Report

PRELIMINARY FIELD SURVEY ON DUGONG AND SEAGRASS HABITAT

Bintan, 22 - 27 August 2016

Organized by:
Ministry of Marine Affairs and Fisheries
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INTRODUCTION

Background

Dugong are endangered and currently listed as vulnerable to extinction species based on IUCN (1996) red list- species and included in Appendix 1 CITES (the Convention of International Trade in Endangered Species of Wild Flora and Fauna). Dugong population in Indonesia scattered almost everywhere on shallow water ocean around Indonesia. Marsh (2002) predicted on 1970 the population of dugong was around 10.000 individuals, but in 1994 the population diminished to 1000 dugong.

Through the collaboration between Indonesia Ministry of Marine Affairs and Fisheries (KKP), Indonesian Institute of Science (LIPI), Bogor Agricultural University (IPB), World Wildlife Fund (WWF-Indonesia), which funded by Global Environment University (GEF) are initiating Dugong and seagrass ecosystem conservation program: *Dugong and Seagrass Conservation Projects* (DSCP). This program has been starting in 2016 and is scheduled to complete in 2019. Some locations in Indonesia have been selected as program implementation sites. The locations are Bintan, Kotawaringin Barat, Toli-toli and Alor.

The existence of dugong and seagrass ecosystem in these four areas have been well known in the national symposium of Dugong and seagrass ecosystem in 2016. To acknowledge the current status of Dugong and seagrass ecosystem in these locations, a preliminary survey in these areas has been established with several methods.

Since 2008 many studies have been done on seagrass ecosystem in Bintan. From the studies as well, it has been acknowledged the appearance of dugong on site. Bintan also part of TRISMADES Project (Trikora Seagrass Management Demo Site), which also an activity funded by GEF which has run from 2007-2010. Even though there have been several studies about Dugong in Bintan, we only have limited information about dugong population, particularly in Bintan. The current news about stranded Dugong in Bintan area should be given more attention. Thus, this location should be prioritized in dugong and seagrass ecosystem conservation program.

Purpose

The purpose of the preliminary field survey is to:

1. Acknowledge the presence and common location of dugong sightings,
2. Acknowledge the seagrass ecosystem condition,
3. Review the awareness level in the community about dugong and Seagrass ecosystems, and
4. Recognize the threats to dugong and seagrass ecosystem

I. STUDY ON DUGONG EXISTENCE AND DISTRIBUTIONINBINTAN

1. Method

1.1. Visualsurvey

Visual survey method is conducted with three different method, including Visual survey by boat, aerial survey, and from under water with feeding trail identification.

1.1.1. Visual survey by boat

Visual surveying by ship was conducted by three observers. Two observers were on the bow of the ship and one person was at the stern of the ship(Figure 1). Two ways were applied in this observation, by using binoculars and without binoculars (observer's eyesight only). Observers who observed dugong were in the bow by using binoculars while observer who was at the stern observed it without the tools, or with their visiononly. One observer in the bow also acts as a data recorder. Observations were made for 15 minutes continuously. After 15 minutes, observersrotated to do other roles. During observation, travel data was stored directly in the GPS.

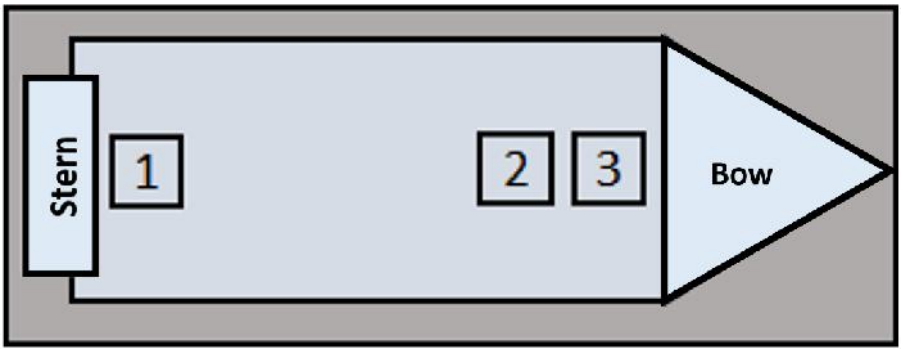

Figure 1. Observer position in boat survey

1.1.2. Aerial visual Survey

Aerial surveys were conducted to record the abundance and distribution of dugongs. Aerial surveys used a small plane/drone. Drones were operated at an altitude of +/- 30 meters abovethe sea level at a speed of 6 m/s. At that height, the drone captured images at 6 meters on the right and left of the line transect. The line transects used was 400 meters long and the distance between line transects was 100 meters. The description of the aerial survey plan was shown in Figure 2.

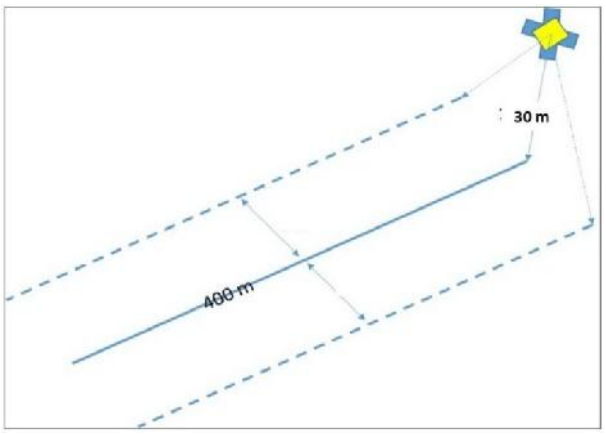

Figure 2. Dugong aerial survey design with drone

1.1.3. Underwater visual survey with feeding trail identification

Feeding trail is a path formed by dugong feeding activity. The initial stage of observation is done by manta tow by boat to detect the presence of dugong feeding traces. The feeding traces found are analyzed, whether they are included as old or new traces.

The new feeding traces are directly documented using the camera, marked with GPS, recorded in length x width by meter and marked using color clips. This is conducted to determine the condition of the feeding trace and to avoid double data. As for the old eating trails, performed the same steps, but with including additional data on the existing high seagrass measurements. This is done to find out how long hasthe feeding trailbeen in the location. Observations were made using basic dive tools (masks, snorkels, fins), GPS, and underwater cameras.

1.2. Bioacoustics survey method

In this method,an omnidirectional hydrophone was connected to a recorder onboard. This hydrophone device was attached to a stick and inserted into the water to 1-meter depth or more from the water surface. The Floating Stationary Survey scheme is shown in Figure 3.

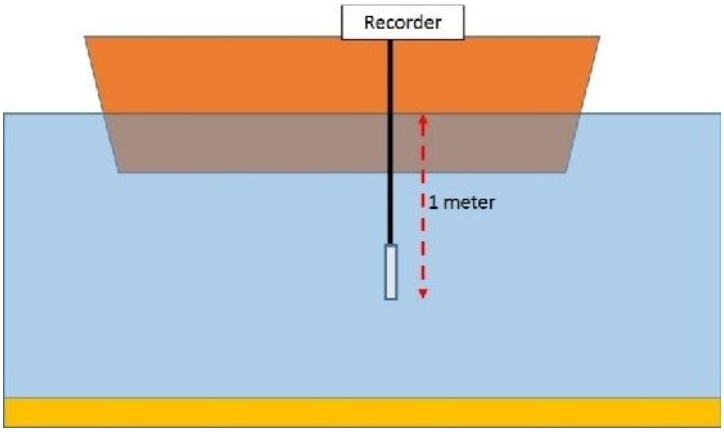

Figure 3. Recording scheme with *floating stationary survey* method

This method required an omnidirectional hydrophone device, voice recorder, battery (power source), headphones, wood, data sheets, and binoculars. One personnel needed to operate omnidirectional hydrophone and two people for visual observation using binocular.

Voice data recording was performed at potential dugong habitat locations. Potential habitat information was obtained based on interviews and results of underwater visual methods or the identification of feeding traces. Data recordingwas conducted at the time of dugong potential occurrence.

One method to record the communication or the sound which has been produced by the dugong is using the Bioacoustics recorder. Bioacoustics observation had been done for 3 days (23-25 August 2016), the tools had been used in this research is a*hydrophone* SQ26-H1, this tool being dipped in the water which indicated any activity from the dugong, and then recording using a recorder (Figure 4 And 5) The soundwave which recorded in the recorder will be analyzed further on the programs which has been settled.

Figure 4. Operating the hydrophone

Figure 5. Hydrophone is submerged into the depth

In general, data collection site is shown in figure 6 as the following.

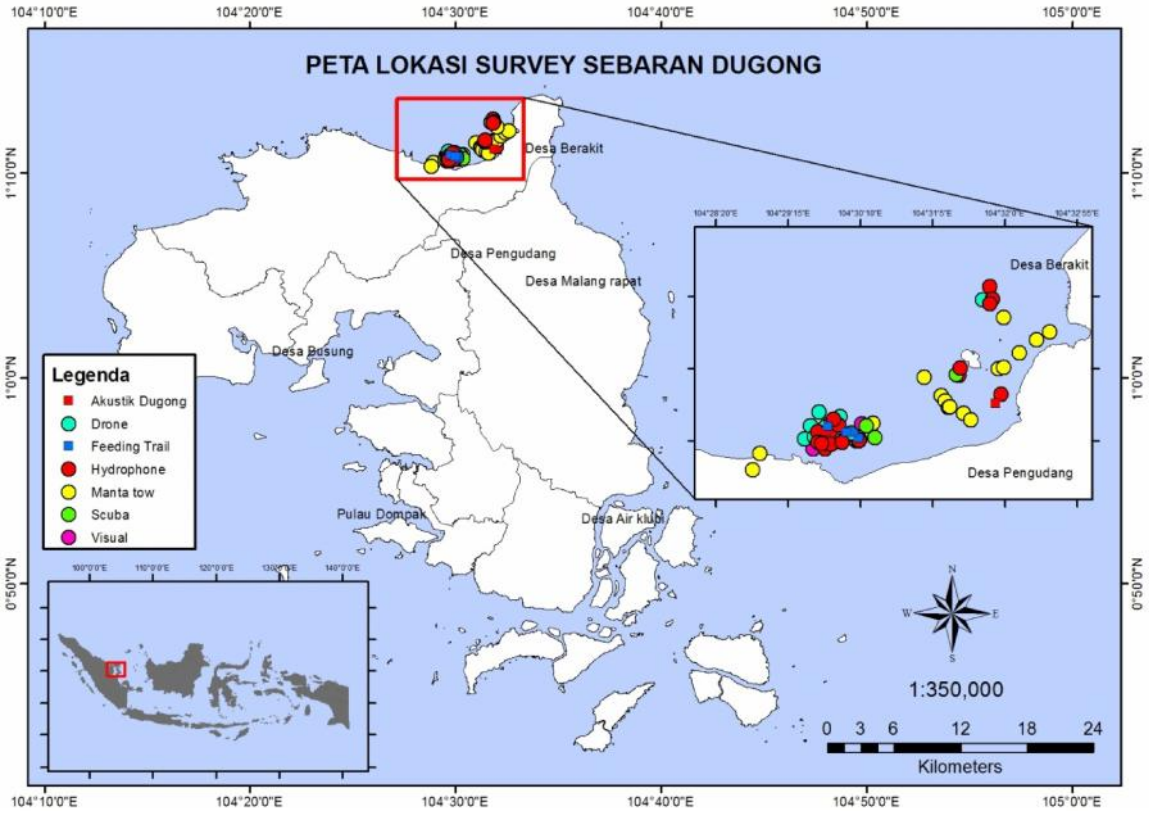

Figure 6. Data collections sites for Dugong occurrence and distribution in Bintan

2. Result and Discussion

2.1. Visual survey result

Activity of the visual survey was focused on coastal regions of Pengudang Village, Sumpat Islandand Berakit, on the east part of Bintan Sea. Observation was being held for 3 days (23-25 Agustus 2016), dugong sightings only observed one time on Thursday, August 25th 2016 at 07.50 (GMT+7), geographical reference of the location is 01°11.513' LU and 104°31.387' BT. The appearance was so fast and couldn't be documented by camera. The location of sightings is in the region of seagrass ecosystem along Pengudang Beach.

Figure 7. Orcaella brevirostris sighted swam around on seagrass ecosystems

During visual observation there wereapproximately 25 *Orcaella brevirostris* (Figure7) sighted passing by the seagrass region at Pengudang Beach, the flock traveled in huge numbers. This region is a feeding ground for *Dugong dugon*.

Observation on Dugong's feeding trail had been done for 3 days (23-25 Agustus 2016). Feeding trail had been found along side of Pengudang Beach with the condition of the trails were a new trail and a protractedly trail. Indicated by overgrown of pioneer vegetation around.

Based on analyzing method, feeding trail surveys should be done on *Dugong dugon's* feeding ground, average length of trail is 4,5–5,8 m, with the width of 18- 21,5 cm (Figure 31). The trail was fit with the one discovered by Anderson *et al*. 1978 and Heinshon*et al.* 1977 which has average width of 19 - 26 cm and the length measurement up to 8 m. Besides the feeding

trails shaped on a lengthy spot, the team also discovered another spot or trail called as *spotting* (Figure 32) on some part of the regions. The occurrence of spotting indicated at Pengudang Beach, dugong swam around and ate in *grazing* position, a crawling position and using both of pectoral fins to prop the bodyweight and plucking on the seagrass to the roots,the activity resulting a huge bare spot on the seabed known as*feeding trail*.

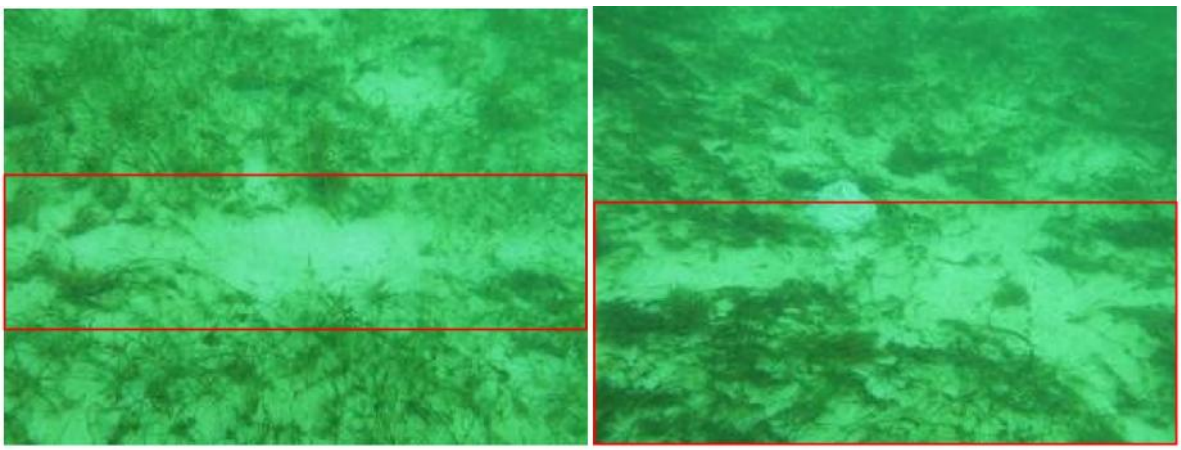

Figure 8. Feeding trails founded alongside of Pengudang Beach

Around the feeding trail as the dugong passed by commonly vegetated by pioneer seagrass type as *Halodule uninervis* and*Cymodocea serrulata*.*Halodule uninervis* grows more with density measurement of 102 ind/m^2 and t percent vegetation covers score only 35%. This result informed that even though *Halodule* as a pioneer in the seagrass ecosystem in Pengudang the score of density and cover vegetation is low.

Figure 9. Feeding Trail Spotted (Spotting) foundedalong Pengudang Beach

To spot the feeding trail and the type of seagrass which grows around the feeding trails, dugong at Pengudang Beach has preferences or likeness to eat tiny seagrass type, fibrous and high cellulosed. Dugong preferred smooth and easier to digest type of seagrass but has high nutrient density as like*Halodule uninervis* and*Cymodocea serrulata*, this is suitable with Preen (1995) statement as mentioned one of dugong's favorite type of seagrass are*Halophila* sp, *Cymodocea* sp. and*Halodule* sp.

The number of feeding trails founded along Pengudang beach indicated that seagrass ecosystem in Pengudang is a habitat or a feeding ground for *Dugong dugon.*

2.2. Bioacoustics Survey Result

The bioacoustics method was performed with 10 sound recordings. Of the 10 recordings, 2 records detected the sound of dugong. The first record was found on August 23, 2016, while the second record was on August 24, 2016. From the two recordings found, 3 pieces of sound occurred on the first recording and 2 pieces of sound were noticed on the second recording. The first recording was not followed by the discovery of dugong through visual surveys, while the second record was followed by the presence of dugong from the visual survey. Voice identification was based on Hishimoto et al. (2004) and Ichikawa et al. (2006).

Identification results found 2 types of sound, Chirp and Trill. The sound sonogram found is shown in Figure 10.

Marine mammals particularly dugongs, communicate in the ocean using soundwave, dugong interact using a smooth screeching sound like a bird's chirp with 3-18 kHz in frequency range and 6 seconds duration. Dugong also communicate using vibrating sound on frequency of 740 Hz, in the range of 3-18 kHz up to 4 minutes (Khalifa 2010). According to Anderson and Barclay (1995), Dugong's voice for communicating divided to 3 which are: *chirp*, *trill* and *bark*. *Chirp* has the frequency in range of 3-18 kHz, *trill* has higher frequency above 740 Hz in range of 3-18 kHz and*bark* frequency is 500-2.200Hz.

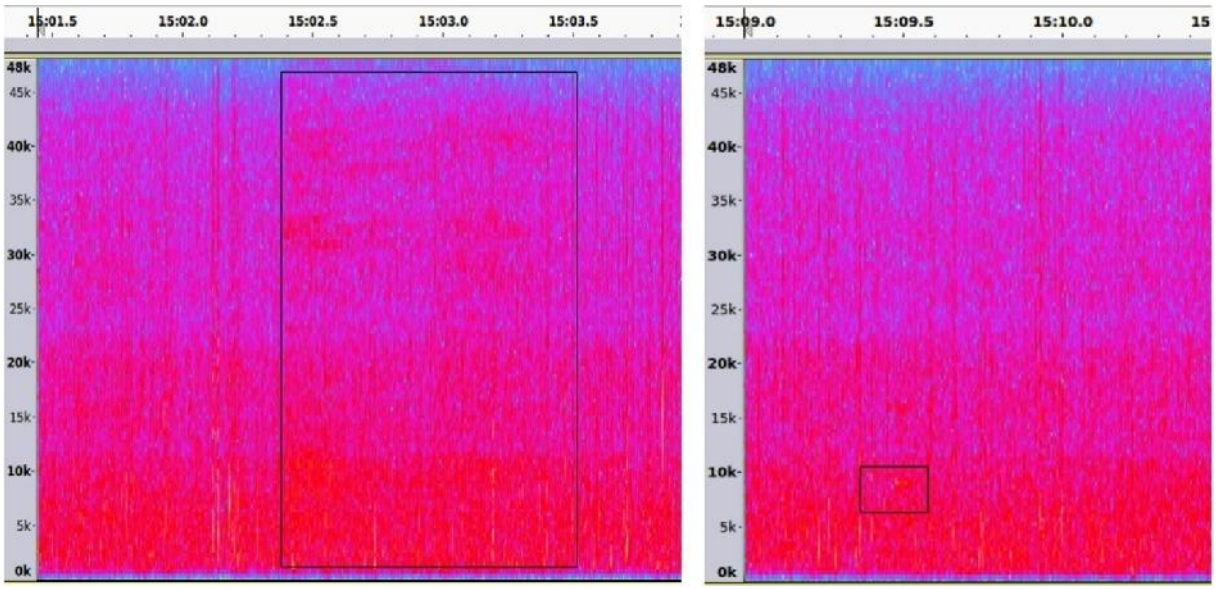

Figure 10. Sound recording of Trill (left) and Chirp (right)

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II. STUDY ON SEAGRASS ECOSYSTEMIN BINTAN

1. Method

The data were collected on three transects with 100 m lengths each and the distance between transects was 50 m so that the total area was 100 x 100 m2 (Figure 11). Several square frames were placed on the right side of the transect with the distance between each square is 10 m so that the total of squares on each transect is 11. The starting point of the transect is placed at a distance of 5-10 m from the first seagrass encountered (from the coast).

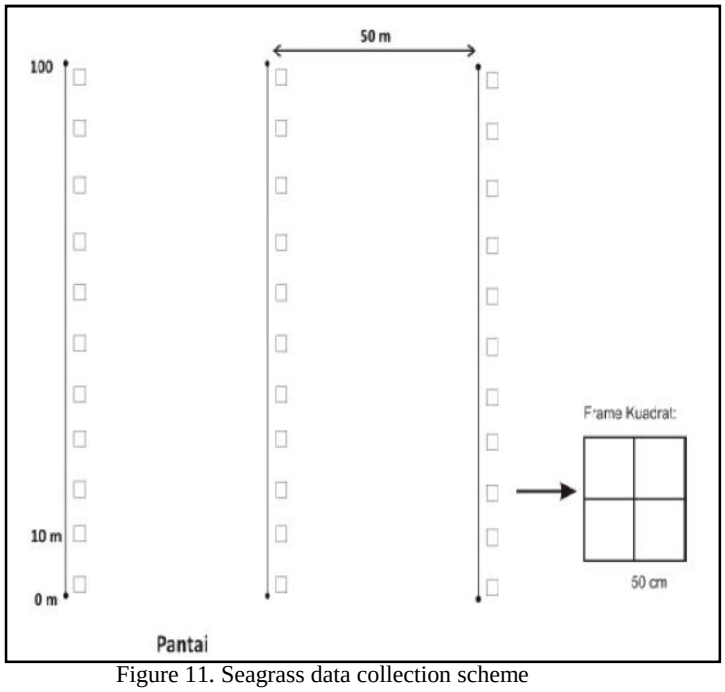


Figure 11. Seagrass data collection scheme

Seagrass and water quality data collection sites is shown in the following figure (figure 12).

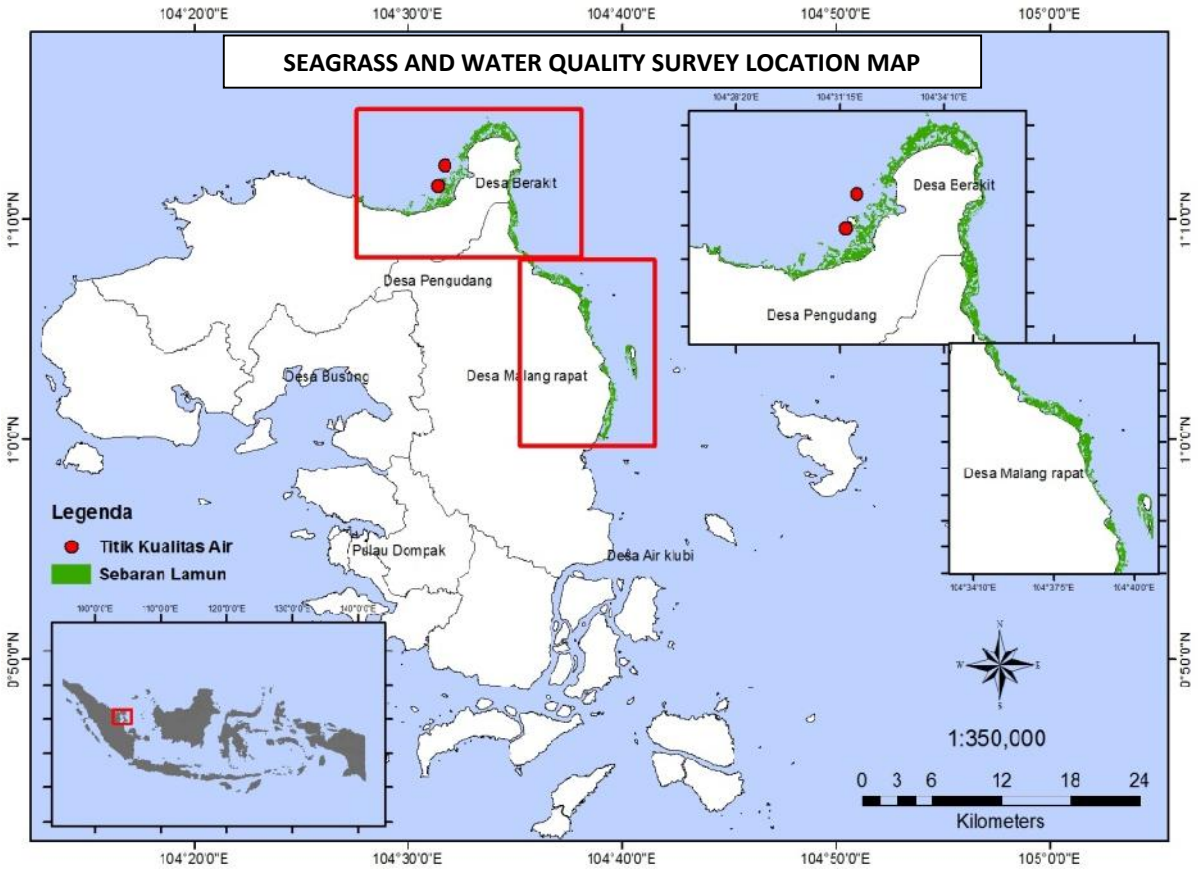


Figure 12. Seagrass and water quality survey location map

2. Result and Discussion

Seagrass is one of the marine biota which compiles the coastal ecosystem and has a role of feeding ground for dugong. Only some species of seagrass that being preferred by dugong as the main meal. In general, based on observation had been done on 4 stations showed seagrass ecosystem in Bintan Island consist of 9 species among others are*Cymodocea rotundata* (Cr), *Halodule pinifolia* (Hp), *Halodule uninervis* (Hu), *Cymodocea serrulata* (Cs), *Syringodium isoetifolium* (Si), *Enhalus acoroides* (Ea), *Thalassia hemprichii* (Th), *Thalassodendron cilliatum* (Tc), and *Halophila ovalis (Ho)*. The cover percentages scores on the seagrass ecosystem in Bintan Island in general have the range between 46.35 % - 70.00 % with the average score is 60.00 %. Referred to the Decree declared by the Ministry of Environment

No. 200 in 2004, vegetation which has average cover percentages scores of 60.00% seagrass ecosystem in the ocean of Bintan island classified as rich/healthy condition.

Observation result on the field is showings that seagrass species are not evenly spread in every observation stations. Further information on the composition percentage of every species of seagrass that observed in Bintan Island ecosystems presented onFigure 13.

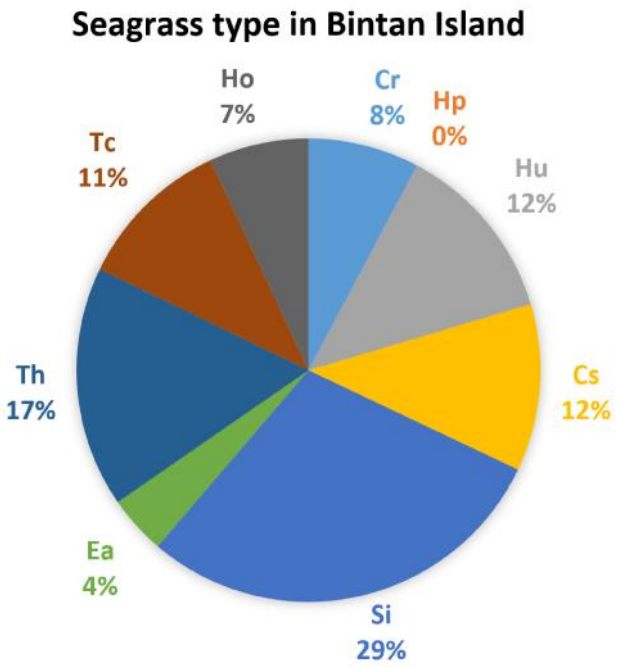


Figure 13. Type of seagrass on the east coastal Bintan Island

(Explanation: *Ho*= Halophila ovalis, *Cr*= Cymodocea rotundata, *Hp*= Halophila pinifolia, *Hu*= Halodule uninervis, *Cs*= Cymodocea serrulata, *Si*= Syringodium isoetifolium, *Ea*=Enhalus acoroides, *Th*= Thalassia)

Figure13 represents the species composition of seagrass on Bintan Island east coast, one of the four locations that has been observed. *Syringodium isoetifolium*is the only seagrass that has the highest percentage cover as the compiler in the ecosystems with 29% measurement throughout Bintan Island. The other species of seagrass that commonly found in Bintan are *Thalassia hemprichii* 17%, *Halodule uninervis* 12%, *Cymodocea serrulata* 12%, *Thalassodendron cilliatum* 11%, *Cymodocea rotundata* 8%, *Halophila ovalis* 7%, *Enhalus acoroides* 4%. *Halodule pinifolia* is the species which became one of the main feeding source of dugong.

Observation result on the field shown, all of the nine-seagrass species are not evenly spread on every observation station. Seagrass species distribution and the percent cover measurement in Bintan Island presented on Table1.

Table 1. Seagrass distributions in Bintan Island

Station	Survey Location	Seagrass Species								
		Cs	Cr	Ea	Th	Si	Ho	Hu	Tc	Hp
1	Pengudang Village	+	+	+	+	+	+	+		+
2	Sumpat Island	+	+		+			+	+	
3	Berakit Village	+		+	+	+	+	+	+	
4	Malang Rapat Village	+		+	+	+	+	+	+	

Source: Field survey (2016); (details: Ho= *Halophila ovalis*, Cr= *Cymodocea rotundata*, Hp= *Halophila pinifolia*, Hu= *Halodule uninervis*, Cs= *Cymodocea serrulata*, Si= *Syringodium isoetifolium*, Ea=*Enhalus acoroides*, Th= *Thalassia hemprichii*, Tc= *Thalassodendron ciliatum*)

Based on the information showed in Table1, it is outward three species of seagrasswhich are*Thalassia hemprichii, Cymodocea serrulata, Halodule uninervis*have wider distribution in all of the observation sites. Besides the common four species of seagrass, there are other seagrass species which commonly be found on other observation station as*Enhalus acoroides, Syringodium isoetifolium, Halophila ovalis, Thalassodendron cilliatum*. The type of rare seagrass species and only can be found on particular station are*Cymodocea rotundata*dan *Halodule pinifolia*.*Halophila spinulosa*species (Wouthuyzen, 2009) and*Halophila decipiens* (Anggraeni, 2015) also can be found in Berakit. Observation stated there are 9 species of seagrass in this Trikora area. Here is a brief explaination of seagrass ecosystem based on each station:

2.1. Station 1 - Pengudang Village

Survey had been done in Pengudang Village on Agustus 23rd 2016 using one line transect and nine quadrant. There were eight seagrass species found, *Syringodium isoetifolium, Cymodocea serrulata, Thalassia hemprichii, Halodule uninervis, Cymodocea rotundata, Halophila ovalis, Enhalus acoroides and Halodule pinifolia* (Figure22). Substrate type in the

area is consist of bare sand, mixed type mud and sand substrate, sand andrubble mixture, and rubble dominant substrate.The depth of water is varies from 38 until 264 cm.

Figure 14. Seagrass condition in Pengudang Village

*Syringodium isoetifolium*has percent cover score 42.5% and 204 ind/m^{2}density score which is the highest among all of species that had been found in Pengudang. In a row here are the list of seagrasses with the highest percent cover and density to the lowest, *Cymodocea serrulata* measured as 13.9% and 66 ind/m^2;*Thalassia hemprichii*measurement 17.7% andvegetation density 56 ind/m^2;*Halodule uninervis*scored 8.3% and 53 ind/m^2 for density; *Cymodocea rotundata*covers 13.5% and 52 ind/m^2;*Halophila ovalis*covers 1% anddensity score 20 ind/m2; and*Enhalus acoroides* with score 2.7% and 17 ind/m^2 (Figure 15).

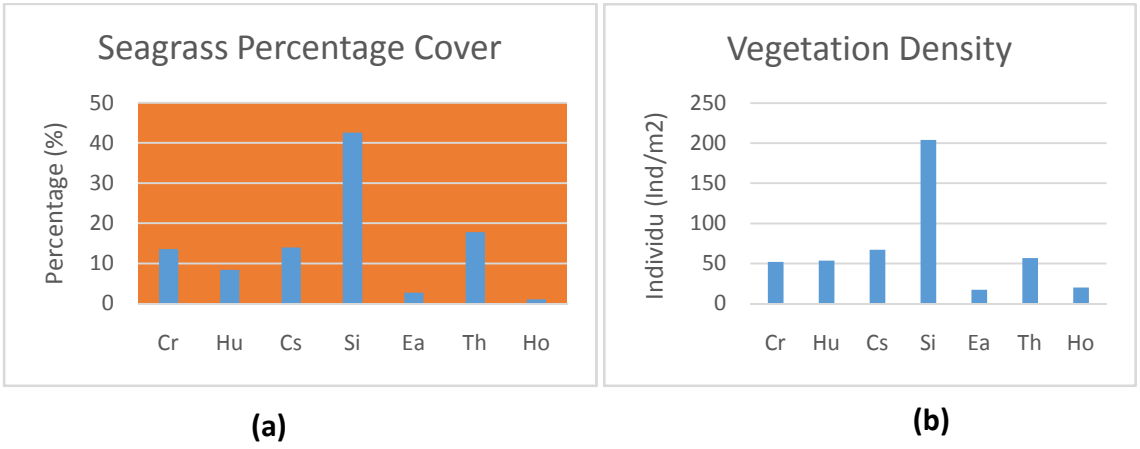


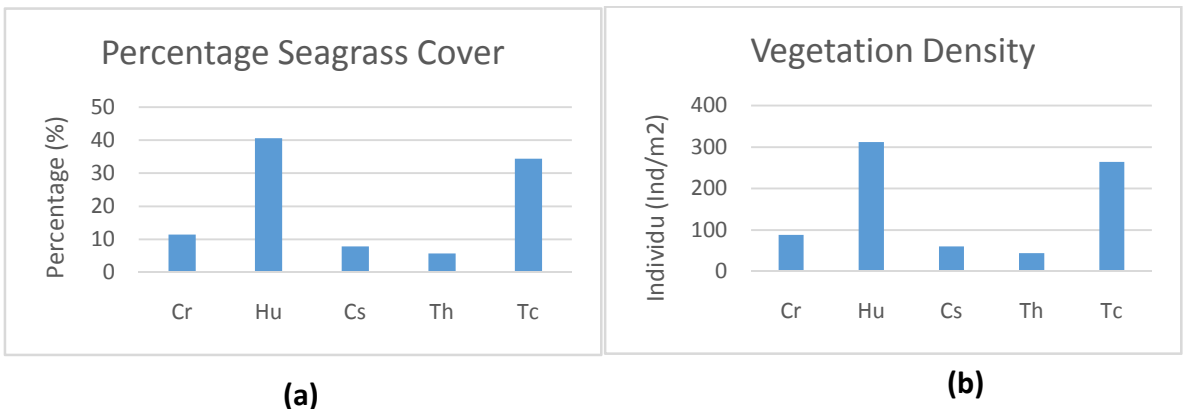
Figure 15. Histogram (a) percentage cover and (b) seagrass species density in Station 1

2.2. Station 2 - Sumpat Island

Seagrass survey in Sumpat Island had been done in 23 Agustus 2016 using one line transect and three quadrants.Five seagrass species were identified, *Halodule uninervis*, *Thalassodendron cilliatum*, *Cymodocea rotundata*, *Cymodocea serrulata*, dan*Thalassia hemprichii* (Figure 16). The dominant Spesies in Sumpat Island is*Halodule uninervis*. The region has substrate type of bare sand, dead corals, and mixture of mud and sand.The depth is about 100–236 cm.

Figure 16. Seagrass condition in Sumpat Island

Halodule uninervis has the highest score of percentage cover and density which is 40.6% and 312 ind/m^{2}and the highest among all other species in Sumpat Island. The list from the highest to the lowest percentage cover and density scores are*Thalassodendron cilliatum* with 34.4% and 264 ind/m^2 density; *Cymodocea rotundata*11.4% and 88 ind/m^2; *Cymodocea serrulata* 7.8% and 60 ind/m^2; and also, *Thalassia hemprichii*5.7% and 44 ind/m^2 density (Figure17).



(a) **(b)**

Figure 17.(a) Histogram ofseagrass percentage cover and (b) Seagrass vegetation density in Station 2 Sumpat Island

2.3. Station 3 - Berakit Village

Survey of seagrass vegetation in Berakit Village was done on Agustus 24th 2016 using one transect and nine quadrant. There were seven species found, *Thalassodendron cilliatum, Syringodium isoetifolium, Halophila ovalis, Halodule uninervis, Cymodocea serrulata, Thalassia hemprichii,* and *Enhalus acoroides.*The dominant species in Berakit are two seagrass species,*Thalassodendron cilliatum* and*Enhalus acoroides* (Figure 18). Type of substrate in this region consist of bare sand, mixture of sand and cobble, ruble sand and cobble, coral sand, cobble sand and coral, ruble sand. The depth varies between 85 to 255 cm.

Figure 18. Seagrass ecosystem in Berakit Village

Seagrass species as*Thalassodendron cilliatum*has the highest density and cover percentage up to 224 ind/m^{2}and 19.2% and it is the highest measurement in Berakit Village. Consecutively, seagrass species which has the highest percent cover and vegetation density are*Syringodium isoetifolium*with score 42% and density of 124 ind/m^2; *Halophila ovalis* scored 8.5% and 100 ind/m^2 densities; *Halodule uninervis* 7.2% and 28 ind/m^2; *Cymodocea serrulata*with 7.2% and density level of 28 ind/m^2; *Thalassia hemprichii*percentage of 11.9% and density 22.4 ind/m^2; and*Enhalus acoroides* measurement cover percentage of 3.4% and 10 ind/m^2 (Figure 19).

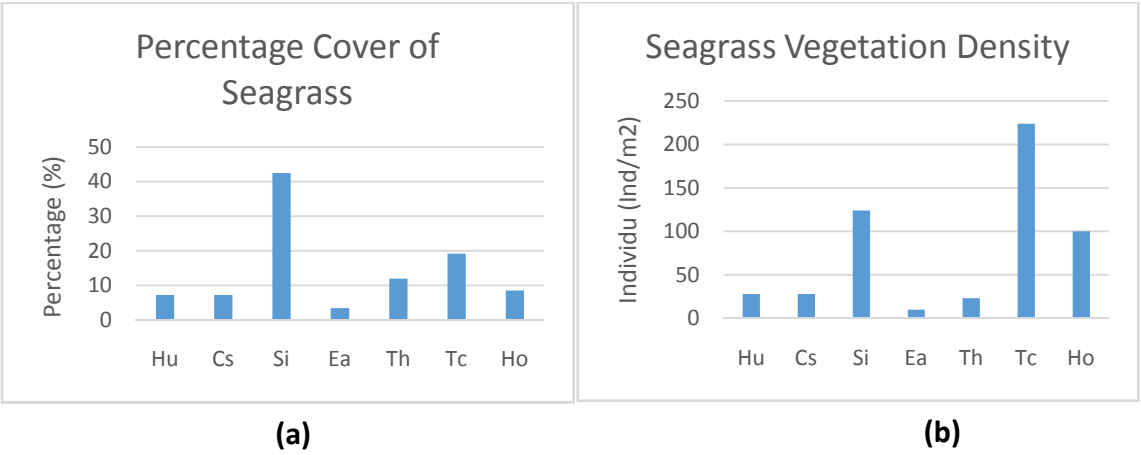


Figure 19. (a) Histogram of Percentage Cover and (b) Seagrass Density in Station 3

2.4. Station 4 - Malang Rapat Village

Field survey in Malang Rapat in 25 Agustus 2016 using one transect and thirteen quadrants. Five seagrass species were identified which are *Halodule uninervis*, *Thalassia hemprichii*, *Cymodocea serrulata*, *Halophila ovalis*, and*Enhalus acoroides* (Figure 20). Type of substrate in the region are sand and mud mixture, ruble sand, ruble sand and mud mixture, coral sand, ruble sand and coral, and dead coral sand. Water depth is in variation between 38 until 82 cm.

Figure 20. Malang Rapat seagrass ecosystems

*Halophila ovalis*has the highest density level of 192 ind/m^{2}and percentage cover of 30% which is the highest measurement result of seagrass species in Malang Rapat. In consecutive list of percentage cover score and vegetation density level from the highest to the lowest are *Thalassia hemprichii*36% and 21 ind/m^2; *Cymodocea serrulata* with 17.5% and 22 ind/m^2;

Enhalus acoroides covers of 14.7% and 11 ind/m^2 densities;and*Halodule uninervis*with 1.8% and density of 6 ind/m^2 (Figure 21).

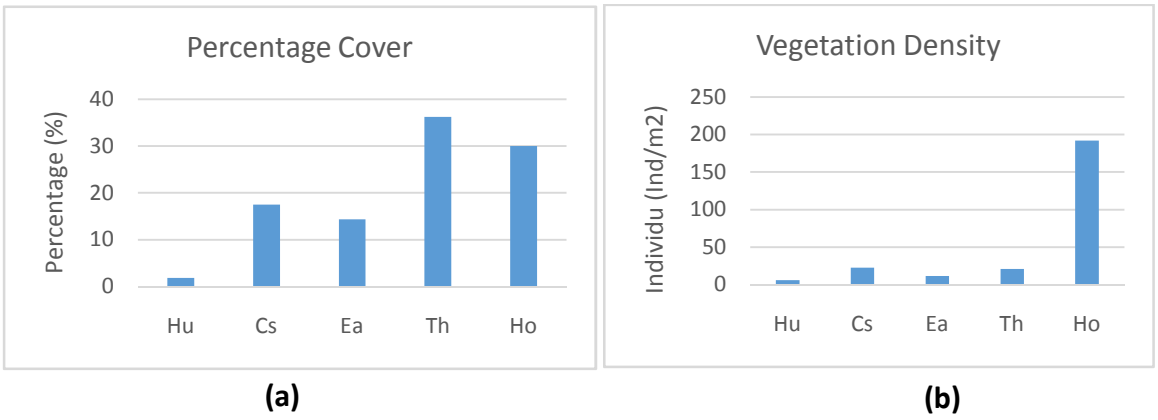


Figure 21. (a) Histogram of Percentage Cover and (b) Seagrass density in Station 4

2.5. Seagrass substrate instation 4 - Malang Rapat Village

Substrate sample collection was being done in Station 4 Malang Rapat Village. Samples were taken from every quadrant transect in line of seagrass observation. Percentage of substrate as the result was from the gradual filtration method and presented on Table 2.In general, the whole type of substrate in Station 4 consist of very fine sand 39.06%, fine sand 29.27%, the next substrate with high gross mass is bare sand 11.46%, coarse sand 11.17%, and gravel with the lowest percentage is 9.04%.

Table 2. Seagrass substrate Composition in Stasiun 4 (Malang Rapat Village)

Station	Classification	Mass Percentage (%)
Malang Rapat	Fine Sand	29.27
	Very Fine Sand	39.06
	Bare Sand	11.46
	Gravel	9.04
	Coarse Sand	11.17

2.6. Seagrass biomass in Bintan

Biomass determination has been done by using Mellor (1991) method. The biomass measurement result on each seagrass species from 4 observation sites presented on Table3. From nine seagrass species that has been found, the highest biomass is from*Enhalus acoroides* as it scored up to 408.03 g/m^2 and 263.76 g/m^2at Station 4 (Malang Rapat Village) and Station 1 (Pengudang Village). High biomass founded also in *Thalassia hemprichii* 225.88 g/m2 at Station1 Pengudang Village, while the lowest biomass has been found in*Halophila ovalis*at Station 1 in Pengudang Village. Among all the seagrass species*Thalassia hemprichii*and *Enhalus acoroides*has the highest result. One of the aspect that affecting that condition is the morphology*Thalassia*and*Enhalus*which is larger than the other seagrass species.

Table 3. Measurement result of Seagrass Biomass

Station	**Seagrass Biomass(gr/m^2)**								
	Cr	Hp	Hu	Cs	Si	Ea	Th	Tc	Ho
Pengudang	43.98	-	24.41	72.37	73.22	263.76	225.88	-	0.06
Sumpat Island	11.57	-	31.13	19.28	-	-	34.92	178.22	-
Berakit	-	-	5.55	16.44	33.64	211.91	81.55	124.41	1.12
Malang Rapat	-	-	3.50	38.79	-	**408.03**	164.01	-	2.45

(In details: Ho= *Halophila ovalis*, Cr= *Cymodocea rotundata*, Hp= *Halophila pinifolia*, Hu= *Halodule uninervis*, Cs= *Cymodocea serrulata*, Si= *Syringodium isoetifolium*, Ea=*Enhalus acoroides*, Th= *Thalassia hemprichii*, Tc= *Thalassodendron ciliatum*)

All around feeding trails that has been passed by the dugong there are some overgrown pioneers seagrass species such as*Haloduleuninervis*and*Cymodoceaserrulata*.*Haloduleuninervis*has been growing more with density of 102 ind/$m^2$and cover percentage 35%.This result informed, even though *Halodule*grows a lot in this area but has a low cover and density.The condition of water quality on feeding trails location has shown in Table 4. In general, water condition on the location is qualified as good for marine biota. However, the oxygen concentration on location is slightly low.

Table 4. Water Quality on Feeding Trail Location

Location	Temperature (˚C)	Salinity (psu)	pH	DO (mg/L)	Depth (cm)
Pengudang	27,89 - 28,77	30,20 - 30,70	7,20 – 8	4,57 - 5,39	0 – 200

Wouthuyzen (2009) compiled criteria related to seagrass ecosystem conditions by considering number of species on location, the density of vegetation, and also biomass weight of dried seagrass.As for the results from every criterion measurement has shown in Table 5. Seagrass ecosystems in Pengudang Village and Sumpat Island are in good condition, while in Berakit dan Malang Rapat the condition is moderate. Local community said dugong often being sighted around Pengudang Village and Sumpat Island. The areas are expected to provide a habitat for dugongs.

Table 5. Seagrass ecosystems condition in Bintan

Location	Score				Seagrass
	Number of Species	Density	Biomass	Total	Condition
Pengudang	4	3	1	8	Good
P. Sumpat	3	3	1	7	Good
Berakit	3	1	1	5	Moderate
Malang Rapat	3	1	1	5	Moderate

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III. STUDY ON COMMUNITY PERCEPTION AND KNOWLEDGE ON DUGONG AND SEAGRASS CONSERVATION IN BINTAN ISLAND

1. Methods

1.1. Interview

Field survey has been conducted on Bintan Island, Riau Islands Province from August 22nd - 27th 2016. Data collection has been done through key informant interviews on 6 locations which are Pengudang, Berakit, Malang Rapat, Busung, Dompak and Air Klubi (Figure 1 and Table 1). Target respondents were government staffs, local residents, and fisherman around research site.

Key informants interviews were done based on questionnaire on dugong sightings and residents perceptions of Dugong conservation program and Seagrass ecosystem using Bahasa Indonesia which has been developed and adapted based on CMS questionnaire (http://www.cms.int/en/project/cms-unep-dugong-questionnaire-survey). Questionnaire list then uploaded to Akvo Flow software and data collection can be accessed through Android based smartphones or tablets. Data which has been collected is available to be downloaded on:https://wwfid.akvoflow.org/.

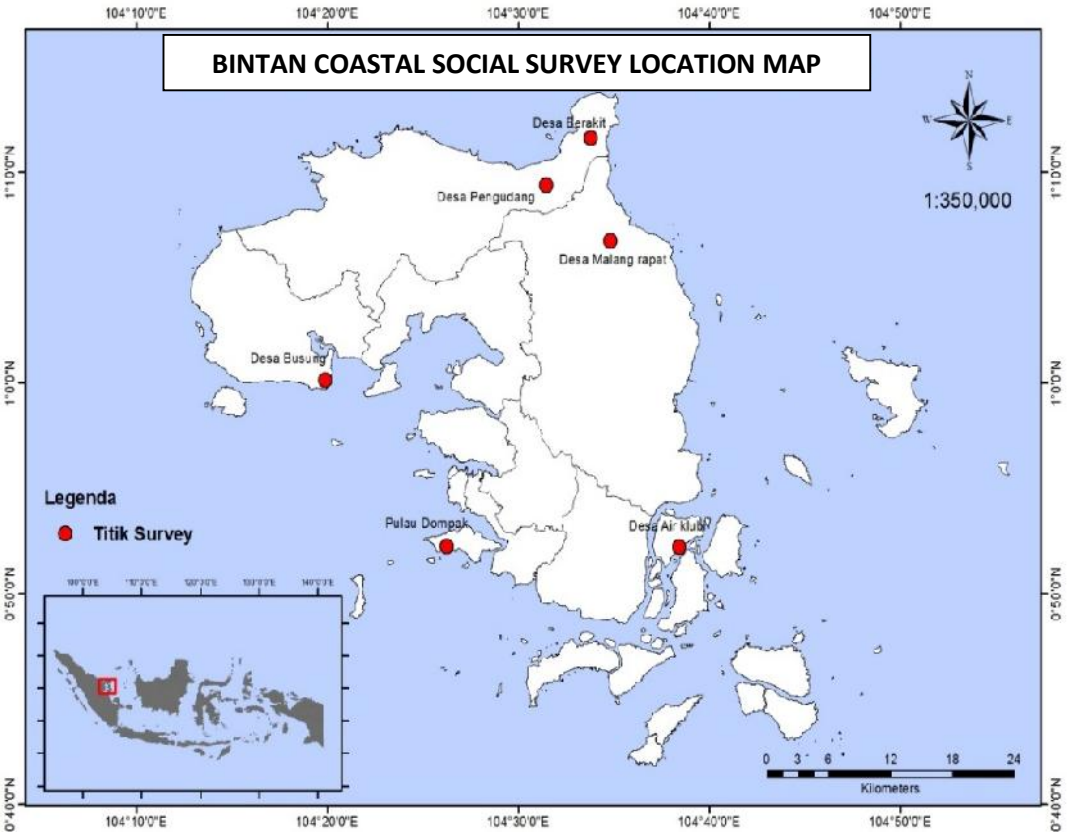


Figure 22. Bintan coastal social survey location map

Table 6. Date and Location of Data Collection

Date	District	Village/Island
23 August 2016	Teluk Sebong	Pengudang
		Berakit
24 August 2016	Sri Kuala Lobam	Busung
	Gunung Kijang	Malang Rapat
25 August 2016	Teluk Sebung	Pengudang
		Berakit
26 August 2016		Dompak
	Gunung Kijang	Air Klubi

1.2. Focus Group Discussion (FGD)

Forum Group Discussion (FGD) was facilitated by the team on August 25th, 2016 at Berakit Village to map every role aside from key informant interviews and Local Fisheries Agency of Riau Island Province (DKP) was involved in hearings session on August 26th 2016. FGDinvolved local residents from Berakit and Pengudang Village to discuss some statements as:

1) Follow-up after Trismades Program.
2) Threats to Dugong and Seagrass ecosystems.
3) Societal expectations for developing areas related to dugong existence and seagrass ecosystems.
4) Tourism development form based on societal expectations.
5) Local producing development program.

Hearings conducted by the team with DKP have been done to consign DSCP and to convey the result from the first field preliminary survey.

2. Result and Discussion

2.1. Key Informant Interview

2.1.1. Respondents Background

Survey team managed to interview 21 key informants (Tabel 2) based on residential distribution atPengudang Village (6respondents), Berakit (3respondents), Busung (3respondents), Malang Rapat (3respondents), Air Klubi (4 respondents), and Dompak Island (2 respondents). Majority of the key informants are male (81%).

Table 7. Name, Age, Gender, dan Residency

No.	Name	Ageyears old)	Gender	Residency (Village/Island)
1	Kusaini	60	Male	Pengudang Village
2	Awaludin	32	Male	Pengudang Village
3	Rahayu	43	Female	Pengudang Village
4	Kamilus	40	Male	Pengudang Village
5	Iwan Kadly	43	Male	Pengudang Village
6	Sadiah	70	Female	Berakit Village
7	Yakobus Abas	38	Male	Berakit Village
8	Ardiah	52	Female	Village Busung
9	Aris	50	Male	Village Busung
10	Jardaif	44	Male	Village Busung
11	Yusran Murni	53	Male	Malang Rapat Village
12	Bahar	56	Male	Malang Rapat Village
13	Rozana	40	Female	Malang Rapat Village
14	Muhammad	37	Male	Berakit Village
15	Atan	66	Male	Pengudang Village
16	Zaenal	50	Male	Air Klubi Village
17	Musa	65	Male	Air Klubi Village
18	Iwan	43	Male	Air Klubi Village
19	Bahar	32	Male	Air Klubi Village
20	Gafarudin	40	Male	Dompak Island
21	Jumahad	37	Male	Dompak Island

Fourteen key informants (67%) said they have been interviewed before associated with marine conservation areas, fisheries, eco-tourism, sea turtles, marine mammals, dugongs and seagrass ecosystems, tourisms and coral reefs, potential areas mapping in Riau Islands, and family planning program.Topics related to dugong and seagrass ecosystems, interview has been going since 2013-2016 begun from a stranding event until public consultation related DSCP conducted by Ministry of Marine Affairs and Fisheries. Seven key informants (33%) said they have never been interviewed before.

Half of the key informants (52.4%) expressed they have been educated informally/trained referred to coastal areas mapping, village administration, PNPM, corporation, village funding program, tourisms, the use of drugs and horticulture procedures, seagrass introduction, fisheries, coral reefs and seagrass protection program, seaweed and fisheries development, and also auto workshop.The last workshop or training program which had been participated was in 1999 until in the beginning of August 2016.Conducted by Bappeda, LIPI, Coremap-

CTI &District and Province DKP, Public Health Regional Offices, Agriculture Regional Offices, andRegional Office of Manpower and Transmigration, also from Private Corporations.

Majority of key informants (71.4%) declared frequently using mass media to seek for information.Type of mass media has been used are newspaper, internet, television, radio and verbal information from residents/relatives.This information shows the key informant relatively being opened to information and interaction from other areas and adequate access to get information.

Majority of key informants (57%) mentioned there had been some dugong and seagrass conservation being conducted (or other conservation program related to environment and natural resources) (Figure 23). Regarding to dugong and seagrass conservation, some of the activities are Seagrass Protection Areas (DPPL), TRISMADES from LIPI, and socialization and Marine Mammals Stranding Response Workshop from DKP of Bintan District.

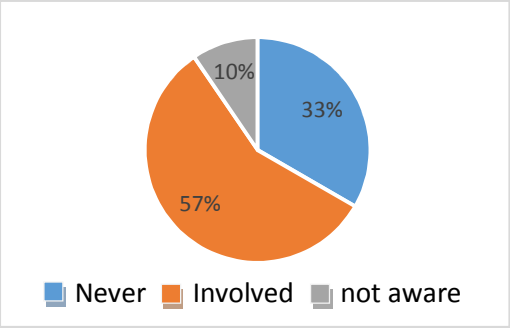


Figure 23. Society involvement in dugong and seagrass conservation in their neighborhood

Half of key informant (57.1%) works as fishermen, with aquaculture fishermen as the main occupation, while the rest of informants work as the head or staff of village administrative officer, farmer, baker, entrepreneur, housewives, instructor, construction labor, fishing guide, restaurant owner.The rest of informantsor 28.6% declaredbeing fishermen is the only occupation they are doing. However, majority of informants (85.7%) have background related to fishing with 71.4% informants' parents and 66.7% grandparents work as fishermen. This result shows most of the key informant have profile and strong background attached to marine and coastal resources.

Key informants who works as fishermen usually go fishing in south season (April-December) and not stopping/declining head seaward in north season (January-March).During the north season, some informants shifting to the coastal area or collecting clams, crabs, snails, or fishing on subside area.

2.1.2. Knowledge on Dugong

Most of key informants (95.2%) stated they have ever seen dugong at their territorial waters and they could differentiate between dugong and dolphin (95%). Some of informants (45%) do not know how long is a lifespan of a dugong.The rest of informants (55%)asserted that dugong has the same lifespan as human with maximal lifespan up to 65-100 years old. Residents called dugongs as mermaids.

Based on Figure 24 and 25, almost in every village/island, dugong has been sighted as accidentally *bycatch* by fishing nets or other fishing tools (43%), while fishing (14%), while sailing to the fishing site (14%), already being chopped (5%),and stranded on Dompak Island (5%).Only 9% from the total of informants are actively hunting for dugong in Air Klubi Village.

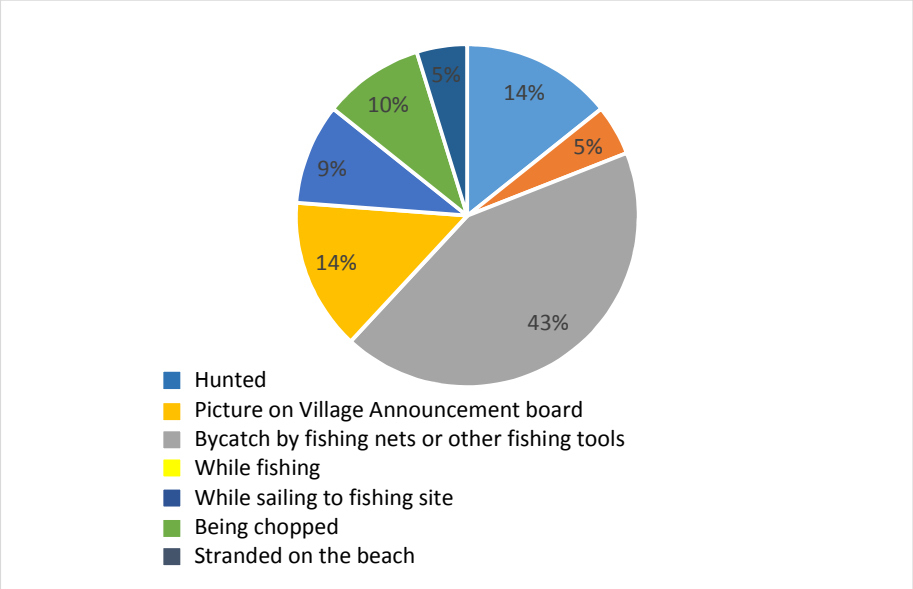


Figure 24. Occasions when key informant sighted dugong

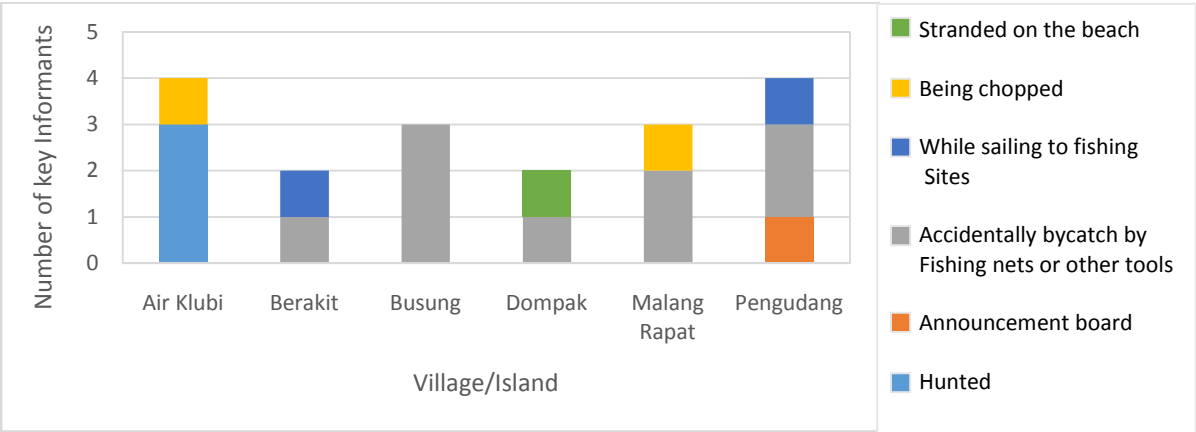


Figure 25. Occasion when key informant sighted dugong based on informant's residency

Majority of key informant claimed they have seen dugong for more than once in their lifetime (50%), even 20% of them acknowledged they often see dugong (Figure26). As for the time based on the state from key informants is relatively random for example during north season, because dugong cannot properly navigated bycatch occurrence often happened (26.3%), south season (15.8%), every month (10.5%), not seasonal (5.3%), and full moon (5.3%). Nonetheless, majority of informants stated they do not know about the timing when the dugong could be sighted (36.8%).During full moon, which usually being associated with high tide therefore dugong has been predicted to be more freely feeding/activating on seagrass ecosystems.

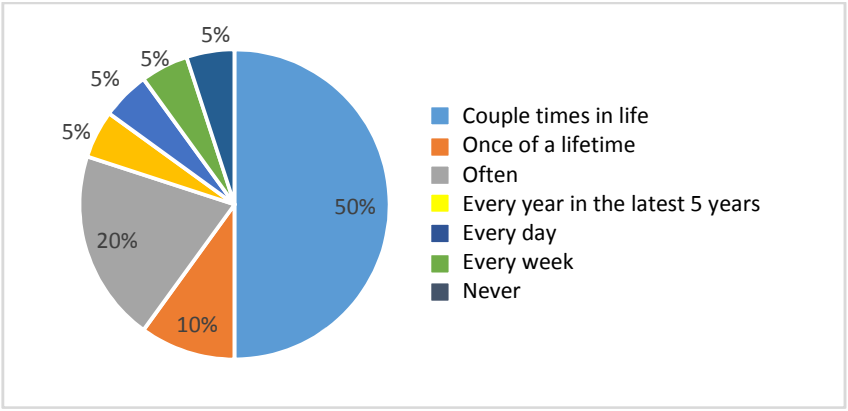


Figure 26. Frequency of Dugong Sighting

Local residents in Pengudang Village, Berakit and Malang Rapatsaid dugong commonly being seen on the coastline of Pengudang and around Sumpat Island. Busung Village residents stated they usually see dugong being sighted around Busung Bay. Dompak Island local residents claimed dugong could be seen around Pasir Panjang (Figure 6).Regarding to key informants, location of dugong sightings changes (35%), never been changed based on time (20%), others (45%) stated do not have any idea if the location have ever changing or not based on timeline. Most of informants (70%) do not aware how many dugongs live in the regions (Figure 7).

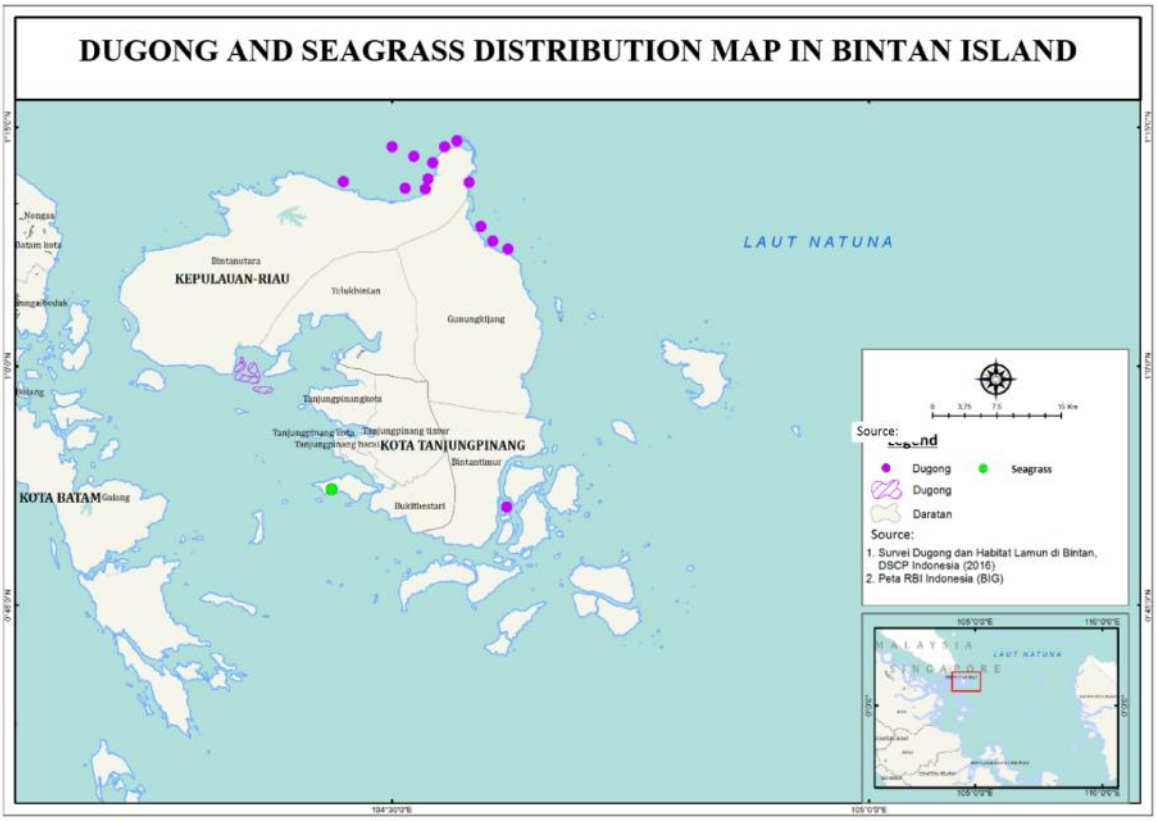


Figure 27. Map of dugong and seagrass distribution in Bintan Island

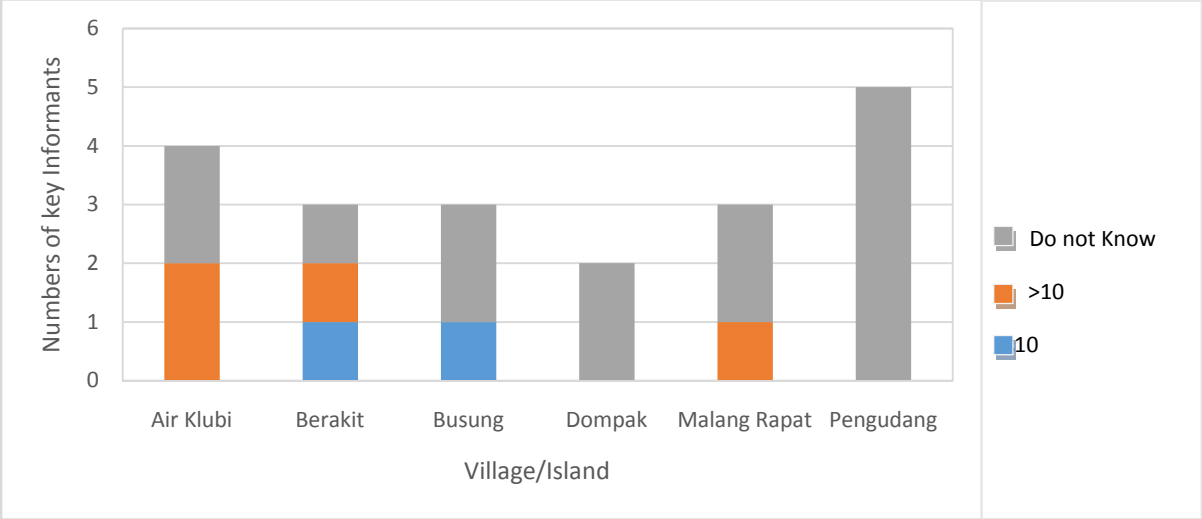


Figure 28. Estimation of numbers of dugong alive

Half of informants stated they have ever seen baby dugong. Key informants from Pengudang, said baby dugong had been seen at Sri Bintan, Senggiling Villagein 2014. Informants from Berakit mentioned baby dugong had been sighted at Tanjung Berakit and around Sumpat Island. Key informant from Busung, baby dugong founded on Busung Seain 2014 and Gorah in 2015. Air Klubi informants saidbaby dugong were seen at Galang Island in 2013 or during west season.

At least 2 of local residents had caught dugong in Air Klubi Village, 2 peoplein Berakit, 6 residentsin Busungsince 2012-2016, 1personin Dompak, 5 peoplein Pengudang, and 5 people in Malang Rapat. Yet, most of informants said that the dugong was accidentally caught either in the different village (80%), or in their own village (70%). At Pengudang, there's been recorded a dugong trapped in set net (*kelongkarang*)owned by one of the local. In Berakit, Busung, and Dompak, dugong founded dead entangled to manta tows. These facts show the critical threat to dugong in Bintan is not because of being hunt but from accidental occurrence (*bycatch*) as trapped in fish trap or manta tow.

Some well-known former specialized dugong hunters in Berakit Village (Mr. Buncit and Family) and Air Klubi (Mr. Musa and Family) were interviewed. Both family hunted dugong as family legacy from the elder and already stopped hunting two years ago because they received socialization and assistance from the government. In the last 5 years, the family from Air Klubi family had caught≤10 dugongs. The tools for hunting were harpoonand spear.

If dugong has been caught as intended to, then dugong commonly being consumed or sold with special request order for example from a resort. If dugong being caught accidentally, fisherman tend to throw the corpse or sell the meat (if it dead already) and release (if it still alive). Information from informants in Busung, the price for dugong meat reach out to Rp. 15.000,- per kilogram. In Dompak, a pair of dugong's tusk valued to Rp. 13.000.000,-in 2006.

Dugong stranded occasion relatively rare to be occurred. Some stranding occasion has been recorded and documented are:

1. 50-60 years ago in Ujung Beting 1 individual.
2. In 2006 on Setumu Beach 1 individual.
3. In 2013 on Galang Island 1 individual (sub-adult).
4. In 2014 behindSiambang Cape 1 individual.
5. In 2015 at Pengudang 1 individual.
6. In 2015 at Berakit 1 individual.

If there were any stranding event, people would report the event to the headman of the village. People would tend to help and try to release back to the sea if the causality still alive. If there were dead case, then buried the corpse, even though there were still some people who taken some effort to take the tusk and meat.

2.1.3. Knowledge on seagrass ecosystem

Every informant declared they have seen seagrass ecosystems. Estimation on seagrass field by the informants in the range of 1-11 type (Figure 29) with the seagrass majority being founded in the depth of 0-5 m (Figure 30).Less than half key informants (45%)said at least they saw there were 3 types of seagrassin the sea which are long seagrass, short seagrass and tiny seagrass.

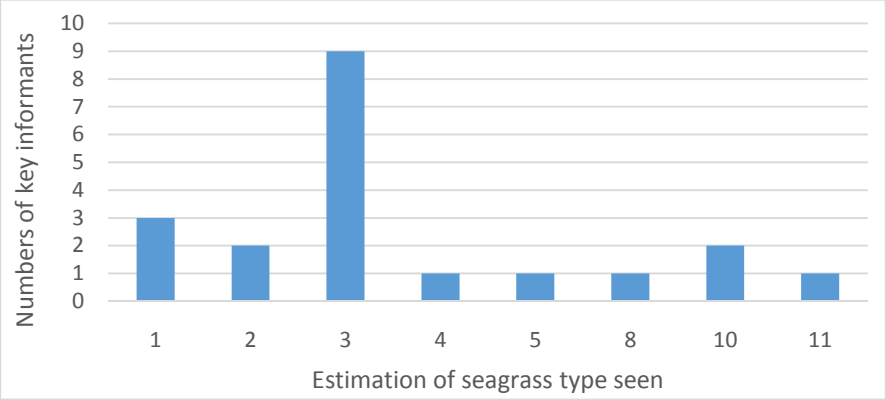


Figure 29. Types of seagrass seen by key informants

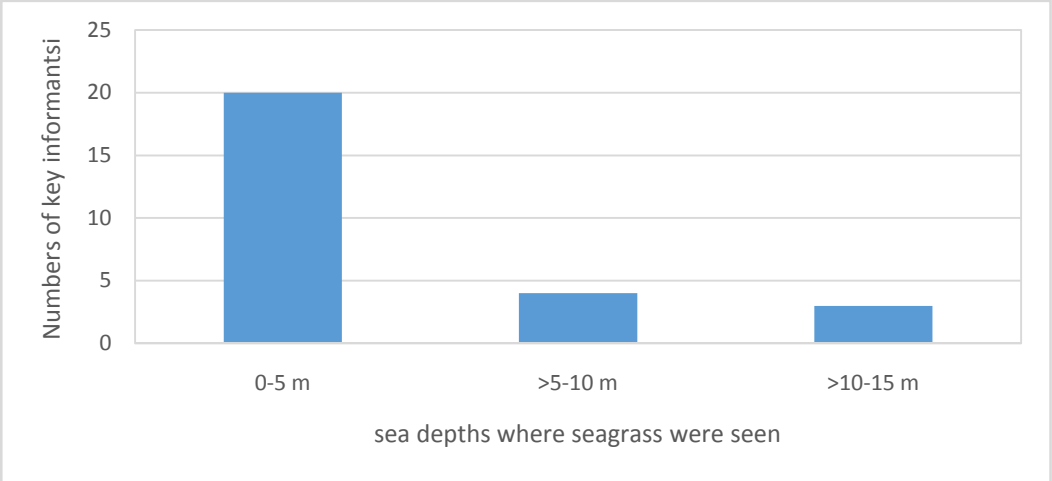


Figure 30. Depth of seagrass seen

All of the informants said seagrass ecosystem is really important because the habitat of seagrass is a feeding ground, playground, and breeding ground for dugong, it also provides enough oxygen to support the whole ecosystems in the ocean. On the other hand, only one informant said seagrass ecosystem is not important for himself. There are some reasons why seagrass ecosystem is really important, because it is a haven, a playground, and breeding ground for fish, hunting and fishing ground for fishes and other marine fauna, and seagrass prevents abrasion along the beach.

2.1.4. Community Perception

In major result (95%) informants said dugong should live freely in the ocean. As many as (75%) informants told the existence of dugong is important (Figure 31). Some explanations as

the reason why people considered dugong existence is important is the flesh, the tears, the oil, the fangs of dugong can be beneficial, dugong as an endangered animal must be preserved, dugong as the protector of ocean's bio diversities and ecosystems. The result showed the awareness level is pretty high about dugong existence in the regions.

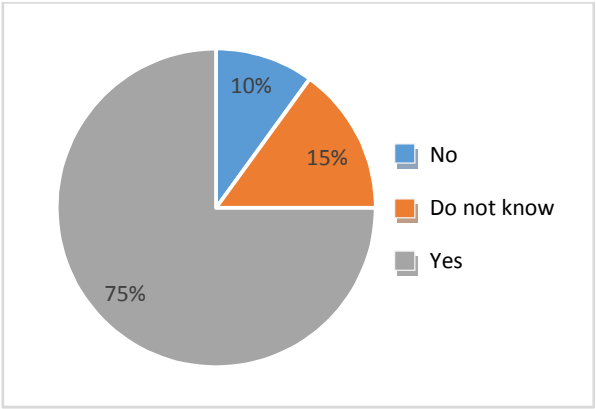


Figure 31. Community Perception about dugong's importance

A little less than half of the respondents (43%) stated the condition of seagrass ecosystems now becoming denser and more diverse (Figure32). Majority of informants utilized the seagrass ecosystems to collect clams/snails/other type of shells (36%) and fishing ground (22%) (Figure33). Some type of marine bio diversities which were being used in the seagrass region such as sea cucumbers, crabs, shells, snails, seahorses, and some species of fish. To catch all those creatures, people use bare hands, shovels, nets, fishing rods, set net (*kelong bilis* and *kelong karang*, *bubu*)and spears. All key informants mentioned the importance of seagrass ecosystems towards the availability of utilized marine bio diversities.

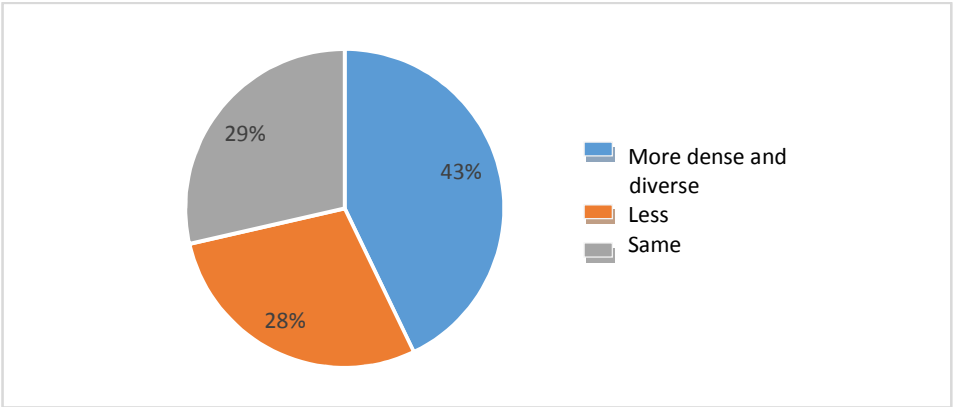


Figure 32. Comparison of seagrass condition in the past and present

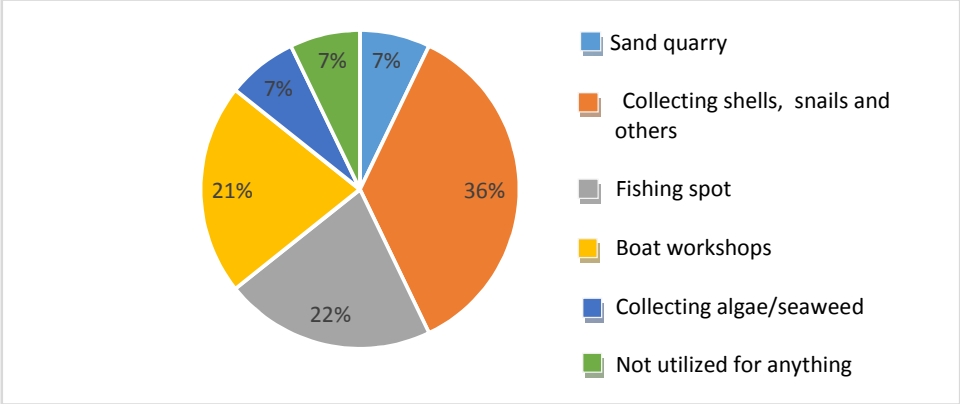


Figure 33. How community use seagrass and its resources

There are 23.5% of key informantwho could explain that the activity of natural resources data collection has an impact of damaging the seagrass ecosystems. The statement represented the perspective from the community inclined to less awareness of the other activities that they have done did not give any negative impact on the seagrass ecosystems health.However, all the respondents are positive about the damaged seagrass can be restored because the health roots still exist and could grow back.

Most informants grasped it is against the law to capture a dugong deliberately (Figure34). Two of the informants from Pengudang, and 1 from Busung who did not know it was against the law, also 1 from Air Klubi who assumed that capturing dugong extendedly is not against the law. Yet, the result is more varies when the case was accidentally captured (Figure35). There is important to do socialization or even a training to release an accidentally captured dugong to minimize the threats of bycatch.

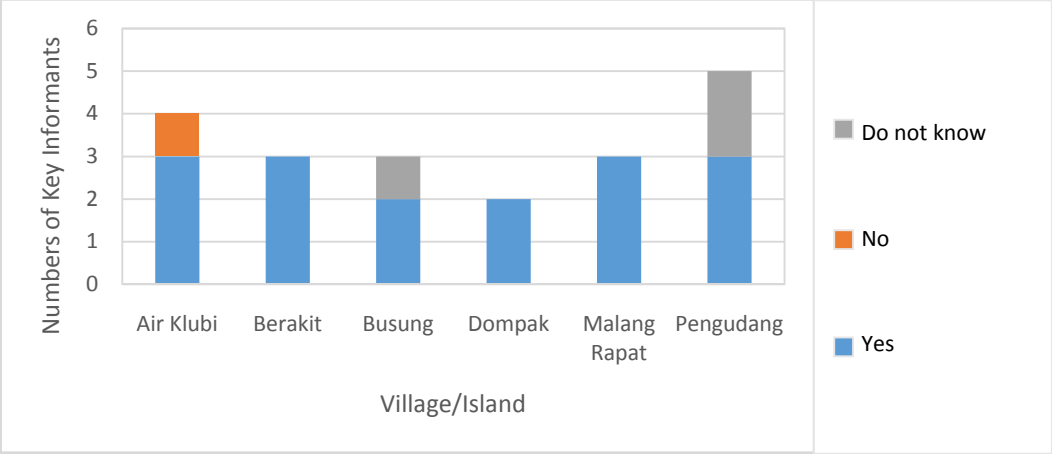


Figure 34. Catching dugong on purpose violates the law or not

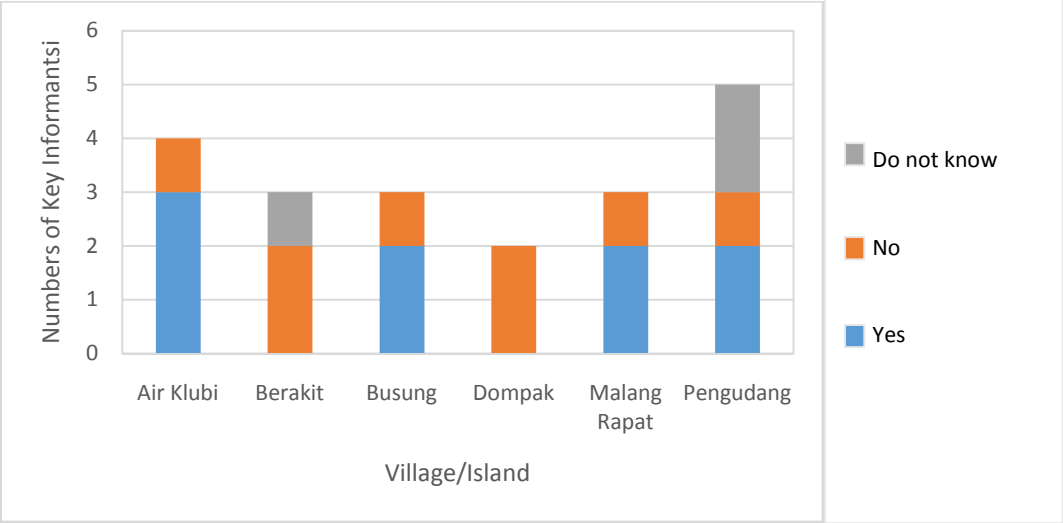


Figure 35. Dugong caught accidentally violates the law or not

Majority of key informants in every village will report the event local officials if there's bycatch except in Dompak (Figure36). Some officials officers who being contacted to report such events are administrative officers staffs in the village/district, DKP of Bintan District, village's known public figure, the navy, and other marine and fisheries local officials.It is also important for official officers to be provided with adequate knowledge.

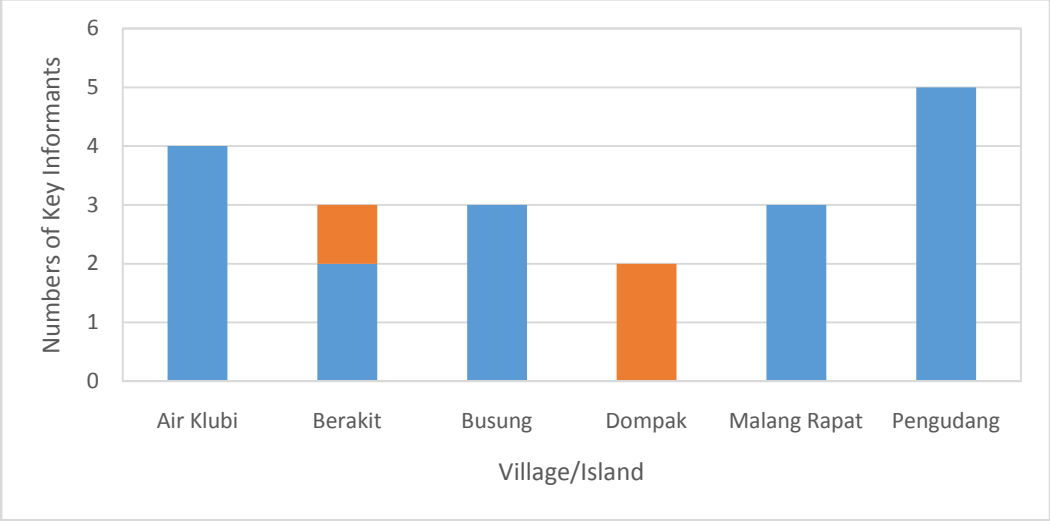


Figure 36. Willingness to report dugong catch to local officials or not

More than a half from all informants (57%) stated they have never seen any patrol activities in the region (Figure37). If there were any, the supervision conducted by the people to prevent foreign ships from other countries get in the territory or by the Navy to protect the sea territory and to prevent drugs smuggling.

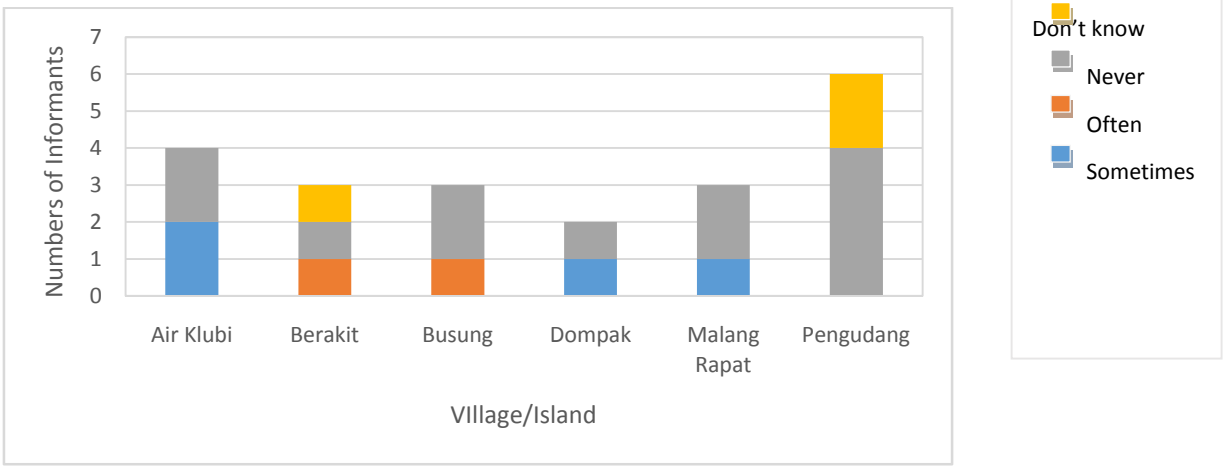


Figure 37. Availability of routine surveillance

There are some believes about dugong from the Busung Village folklore and the Sea Tribe at Berakit Village. Busung village version is: Once upon a time there's a lady who is less than six months pregnant and has been craving on seagrass fruit. And there the lady goes to the seagrass field when the tide went low, her husband reminded her to go back home before the high tide come. However, until the high tide comes, the lady has not been coming back yet because she gets overwhelmed snacking on the seagrass fruit. In mean time the lady turns to be a dugong and cannot come back to the land. That lady became the pioneer of Dugong.The

version from the Sea Tribe: dugongs are an animal, on the other hand mermaids are spirits of the sea. Spirit of the sea represented as a woman with white hair and her lower body parts is in the shape of fish. The Spirit of the sea commanding all the sea creatures and able to hurt human who had bothered her.

Almost all of the key informants (81%) stated the government, public figures, community organization and/or private corporations tend to support the effort of marine and coastal conservation activities especially about dugong and seagrass ecosystems (Figure38). Two third of the informants (90%) has claimed they want to be involved and have a role and support in the attempt of dugong and seagrass conservations. Actions and events that had been submitted are involved in protecting and preserving dugong an participated in conservation community and organization, hand knowledge, enforced the law and rules, stopped hunting and damagin and also trained as a responder to release dugong back to the sea. T shows there are high interests and supports for the dugong and seagra to be obtained again in Bintan.

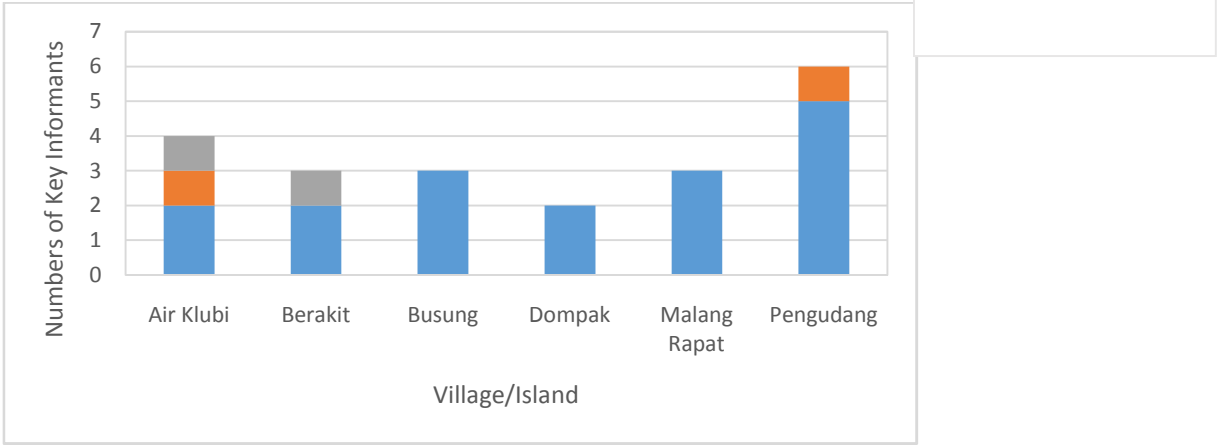


Figure 38. Community perception in regards with the role of governments, public figures, community organization, and/or private corporations (e.g.: tourism resorts) about the effort for coastal resource conservation projects (especially for dugong and seagrass.

Figure39 shows the community perception on the aspects that have been impacted dugong and seagrass conservation. In majority respondents said the increasing number of human population in the region would not affect the conservation project. The rest of the respondents stated the opposite if in that case the increasing population also utilized the seagrass ecosystems (Figure39a).

More than half of the key informants (60%) declared the increasing of tourism facility/activity has an impact in their region (Figure39b). This indicated that local residents aware of the regions for once in a while became a tourist destination. Key informant from Pengudang mentioned the same and remarked that Pengudang had been visited by a type of cruise liner but the passengers never got out of the ship which made the local residents wonder about what they were doing in the territory.

Majority of key informants (66.7%) mentioned that industrial/mining activities will be really affecting to the dugong and seagrass habitat (Figure39c). The impact would be really negative and damaging the environment. Sand quarry activities had been taken sites on Pengudang Village and Berakit, however the activity has stopped.

More than 70% of the key informants (76.2%) expressed that the outlay of garbage/waste or the absence of program/facility to take care the garbage will leave it up to dugong and seagrass habitat (Figure39d). The key informants said couple times in a year, Pengudang Beach and Berakit always being polluted by garbage and waste from the ship which was sailing and did not know exactly where was the origin of location from. The waste is really polluting and damaging the ocean.

More than half of the respondents (52.4%) stated the weather changes/climate pattern do not weigh on dugong and seagrass ecosystems (Figure39e). Mean while, the common perceptions seemed split to the influenced of the increasing utilization from machine boats (Figure39f). In Berakit Village has built an international standard harbor but still have not been operating yet. When it would be officially operational then boats will be passing by frequently on seagrass ecosystems.Hence, majority of respondents from Berakit Village (66.75%) mentioned about the increasing intensity by the machine boats would give an influence.

Most of the informants (61.9%) stated fishing activity using some destroying habitats methods obviously influencing to dugong and seagrass ecosystems. (Figure39g). Even though the key informants said the local residents have never used cyanide (e.g.) for fishing anymore. But eventually other people from different region has used it in their territory.

Majority of the key informants (61.9%) said the community incomprehension would take effect on dugong and seagrass ecosystems(Figure39h). Despite the key informants has

knowledge and consciousness in regards with dugong and seagrass, awareness program, and increase fixed and relevant awareness.

More than half of the informants (52.4%) gave a statement that the existence of conservation areas and marine protection has no effect to dugong and seagrass ecosystems (Figure39i). This survey result showed the recent socializations about the function and impact of seagrass beds protection and conservation area is needed to be done. The function and impact of seagrass beds protection and conservation area need to be upgraded in order to let people get the benefit from the areas.

A little more than half of the informants (57.1%) restated that the water patrol/law enforcement is not giving any influence to dugong and seagrass ecosystems (Figure39j). This revealed that the authority officers less being involved in the community. People tend to do patrol on their own hence when they reported an event the reaction from the government always slow.

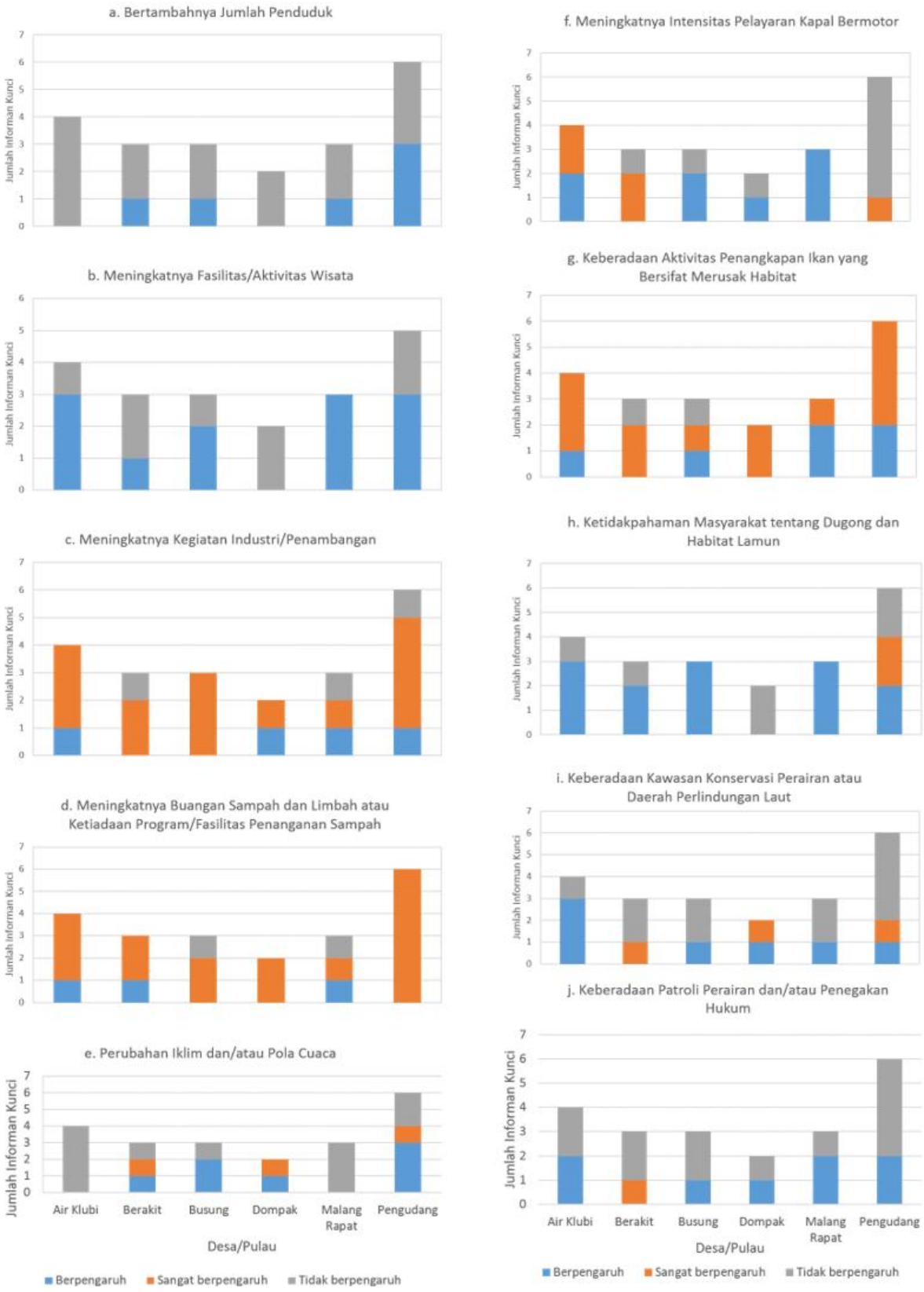


Figure 39. Perception about factors affecting dugong and seagrass ecosystems

Figure40established the perception around the people of some infrastructure development plan or even business firm in the village. Most of the key informants (81%) agree and strongly agree (Figure40a). As well as the motorization fishing boats (61.9%-Figure40b), Hotel/resorts constructions (Figure40c), and housings (Figure40e).

In relation about mall/shopping center, the result showed various perception even most of them (57.1%)is still agree on the development of those infrastructures (Figure40d). The rest of the key informants do not agree with developing such infrastructure in the region because it is less appropriate with the characteristic of the region/community.

All of the informants do not agree on opening a bar/night club (Figure40f) because it is not suitable with the values that adopted/norm (Figure40f). Most of the key informant (95.2%) was agreeing to develop local knowledge in order to preserve the values and also the folklore in the community. (Figure40g).

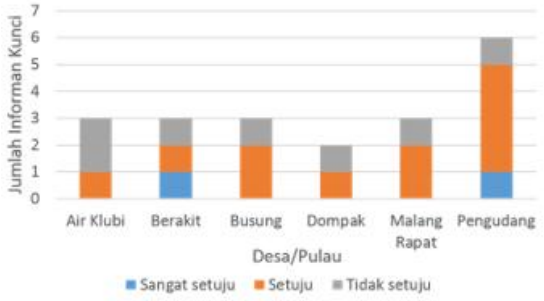
Majority of the key informant (76.2%) has been approving the idea of closing one area for seagrass restoration area (Figure40h). On the other hand, at the other 2 villages which already haveseagrass bed protection and conservation area(DPPL)as in Pengudang and Malang Rapat, one third until half of the informants did not agree of the idea to close locations. Socialization as well as revitalization of DPPL needs to be done to restore the function and the role for the environment.

In association with the agreement to develop hotel/resort, two third (90.5%) of the informants agree to establish marine tourism activities which supports dugong and seagrass conservation (Figure40i). The whole informant agrees and strongly agree with developing domestic industries that support marine tourism (Figure 19j).

a. Pembangunan Jalan

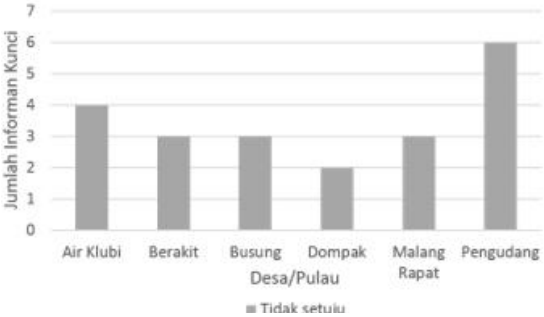
b. Motorisasi Perahu Nelayan

c. Pembangunan Hotel/Resort



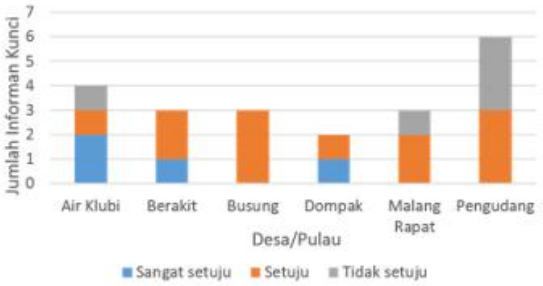
e. Pembangunan Perumahan

f. Pembangunan Bar/Klab Malam



g. Pengembangan Kearifan Lokal

h. Penutupan Suatu/Sebagian Wilayah untuk Memulihkan Habitat Lamun dan Pesisir



i. Pengembangan Kegiatan Pariwisata Bahari yang Mendukung Upaya Konservasi Dugong dan Habitat Lamun

j. Pengembangan Industri Rumah Tangga yang Menunjang Pariwisata Bahari dan Mendukung Konservasi Dugong dan Habitat Lamun

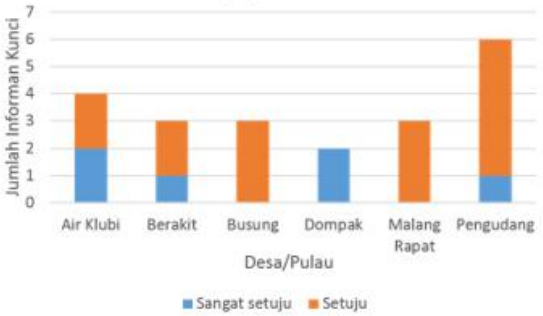


Figure 40. Perception about development plan in the region

2.2. Focus Group Discussion and Hearings with DKP Riau Islands Province

Some of the main points as the result from FGD in Berakit Village:

- Follow-up after Trismades Program:it is very unfortunate Trismasdes should be stalled because of no funding right on the moment the highest peak of community interest to do the project. Trismades Project was established in 2007-2010. Through DSCP, there is a hope to continue Trismades project that had been stopped. Some of the remains from the projects and from the socialization conducted by the government official (DKP Bintan, BPSPL Padang Satker Tanjung Pinang) are still available as the signpost, gate, as well as dugong sculptures spread around the survey locations (Figure41).

a. Welcome signpost with a shape of dugong inMalang Rapat

b. Announcement board as socialization tools put on “Save Dugong” from BPSPL Padang

c. Trikora Monument with Dugong Sculptures

Figure 41. Signpost (a), socialization board (b), and monument (c) of dugong

- Threats to Dugong and Seagrass Ecosystems:
  a. Waste from South China Sea always come to Pengudang and Berakit Village every year and polluting the coastal areas (in fact it could happen once every 2 months). Local residents feel there are no follow-ups and responds from the government. The waste problem is a bilateral issue and samples had been taken to analyzed the source of the waste.
  b. *Bycatch*because being trapped in set netor caught up in the nets.
  c. Construction on the seaside and garbage/waste disposal which affecting to the seagrass ecosystem healthiness.

- Social expectations for developing the area related to dugong and seagrass: People expected that their residency can be developed as tourism destination.

- The form of development that is expected:
  a. People in Berakit expressed there has been an expansion planning for mangrove, coral reef, diving and snorkeling tourism at Sumpat Island.
  b. Pengudang local residents already planning to build a Dugong Center because of 1) it is related Dugong as the icon of Bintan island, 2) Pengudang as tourism village, and 3) the assembled skeletons of dugong has been settled. Dugong Center is not only as a tourist attraction but also as educational facilities.

c. There is a plan from the Province official to promote tourism area in Teluk Bakau, Malang Rapat, Berakit, and Pengudang.

- Local manufactured products which can be developed:
  a. Need to give a workshop and training to create garbage/waste to souvenirs.
  b. Producing fisheries products as chips from bilis fish (anchovy), gonggong chips, etc.
  c. Entrepreneurship training feels to be needed.

Some of the results after hearings with DKP Riau Island Province:

- Kawasan Konservasi Perairan Daerah (KKPD) Bintan has been planned as a backup region in 2007. In 2008 according to the corresponding command of the Head Regent No. 8 In 2008 about Conservation Areas. In the beginning, conservation areas were assigned as Kawasan Konservasi Laut Daerah (KKLD) and since 2014 the area has been changed to KKPD. However, after the constitution No. 23 in 2014 about RegionalAdministration being appointed, the process of the plan has been laid to.
- There is some information about dugong hunting activities by Sea Tribe in Tanjung Biru, Lingga. The community speared on 12-13 dugongs who were taking their feeding activities. The fangs were sold for Rp. 2.500.000,-for each fang to tauke China.
- It is important to build a conservation network for dugong handling. Since 2008, there has been 10 bycatch cases recorded and 4 cases succeeded to be released back.
- Coremap program will be started next year. The program will have based on DPPL Trismades as the pioneer point. Moreover, this year seagrass ecosystem monitoring will be conducted according to Trismades points.
- Water pollution by the ballast ships is a annual events every year and this is an international issue which need a lot of collaboration from a lot of parties and contribution to identify and prosecute the person who has done it.

References

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Marsh, H., and S. Sobtzick. 2015. *Dugong dugon*. The IUCN Red List of Threatened Species 2015:e.T6909A43792211. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T6909A43792211.en. DownloadedinSeptember 9th 2016.

CONCLUSION

The majority of the key informant has already seen dugong and can differentiate dugong to dolphin. Seagrass conservation program through Trismades project facilitated by P2O-LIPI has succeeded to expand people knowledge and comprehension about the main point and status of dugong and the seagrass ecosystems.The remains from the projects still can be seen from the dugong sculptures and DPPL signboards.Even though some still asking about what is the beneficiates,DPPLis still exist.

Nowadays dugong has not been hunted anymore. Some dugong hunter from Berakit dan Air Klubi Villagewho were really active in hunting finally stopped after getting awareness and assistance from the government.Although now some cases showed up when a dugong accidentally got captured in set net (such asin Pengudang Village) and entangled in Manta tow (asin Busung Village). Busung Village has the highest rate of bycatch cases (has been documented of 6 dugong got trapped cases and ended with death).

Tourism becomes one of the attraction and the most likely sector to expand by the local resident as a program which can provides regional income and contributes to dugong and seagrass ecosystems.Pengudang Village had planned to build a Dugong Center as information center about dugong and the seagrass habitat.The presence of Dugong Center be expected would giveinformation and education to the visitor and also be the attraction for the tourist. At the Dugong Center also will be shown an assembled skeleton of dugong which has been arranged by associates from Bogor Agricultural University(IPB).

Dugong is the icon Bintan District. DKP Riau Island Province is very welcoming Dugong and Seagrass Conservation Project which has been running some programs.Provincial government is ready to support the implementation of every program, although still requirements from the main organization.

MANAGEMENT ADVICES

- Interventions need to be developed to reduce the number of bycatch case, either though fishing tools modifications (e.g: Ping tools installation which producing sounds which would make dugong stay away from the tools) and also there should be time and location arrangement while using set net.If on a location has been identified as an important habitat for dugong, it is necessary to arrange the type of tools, the location and the time to settle a fishing tools.
- It is important to do a refinement on the regulation for an environmentally friendly (dugong friendly) fishing tools utilization as fish trap and fishing rod. Perlu perbaikan regulasi terkait penggunaan alat tangkap yang ramah lingkungan (ramah Dugong) seperti bubu dan pancing. The catch can be lifted using '*Eco-labeling*'mechanism.
- Involvement from tourism sector feel to be needed as one of the party who has a big influence in dugong and seagrass conservation.Tourism sector can contribute in the conservation action or even financially through CSR.
- Dugong as an icon should be developed as a tourism model, even though dugong cannot always be sighted. E.g.: Trang Tourism Village in Thailand who has dugong as the icon.
- Local university should get invited and involved as Raja Ali Haji Maritime University (UMRAH) in study/monitoring activities related to dugong and seagrass ecosystems.
- A better communication and coordination in every governmental office from central, province, district, and village should be constructed as a synergy for DSCP.

Appendix 1. Interview, FGD, and hearing

Interview Processto Key Informant in Pengudang

Interview Process to Key Informantin Berakit

Interview Process to Key Informantin Busung

Interview Process to Informant in Malang Rapat

FGD at Berakit Village

Hearings at DKP Riau Islands Province

Appendix 2.Dugong Monitoringin Bintan

Date :23/08/2016

Lokasi :Pengudang-Sumpat Island

No	Methods	Time	WP	Latitude	Longitude	Velocity	Finding	Environmental Condition	Information
		(a-b)	(c-d)					#Individual Behavious	
1	Manta tow	10,30	2	01°10.506'	104°28.892'	4.2 km/h		Scattered Cloud	Started towing from Southwest of ujung pengudang
2	Manta tow	10,33	4	01°10.664'	104°30.117'	4.2 km/h	Feeding Trail		
3	Manta tow	10,35	5	1° 10' 40.159"	104° 30' 8.579"	4.2 km/h	Feeding Trail + Photo		
4	Manta tow	10,36	6	1° 10' 40.926"	104° 30' 9.223"	5 km/h	Feeding Trail		
5	Manta tow	10,45	7	01°10.891'	104°30.322'	6 km/h			Changed direction to Northwest
6	Manta tow	10,55	8	01°11.474'	104°30.971'	5.6 km/h			Started towing toEast
7	Manta tow	11,02	9	01°11.243'	104°31.193'	5.6 km/h			Stop shallow
8	Manta tow	11,09	10	01°11.173'	104°31.242'	4.4 km/h			Started towing DPPL pengudang Northwest direction
9	Manta tow	11,13	11	01°11.097'	104°31.287'	4.4 km/h			Cropping marking + photo
10	Manta tow	11,15	12	01°11.102'	104°31.301'	4.4 km/h	Feeding Trail Indicated		Started towing to South direction
11	Manta tow	11,21	13	01°11.015'	104°31.474'	4.7 km/h	Feeding Trail Indicated		Changed towing direction to

									Southwest
12	Manta tow	11,22	14			3.6 km/h			Changed direction to Northeast
13	Manta tow	11,30				3.6 km/h			Changed directionto Southwest
14	Manta tow	11,34	15	01°10.935'	104°31.571'	3.6 km/h			Stop shallow
15	Hydrophone	13,15	16	01°11.262'	104°31.952'	h=-3 m			Resto site and test hydrophone
16	Hydrophone	13,22				h=-3 m			Trial 5' voice recording and drone seagrass site near Pengudang
17	Drone dan Hydrophone	14,15				v= 3m/s; h= 30 m			towards way point for drone + hydrophone
18	Hydrophone and Scuba	14,40	17	01°10.679'	104°30.149'	h=-3 m			Voice recording and drone, suspected area forfeeding trail
19	Hydrophone and Scuba	15,10	17	01°10.679'	104°30.149'	h=-3 m	Feeding Trail Indicated		Done recording and continue with scuba to check feeding trail

Note:Weather scattered cloud (6/8 : Cumulus), SS 3 onshore wind, Way Point 010-015 DPPL Pengudang, sighted*Thalassodendron ciliatum*, *Enhalus acoroides*and*Halophil ovalis*.

Date :24/08/2016

Lokasi :Pengudang-Sumpat Island

No	Methods	Time	WP	Latitude	Longitude	Velocity	Finding	Environmental Condition	Information
		(a-b)	(c-d)					#Individual Behaviour	
1	Manta tow	10,15		01°10'18"	104°28'48"	v= 3m/s; h= 30 m			
2	Visual, Drone and Hydrophone	10.20-11.25		01°10'34"	104°29'34"	v= 3m/s; h= 30 m	Dugong voices indicated		
9	Visual, Drone and Hydrophone	11,11		01°10'53"	104°30'11"	v= 3m/s; h= 30 m	*Fresh Feeding Trail*		
11	Scuba	11,40		01°10'53"	104°30'11"				
12	Break	12.11-13.45							
13		13,45							
14	Manta tow	14,07		01°11'35"	104°31'55"	4 km/h	towards sighting areaSumpat Island		
15	Manta tow	14,10		01°11'36"	104°31'59"	4 km/h	Manta tow from Sumpat Island-Harbor		
16	Manta tow	14,12		01°11'36"	104°31'59"	4 km/h	winward 60° Eastfrom Sumpat		
17	Manta tow	14,13		01°11'36"	104°31'59"	4 km/h	Cropping lamun		
18	Manta tow	14,14		01°11'47"	104°32'11"	4 km/h	Cropping lamun		
19	Manta tow	14,17		01°11'47"	104°32'11"	4 km/h	Cropping lamun		

20	Manta tow	14,20		01°11'47"	104°32'11"	4 km/h	Continue tow		
21	Manta tow	14,23		01°11'47"	104°32'11"	4 km/h			
22	Manta tow	14,26		01°11'57"	104°32'24"	4 km/h			
23	Manta tow	14,35		01°12'03"	104°32'34"	4 km/h			
24	Hydrophone	15,00		01°12'14"	104°31'59"	4 km/h			
25	Scuba dan Hydrophone	15,40		01°11'30"	104°31'25"	h=-3 m			
26	End	16,20							

Date :25/08/2016

Lokasi :Sumpat Island

No	Methods	Timing	WP	Latitude	Longitude	Velocity	Finding	Environmental Condition	Information
		(a-b)	(c-d)					#Individual Behaviour	
1	Drone, Hydrophone, and water quality measurement	7,3	18	01°11.513'	104°31.387'	v= 3m/s; h= 30 m			
2	Drone	8,4	19	01°10.862'	104°30.240'		Sighting Dholpin (Pesut)	Wandering around	
3	Drone, Hydrophone, Scuba and water quality measurement	9,04	20	01°12.462'	104°31.713'	v= 3m/s; h= 30 m			
4	Water quality measurement	10,53	21	01° 12.256'	104° 31. 425'				