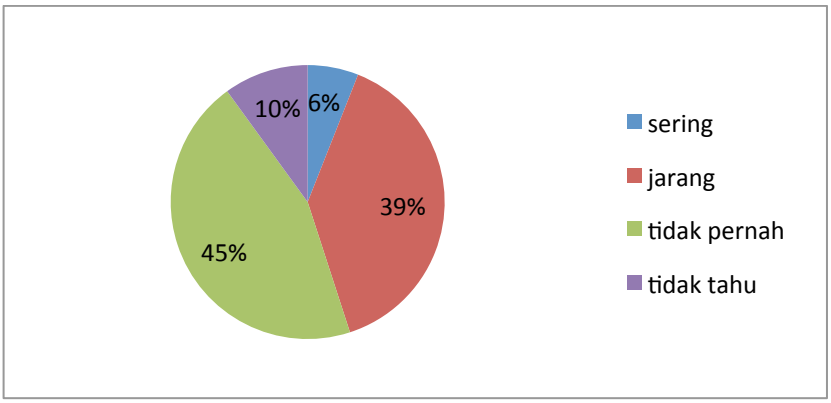


Figure 27 Routine surveillance or patrol activities in water area

Sixteen key informants (52%) said they want to engage and participate in supporting Dugong and Seagrass Conservation, as many as 24 key informants (77%) strongly supported the role of government, society leader, people's organization, and / or private parties (eg resort tourism) to conservation efforts.

Based on interviews, the people that represented by key informants had different views on the impact of activities occurring in coastal environments on dugong conservation and seagrass habitats. According to them (49%), population increase affectsthe dugong and seagrass conservation efforts, 58% argue that the increase tourism facilities or activities is influential, 97% of informans said the increase of industrial activity / mining of sand and rock (coral reefs) influences the conservation of dugong and seagrass, 97% also stated that the increase of waste and trash had significant influence, 84% said there was influence by climate change / weather pattern, the intensity of motorized boats voyages especially with passenger stated 64% influenced, and also 97% informants said fishing that destructing habitat has an influence on the duguong-seagrass conservation efforts. Meanwhile in terms of understanding, 57% of informants argued that the people's lack of understanding about the importance of dugong and its habitat in lamun ecosystem affecting to conservation efforts, while the presence of water conservation areas is expressed by 57% informants that could affecting dugong and seagrass conservation. Besides that, one of the most significant could affecting conservation efforts, is the existence of patrol and / or law enforcement patrols for those who violate protected animal protection regulations, especially dugongs and seagrasses.

People's perception of development and other protected animals

All key informants (31 persons) said that they agreed if their village developed road construction, 97% of informants also agreed if there is motorization (motoring) on the fishing boat. Different views were found in the construction of hotels / resorts in their region, 61% of key informants agreed while 39% disagreed. Meanwhile, 48% of key informants agreed that if there is a shopping center development in their area.

All key informants said they had seen sea turtles. The people of Kabola called sea turtles "kea" and "ji'u", with the type of sea turtles seen are lekang sea turtle, sisik sea turtle, and green sea turtle. All of them also saw dolphins and / or whales when heading to fishing location and when fishing. There is a special time for the occurance of whales, which is in the West Season, October – December, while dolphins can be found almost every month. In 2015, people claimed to have found a single whale stranded in the coastal area of Batu Putih with a wound on his back.

CONCLUSION

Based on the results of the study, it can be concluded that:

1. Many activities were done by dugong in Mali water, such as swimming at the surface, swimming at the base, eat, rest, breath, play the wheel, play the camera, play hydrophone, socialize with sea turtles and fish, rubbed its body to boat, rubbed its body to wheel, took out penis and rubbed it to boat, and also hugged human.
2. With the behavior of the type of sound produced by dugong which are chirps, Barks, and Trills. The sounds of dugong gives a signs of its existence and activity.
3. Dugong is very familiar with humans and dare to do activities that should not be done by dugong to humans.
4. A total of 31 key informants become key informants in questionnaire survey in Kabola Village, Pante Deere Village, Nurbenlelang Village, and Lembur Barat Village. Local people already know about the existence of dugong and seagrass ecosystem, ad also has an understanding of the status of dugong as a protected animal by the State and the law. There is a different understanding of the relationship betwee the existence of seagrass and its influence on the existence and preservation of dugong.
5. The people have understand the activities that can affect conservation efforts and sustainability of dugong and seagrass, which is the increase of population, increasing facility or the influential tourism activity, the increase of industrial activity / mining sand and stone (coral reefs), escalation waste and waste disposal have a significant influence, the effect of climate change / weather patterns, the intensity of cruise ships, fishing that destruct the habitat. People also expressed the people's lack of understanding about the importance of dugong and its habitat in the seagrass ecosystem affecting the conservation effort,
6. One of the significant factors affecting protection efforts is the existence of conservation aeras, as well as patrolling and / or law enforcement activities for parties violating protected animal protection regulations, especially dugong and seagrass.

REFERENCE

Anderson, P. K. R. M. R. Barclay. 1995. Acoustic signals of solitary dugongs: physical characteristics and behavioral correlates. *Journal of Mammalogy*. (76):1226-1237.

Burgess AE, Lanyon JM, Keeley T. 2012. Testosterone and tusks: maturation and seasonal reproductive patterns of live, free-ranging male dugongs (Dugong dugon) in a subtropical population. *Reproduction*. (143): 683–697

Hodgson AJ. 2004. Dugong behaviour and responses to human influences. *PhD thesis, James Cook University*,Townsville, Ausralia.

Ichikawa K, Akamatsu T, Shinke T, Arai N, Hara T, and Adulyanukosol K. 2003. Acoustical Analyses on the calls of dugong. *Proceedings of the 4th SEASTAR 2000 Workshop*, *pp*. 72–76

Ichikawa K, Tsutsumi C, Arai N, Akamatsu T, Shinke T, Hara T, and Adulyanukosol K. 2006. Dugong (*Dugong dugon*) vocalization patterns recorded by automatic underwater sound monitoring systems. *J. Acoust*. Soc. Am. 119, 3726–3733.

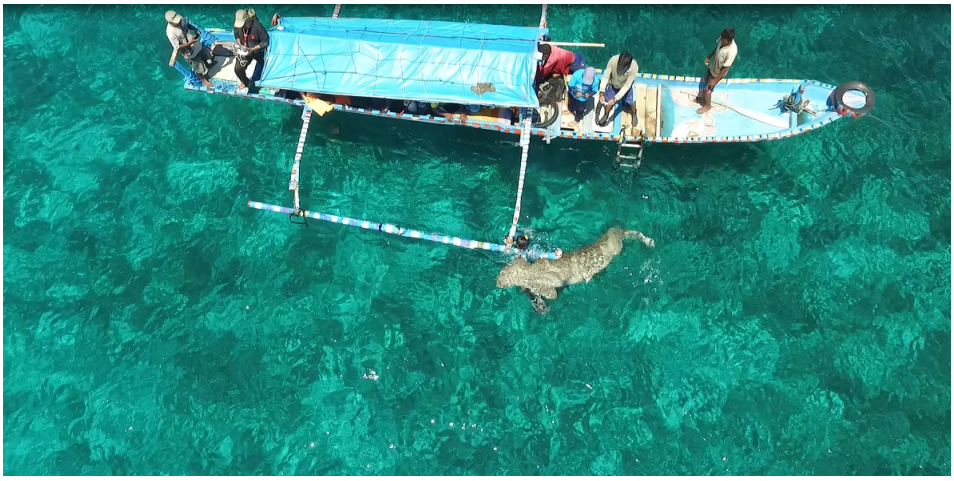
APPENDICES

Appendix 1 The atmosphere of dugong's voice observation in Mr. Onesimus Laa's boat

Appendix 2 The atmosphere of dugong's voice observation in Mr. Musa's boat

Appendix 3 Dugong Swimming At The Surface

Appendix 4 Dugong interacting with human



Appendix 5 Table of Dugong Behavior

No	Tingkah Laku	Definisi
1	Swim at The Surface	Swimming on the surface is an activity performed by dugong by swimming around the ship or in the sea, with the position of the body near the water surface
2	Swim at The Base	Swimming at the bottom of water is an activity performd by dugong at the base of water. Usually this activity is done when dugong will eat or rest
3	Eat	Grazing or eating is an activity performed by dugong on the ocean floor. There are two ways dugong when it eating : grazing and cropping. Grazing is one way of eating done by dugong by eating the whole body of seagrass, ranging from leaves, stems, and rhizomes. This way of eating is done by prying and digging the entire body of seagrass, which will lead to the puff of sediment around it. Dugong's eating activity in this way, results in traces or paths that used to pry and excavations on substrate on the seafloor or known as feeding trail.cropping is a way of eating done by dugong by only taking part leaf strand and leaf blade, so the sediment does not get stirred, does not lead to sediment and leaves no trail of feeding trail.
4	Rest	Resting is done by dugong on the surface, the water column and at the bottom of the substrate
5	Breath	Breathing is an activity performed by dugong to take the air. As it rises to the surface, its nostrils open to realease CO_2 and inhale oxygen and close it quickly in just seconds. Dugong will do this activity every 3 – 5 minutes.

6	Socialize	Socializing is an activity performed by dugong by interacting with other dugong, sea turtles, or other animals.
7	Play The Wheel	Playing the wheel is an activity performed by dugong by crashing its back or try to reach the wheel with both flipper.
8	Play The Camera	Playing the camera is an activity performed by dugong by crashing its back or try to reach the camera with both flipper
9	Play The Hydrophone	Playing the hydrophone is an activity performed by dugong by crashing its back or try to reach the hydrophone with both flipper
10	Rubbing Body	Rubbing body is an activity performed by dugong by rubbing its body (back, lower body, penis) to the ship.
12	Hugged Human	Hugging humans is an activity done by dugong by hugging human with both flippers and then locked by bending its tail.

Appendix 6. Recommendation of ethical code for dugong tourism

- Boat

  Should be closed for the sake of visitor's convenience, if possible seated with direction to the sea. But it can also use open roof boats to expand visibility.
- Engine and the speed of boat

  Reduce speed when entering dugong's habitat, observing dugong in a dead engine state.
- Number of visitors : 5-7 persons (according to boat's capacity)
- Number of boats : maximum 2 boats with a distance not too close (+/- 100 meter)
- Visit duration: maximum 30 minutes
- Visit time: 10-15 WITA
- Allowed interaction : observing from the boat (not touching, not took limbs out of the boat, except to take pictures)
- Allowed documentation : taken from the boat, for underwater camera taken using selfie stick / tongsis, no flash allowed, not allowed to pull and drop or seeking dugong's attention

- Number of visits per day : maximum 2 – 3 times
- Number of visits per week : maximum 3 times
- Management mechanisms

  Licensing to the Provincial DKP (next the SAP Strait Management Agency), forwarding to Mr. One and team to set the schedule.
- The availability of price and service standard.

Appendix 7 Dugong observation rules

1. Not allowed to swim and or dive (except for research and permission from village and DKP of NTT Province)
2. Not allowed to took limbs out of the boat (except shooting using selfie stick)
3. Not allowed to hold / touch the body of the dugong
4. Not allowed to make noises (laugh, joke, yell)
5. Not allowed to use blitz / flash when taking picture of dugong underwater
6. Not allowed to feed dugong
7. Not allowed to dispose trash on the coast and along the way to dugong habitat
8. Not allowed to swim around the dugong habitat (Mali Beach and Sika Island) without coordination with the local people