Report

PRELIMINARY FIELD SURVEY ON DUGONG AND SEAGRASS HABITAT

Tolitoli, 19 – 26 September 2016

Organized by:
Ministry of Marine Affairs and Fisheries
Research Center for Oceanography -LIPI
Bogor Agricultural University
WWF-Indonesia

Supported by:

LPKSDMO, PPO, LIPI
University of Sultan Ageng Tirtayasa
Center of Research, Recovery, and Fish Resources Conservation, MMAF
Departement of Marine and Fisheries, Tolitoli Disctric,
Central Sulawesi Province

Editorial Team

Sekar M.C. Herandarudewi, M.App.Sc.
Juraij, M.Si
Erik Munandar, M.Si
Riswanto, M.Ba
Acmad Arifin
Fitriyah Anggraeni, M.Si
Suhardi
Dwi Suprapti, DVM
Yoppy Endano, S.E.
Syarif Yulius Hadinata, S.Sos.

Table of Contents

List of Figures

List of Tables

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.

As emerged in the National Symposium, dugong hunting has threatend dugog population in Central Sulawesi, particularly in Tolitoli Regency. While the existence of Dugong in Tolitoli is known from the report of the community in the form of domestification of two Dugongsfor nine years in Santigi Village. As the following action, Tolitoli local government, KKP, LIPI, WWF Indonesia, and RASI released the two dugongs. Furthermore, a campaign and training program for stranded marine mammals has been conducted in 2015. Tolitoli government support, especially from marine and fisheries agency towards DSCPhas been expressed in the symposium. The study of Dugong and seagrasses in Tolitoli district is very limited. There is only one study by Supriyadi et.al. (2010) about the seagrass in Tolitoli District and surrounding islands.

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 DISTRIBUTION INTOLITOLI

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 vision only. 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.

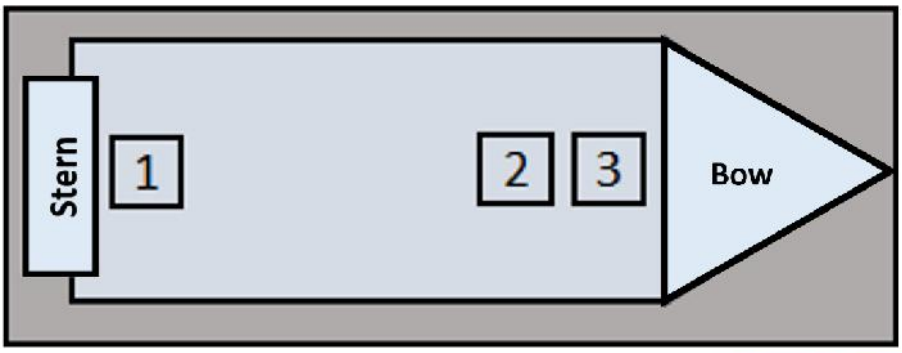

Figure 1. Observer position in boat survey

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.

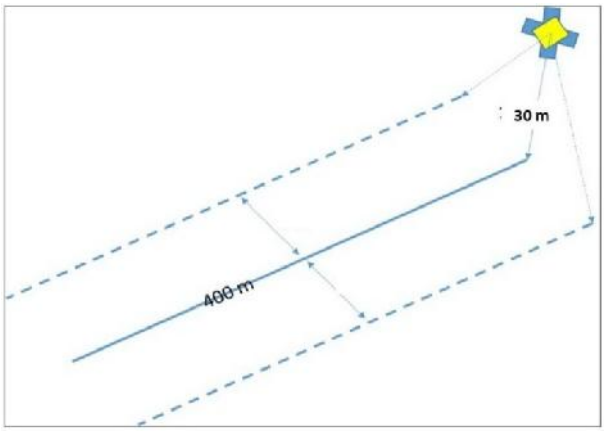

Figure 2. Dugong aerial survey design with drone

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.

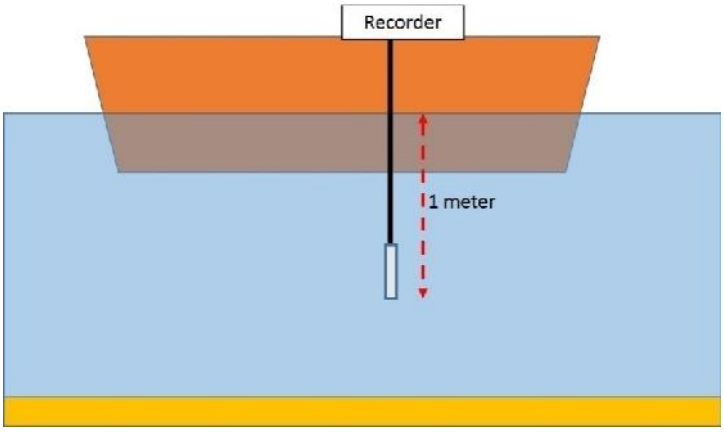

Figure 3. Recording scheme with *floating stationary survey* method

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.

To record this way of communicating or the soundwave made by dugong, a bioaccoustic device is needed. This bioaccoustic observation was conducted for six days (September 20-24, 2016), the device used in this activity was *hydrophone* model SQ26-H1. The device was submerged to a spot where dugong always swim and do their activity. The sound was then recorded by using recorder (Figure 4 and 5). The soundwave saved in the device will be analyzed further using a specified program.

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 illustration.

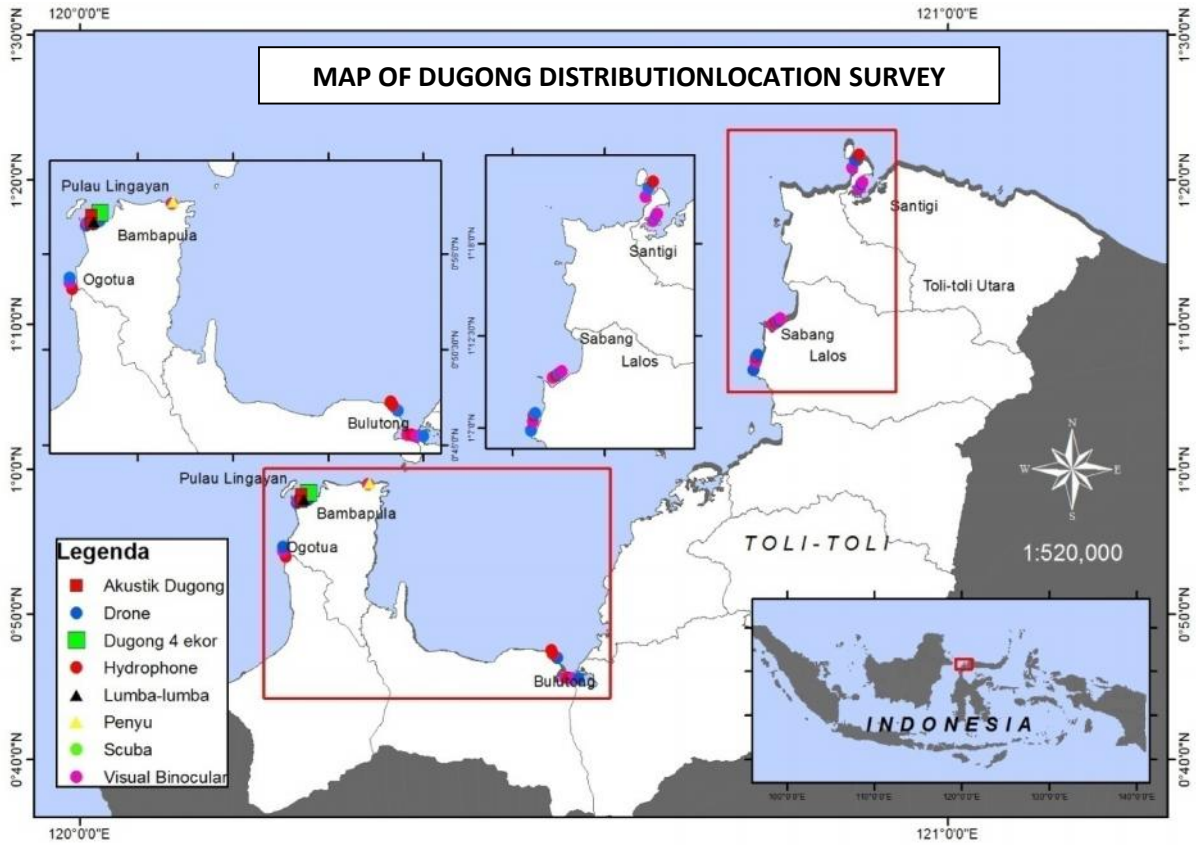

Figure 6. Data collections sites for Dugong occurrence and distribution in Tolitoli

2. Result and Discussion

2.1. Visual survey result

Visual survey was conducted by using drone, binocular, and diving gear. The activity was centered in coastal region of Liyangan Island, north of subdistrict Ogotua and Malala bay. The visual survey was conducted for 6 days (September 20-25, 2016), and the appearance of dugong was observed on day four and five (Friday and Saturday). On Friday September 24, 2016 around 18.30 WITA, four active dugongs were seen in the norther subdistrict Ogotua, Jelaje Village, precisely at $0^0$57’56.471”, $120^0$15’44.821”. The next appearance was observed in the same spot as on Friday and it was only one Dugong which was swimming around seagrass beds in Jelaje village. This occurred on Saturday September 25, 2016 at 16.44 WITA (Figure 7)

Figure 7. A group of dugongs was observed doing their activity in a segrass beds area

Based on the visual observation, dugong was foraging ini seagrass beds in Jeaje Village.

Feeding TrailSurvey

Feeding trail survey was conducted for 5 days (September 20-24, 2016). The feeding trail was found mostly in the northern sub district Ogotua, Jelaje Village ($0^0$57'53.257", $120^0$15'48.534"). The feeding trail was apparently recent and was just left by the dugong. This could be seen from the cleanliness of the feeding trail and it has not been overgrown by pioneer seagrass. The location in which feeding trail was found was nearby the encounter spot of dugong. This strengthen the assumption that the feeding trail was a recent one.

Based on feeding trail analysis, the average length of feeding trail was ranging from 2,1 – 3,1 m, width range from 12,1- 17 cm and depth ranging from 2,5-2,7 cm (Figure 8 and 9). The feeding trail feature was elongated and twisted. This indicates that dugong which live in Jelaje Village waters eats their food by *grazing;* crawling using pectoral limb and eat the whole seagrass up to its root. dengan *feeding trail*. Such activities will leave a distinctive "track" which termed as "feeding trail"

Figure 8. Feeding trail found in Jelaje Village waters

Around the feeding trail, seagrass from species of *Halodule uninervis*, *Cymodocea serrulata*, *Halophila* ovalis and Thallasia *hemprichii*were found the most.

Figure 9. Some feeding trails in Jelaje Village waters

Looking at the feeding trail and the type of seagrass species which grow around it, dugong in Pengudang beach prefer to eat seagrass which is small in size, high in fiber or selulose. Dugong tend to eat type of plant which is soft and easy to digest but has a high nutritional value such as *Haloduleuninervis* and*Cymodoceaserrulata*. This finding is similiar to what has been stated by Preen(1995), that one of Dugongs' favourite feed is *Halophila* sp, *Cymodocea*spand*Halodule* sp.

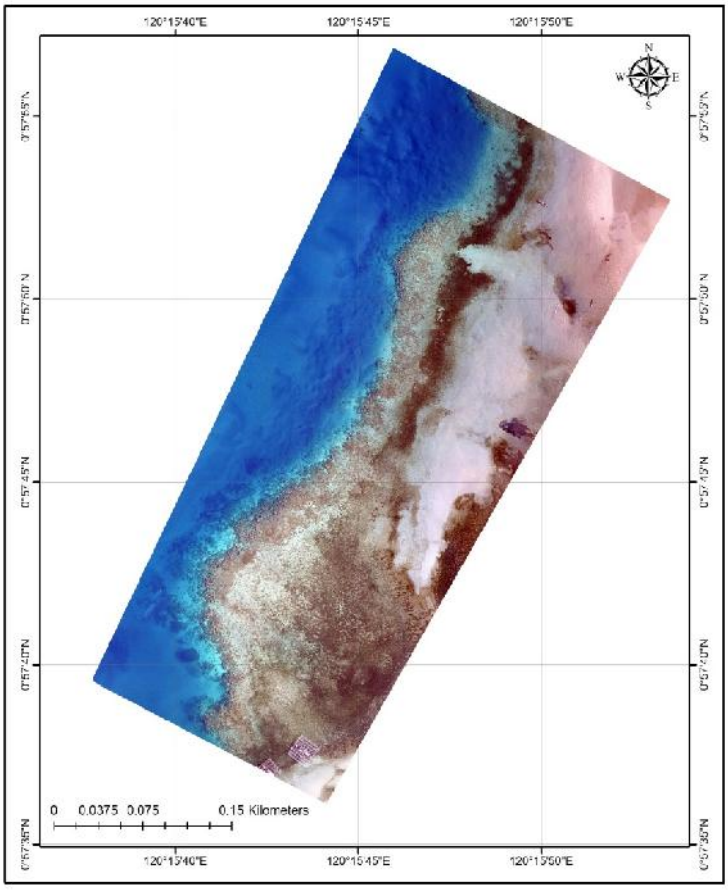

Figure 10. Mosaic Illustration of Dugongs' Foraging Ground in Jelaje

Based on the number of feeding trail in Jelaje Village, there is an indication that seagrass meadows situated in that village is the foraging habitat of *Dugong dugon*. (Figure 10).

2.2. Bioacoustics Survey Result

The bioacoustic method was performed with 14 sound recordings. Of the 14 recordings found 1 record detected the sound of dugong. The recording was obtained from dugong found accidentally caught by fishermen. In the recording,there was 4 pieces of sound. Voice identification is based on Hishimoto et al. (2004) and Ichikawa et al. (2006). Identification results found 1 type of sound, Chirp. The sound sonogram found is shown in Figure 11.

Marine mammal, especially dugong, communicate in the water by using soundwave. Dugong communicate by making chirping sound which is similar to birds. The sound has a frequency range from 3-18 kHz for 6 seconds. Dugong also communicate by making trembling sound in a frequency of 740 Hz, within 3-18 kHz for 4 minutes (Khalifa 2010). According to Anderson and Barclay (1995), there are three types of sound that are used by Dugong to communicate, i.e.: *chirp, trill,* and *bark. Chirp* has a range of frequency of 3-18 kHz, while*trill* has a range of frequency which is higher than 740 Hz dalam batas 3-18 kHz and lastly, *bark* is ranging from 500-2.200Hz.

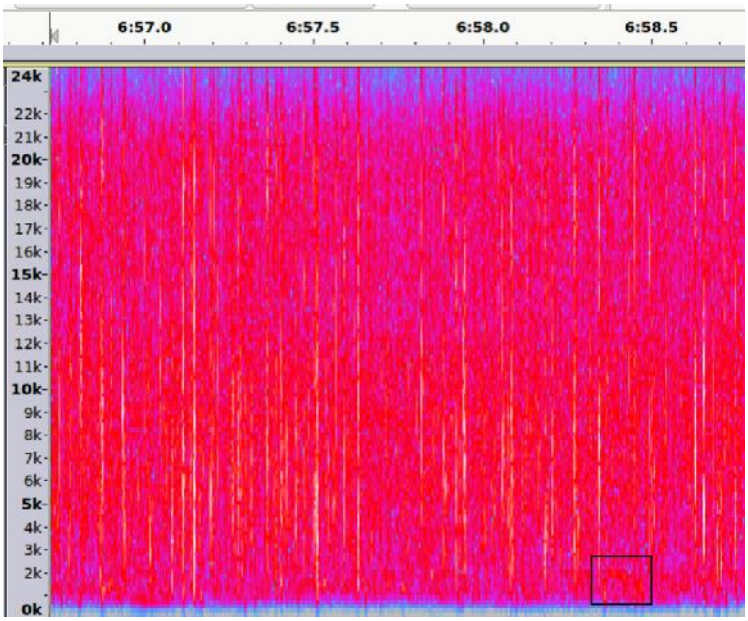

Figure 11. Sonogram of *chirp* sound (right)

References

Anderson, P. K. and R. M. R. Barclay. 1995. Acoustic signals of solitary Dugongs: Physical characteristics and behavioral correlates. *Journal of Mammalogy*, 76 (4): 1226 – 1237.

Heinshon, G.E., Wake, J., Marsh, H. and Spain, A.V., 1977. The Dugong (*Dugong dugon*) in the seagrasss system. *Aquaculture*, 12: 235-248.

Hishimoto Y, Ichikawa K, Akamatsu T, Arai N. 2005. The acoustical characteristics of dugong calls and the behavioral correlates observed in Toba aquarium. Kyoto University repository.

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

Khalifa, M. A. 2011. Tingkah laku dan karakteristik suara *Dugong dugon* di SeaWorld Indonesia, Taman Impian Jaya Ancol, Jakarta. Skripsi, Institut Pertanian Bogor, Departemen Ilmu dan Teknik Kelautan, Fakultas Perikanandan Kelautan.

Preen A. 1995. Diet of Dugongs: Are they omnivores?. *Journal of Mammals.* 76(1),163-171.

II. STUDY ON SEAGRASS ECOSYSTEM IN TOLITOLI

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 12). 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).

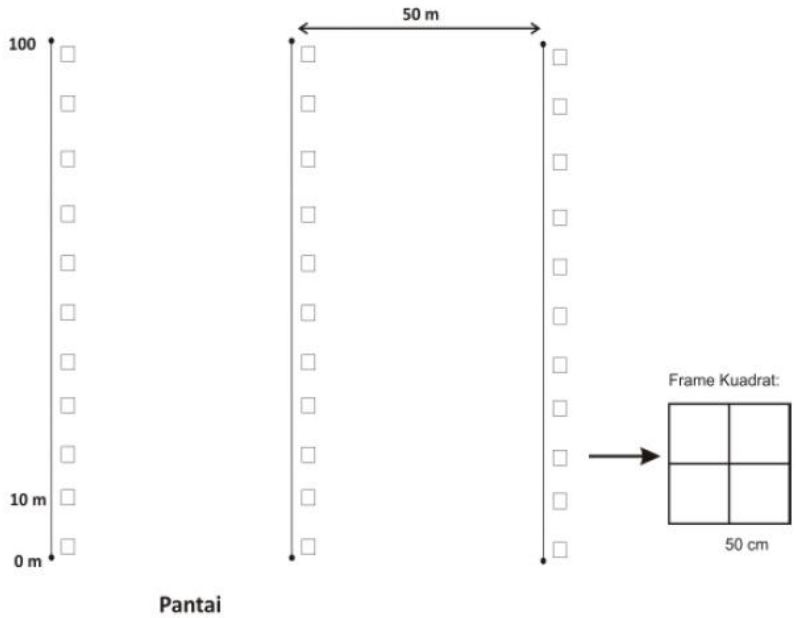

Figure 12. Seagrass data collection scheme

Seagrass and water quality survey sites are shown as the following figure (figure 13).

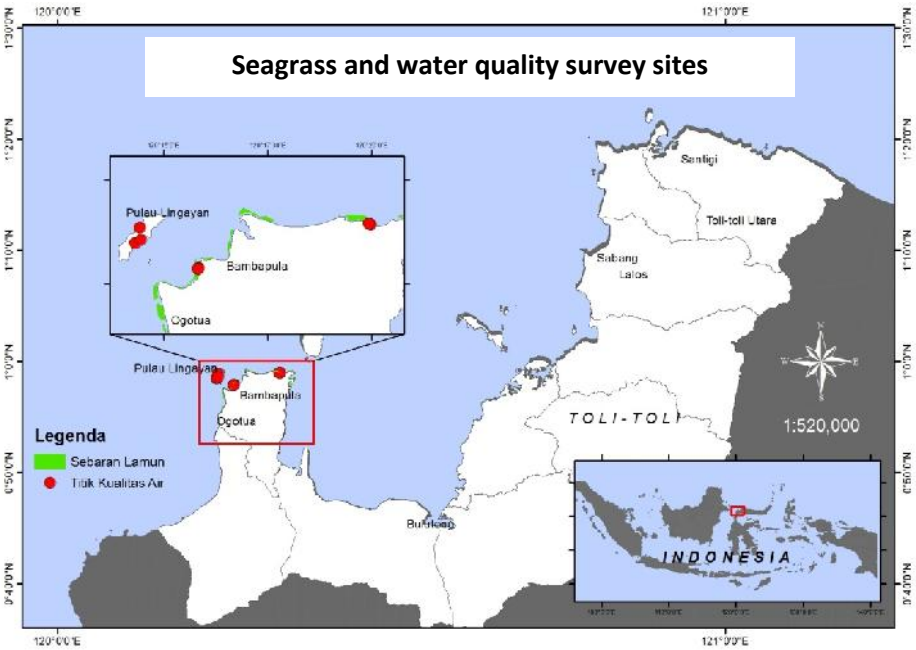

Figure 13. Seagrass and water quality survey sites in Tolitoli

2. Result and Discussion

Seagrass provides ecosystem services in the form of goods or services for biotas, other ecosystems, and humans, especially coastal communities. *Dugong dugon* Muller is one of the marine mammals that depends on seagrass. This endangered biotautilizes the seagrass ecosystem as theirfeeding habitat, apart fromsmall quantities of algae. As a major food source for dugongs, seagrass conservation alsoneeds tobe maintained for the survival of the dugong. Observation of the community structure of seagrass as a feeding habitat in Tolitoli was conducted to determine the species composition of seagrass which is the main food for dugong. This is necessary because dugongs are found in the waters of Tolitoli. The results of these observations are also expected to provide information about the location of feeding habitat as well as to support the efforts of the managing and conservingthe dugongs in the district.

Local communities have known the seagrass for a long time, calling it asNambo grass, since their ecosystems spread across the coastal of Tolitoli District. Observations ofthe seagrass community structure are conducted around the village Ogotua, District of North Dampal. The observations have been carried out in three places, namely Lingayan Island, Dusun Babanji, and Dusun Jaleje(Table 1). Lingayan Island is one of the outer islands of Indonesia that are

located in Tolitoli. Dusun Babanji and Jaleje are the coastal areas of the mainland island of Sulawesi. Dusun Jalejeis located opposite to the Lingayan Island. According to the information fromthe local fishers, dugong often found in the waters between the island and mainland LingayanOgotua village (Dusun Jaleje and vicinity). Therefore, seagrass observations were conductedon the Lingayan Island and Dusun Jaleje, while Dusun Babanjiwas treated as an additional location for the observation of seagrass. This is because the dugong caught in fishing nets were maintained for one week in this hamlet(dusun) before it was released back into the sea. The observations of the seagrass in LingayanIsland and Dusun Babanjiwere conducted in three replications, whereas inDusun Jaleje had only two replications

Table 1. Geographical position of Seagrass observation locations in Tolitoli District

Location		**Geographical position**	
		Latitude (Lat)	**Longitude (Long)**
Lingayan Island	PLYLM01	00° 58’29,08"	120° 14’17,90"
	PLYLM02	00° 58’ 50,56"	120° 14’25,04"
	PLYLM03	00° 58’33,68"	120° 14’26,40"
Dusun Babanji	BBJLM01	00° 58’56,21"	120° 19’57,59"
	BBJLM02	00° 58’55,84"	120° 19’58,58"
	BBJLM03	00° 58’56,74"	120° 19’55,83"
Dusun Jaleje	JLJLM01	00° 57’52,88"	120° 15’50,02"
	JLJLM02	00° 57’51,25"	120° 15’48,70"

Overall, the quality of waters at the site of seagrass observations in Tolitoli qualified as seagrass habitat, as shown in Table 2 and Table 3. The water quality at the location of the observations has a range of values that are quite narrow. Measurements of water quality on the Lingayan Islandwere carried out at 07:28 – 8:36 WITA (Central Indonesian Time), in the Dusun Babanji, were at 10:30 – 11:05 WITA, while in Dusun Jaleje were carried out at 12:11 – 12:55 WITA. The highest temperature range observed was inDusun Babanji, even thoughthe measurements in Dusun Jaleje were carried out later in the day. Whereas, therange of salinity level in the waters observed inDusun Jaleje were the highestin spite of the fact that the estuary lies in this hamlet (dusun). The range of pH values at all the observation sites was considered as alkaline, and the Dissolved Oxygen (DO) was high.

Table 2. Quality of watersat the observation sites in Tolitoli District

Location	Temperature (°C)	Salinity (psu)	pH	DO (mg/L)	TDS (g/L)	Depth (cm)
Pulau Lingayan	29,19 - 29,91	29,9 - 31,4	8,28 - 8,50	26,87 - 48,64	50,50 - 52,40	79 - 259
Dusun Babanji	30,21 - 30,82	30,9 - 31.9	8,47 - 8,54	44,67 - 46,07	48,70 - 54,80	37 - 98
Dusun Jaleje	29,79 - 30,92	31,6 - 32,0	8,50 - 8,67	44,50 - 47,47	51,80 - 52,50	32 - 294

The waters at the observation siteswere very clear, but the concentration of dissolved solids ranged between 48.70 to 54.80 g / L. The depth of seagrass ecosystem in the observation sites varied, but all locations received solar radiation which was good enough for the continuity of the photosynthesis processof the seagrass. The grain size of the substrate on seagrass ecosystemat the locations of the observations are presented in Table 3. Based on the observations, the percentage of the pebble grain was very smallcompared to any other substrate both on the Lingayan Island and Dusun Babanji. Granular substrate at the seagrass ecosystemonboth observation sites were dominated by fine sand.

Table 3. The Percentage of substrate grain size on the seagrass ecosystem

Location	Gravel (4 -8 mm)	Coarse sand (0,5 - 2 mm)	Fine sand (0,125 - 0,25 mm)	Mud (residue - 0,65 mm)
Lingayan Island	2.60	32.84	40.69	23.87
Dusun Babanji	6.36	20.64	62.90	10.09

Seagrass species found in these observations as many as 10 types, namely *Cymodocea rotundata, Cymodocea serrulata, Enhalus acoroides, Halodule pinifolia, Halodule uninervis, Halophila decipiens, Halophila major, Halophila sulawesii, Syringodium isoetifolium, and Thalassia hemprichii*. Previously, Supriyadi (2010) mapped the seagrass in the bay of Tolitoli and found seven species of seagrasses. The type and distribution of the seagrass observed is shown in Table 4. Lingayan Island has 4 types of seagrass largely a seagrass species that is often considered as a sign of the end of the succession (late-succession species) in a seagrass ecosystems. Dusun Babanji has the largest number of seagrass species, i.e. 8 seagrass species. Seagrass ecosystem in Dusun Babanji comprise of the slow growing seagrass (late-succession species) and fast-growingseagrass (pioneer species). Similarly, Dusun Jaleje has species of seagrasses.

Table 4. The species composition and distribution of seagrass in Tolitoli*

Species	Lingayan Island	Dusun Babanji	Dusun Jaleje
Cymodeocea rotundata	+	+	+
Cymodocea serrulata	-	-	+
Enhalus acoroides	+	+	-
Halodule pinifolia	-	+	+
Halodule uninervis	-	+	-
Halophila decipiens	-	+	+
Halophila mayor	-	-	+
Halophila sulawesii	-	+	+
Syringodium isoetifolium	+	+	+
Thalassia hemprichii	+	+	-
Total	4	8	7

*Remarks: (+) = found, (-) = not found

The percentage of seagrass cover in each of the locations observed indicated on the Table 5. Seagrass ecosystem in Lingayan Island hasthe average percentage of the total seagrass cover of 40.34 ± 18.81% with the range of cover between 7.5% to 75% on each transect squares. Babanji and Dusun Jalejehas the average percentage of the total seagrass cover of 39.84 ± 15.76% and 32.25 ± 13.86% respectively. The seagrass cover percentage on each square transects in Dusun Babanji ranged between 18.75% to 65%, whereas in Dusun Jalejeranged between 16.25% to 58.75%. The range values of the seagrass cover percentage indicated that seagrass in Lingayan Island has a higher variation than in Babanji and Dusun Jaleje.

Table 5. The percentage of seagrass cover at the observation locations in Tolitoli

Location	Seagrass speccies	Cover percentage (%)	
		Species	Total
Lingayan Island	*Cymodeocea rotundata*	10,79 ± 6,84	40,34 ± 18,81
	Enhalus acoroides	14,65 ± 10,00	
	Syringodium isoetifolium	1,50 ± 0	
	Thalassia hemprichii	24,18 ± 15,95	
Dusun Babanji	*Cymodeocea rotundata*	7,47 ± 8,33	39,84 ± 15,76
	Enhalus acoroides	11,63 ± 5,81	
	Halodule pinifolia	8,31 ± 8,42	
	Halodule uninervis	2,51 ± 2,12	
	Halophila decipiens	4,22 ± 5,46	
	Halophila sulawesii	6,25 ± 2,83	
	Syringodium isoetifolium	12,79 ± 13,61	
	Thalassia hemprichii	12,50 ± 11,96	
Dusun Jaleje	*Cymodeocea rotundata*	17,17 ± 13,13	32,25 ± 13,86
	Cymodocea serrulata	23,05 ± 9,40	
	Halodule pinifolia	22,13 ± 3,28	
	Halophila decipiens	3,38 ± 0,53	
	Halophila mayor	12,50 ± 3,75	
	Halophila sulawesii	2,17 ± 1,01	
	Syringodium isoetifolium	5,94 ± 6,42	

*Thalassia hemprichii*is the dominant seagrass species in seagrass ecosystem in Lingayan Island, indicated by the average value of the cover percentage of such species. Inversely proportional to *Thalassia hemprichii*, seagrass species of *Syringodium isoetifolium*has the smallest average value of the cover percentage. Seagrass ecosystem in Lingayan Island indicates that it has reached itsfinalsuccession, but the cover of epiphytes and macroalgae are also quite high (Figure 14a). Lingayan island has a reef that is widespread, especially in the West side. Seagrass community structure on the north side begins with final succession seagrassesalong with macroalgae toaround 200 m off the shore. Followed by colonies of coral reefs, both small and large. The seagrassesare dominated by *Thalassia hemrpichii* dan *Halophila sulawesii*that aregrown on the substrate between the colonies of coral reefs to the deep (Figure 14b).

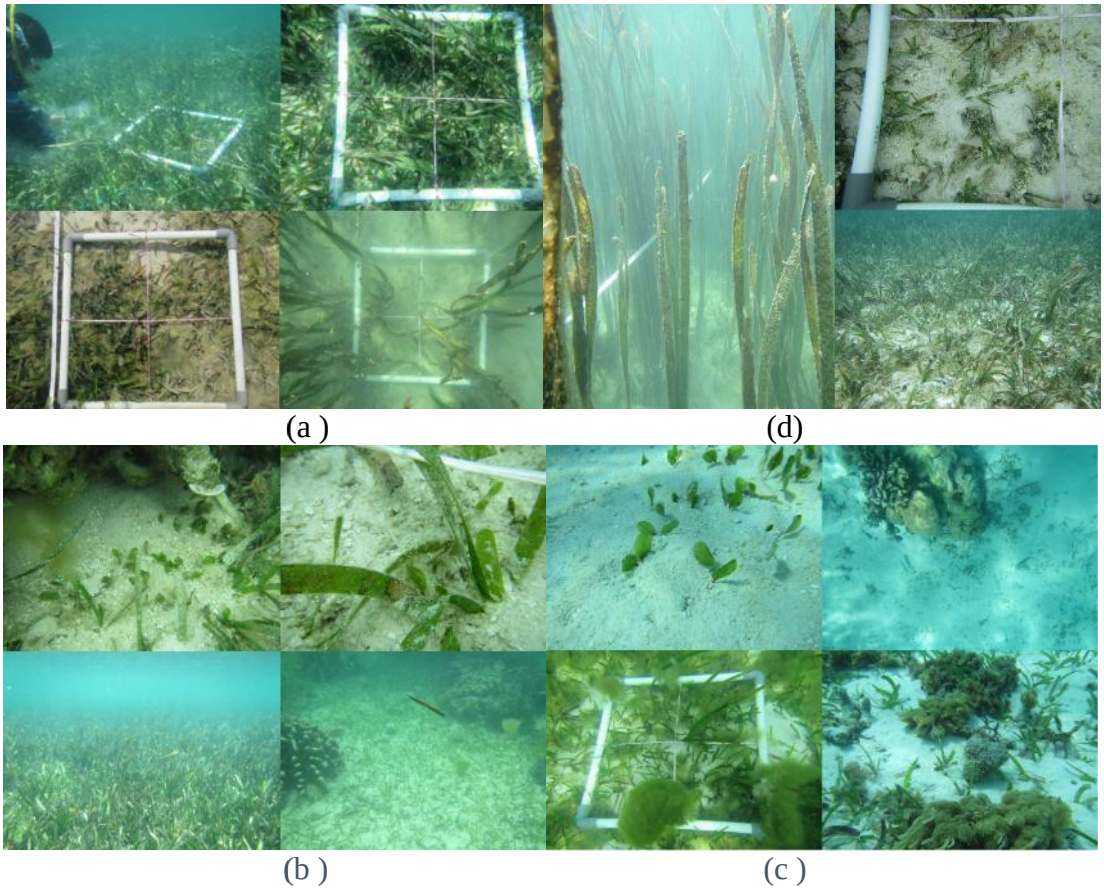

Figure 14. Condition of the seagrass ecosystem in Lingayan Island; seagrass observation (a), Seagrass profileat the north side (b), seagrass profile on the west side, seagrass profile on the east side

The West side of Lingayan Island have the most extensive reefs with a length of ± 3.5 km. This side also has a lagoon at the center of the reef flats. Seagrass on the West side has a different community structure from coastal to the brink. Seagrass *Thalassia hemprichii*types dominate the seagrass near the beach, then *Cymodocea rotundata*grown rare in the lagoon, while the edge is dominated by the pioneer seagrass*Halophila sulawesii*types that grow close to the coral reef colonies (Figure 14c). Macroalgae cover is quite high at seagrass near the beach until the beginning of the lagoon. Seagrass on the east side is very different from the North and West sides. Waters on the East side of the Lingayan Island tend to be quieter because it is protected by Koko Island which lies right in front of it. Seagrass species that dominate the seagrass near the beach in this side is the species of*Enhalus acoroides*.

The length of this seagrass canopy is more than 2 m, but almost all the leaves are covered by the epiphytes dominated by *filamentous algae*and Ascidian (*Didemnum molle*). The existence of these seagrass communities that resembles an underwater forest are up to about 200 m from the beach. After 200 m from the beach, the presence of seagrass species of *Enhalus acoroides*reduce and the length of leaves are also getting shorter. Seagrass species of *Thalassia hemprichii* began to dominate the structure of seagrass community. Halfway between the East coast of Lingayan and Koko Islandhas waters that are not too deep. Right there in the middle, coral reef colonies began to be found to near Koko Island. Seagrass community structure in this region is dominated by seagrass species of*Thalassia hemprichii* and macroalgae cover is quite high (Figure 14d).

Dusun Babanji seagrass ecosystem, where dugong was released, has seagrass that is not too extensive, which is about 30 m. After 30 m, coral reef ecosystems are found. Seagrass species of*Syringodium isoetifolium* and *Thalassia hemprichii* dominate this seagrass ecosystem (Figure 15). Seagrass *Enhalus acoroides*species can still be found in the coral reef ecosystem but merely in a small number. Among the colonies of coral reefs, seagrass *Halophila sulawesii*species grown on a substrate of sand also in a small amount. Species of seagrass that is main food of dugong, such as *Halodule sp.* and *Halophila sp*., found on seagrass ecosystem in Dusun Babanji but with a small cover percentage. The substrate in this ecosystem is dominated by fine sand (Table 3). Considering the presence of the main seagrass species for dugong and types of the substrates, seagrass ecosystem in Dusun Babanji is potential as a feeding habitat for dugongs. The dominance of fine sand might cause substrates to undergo resuspension into the water easily. The existence of seagrass as a waters substrate stabilizer is needed in the coastal of Dusun Babanji.

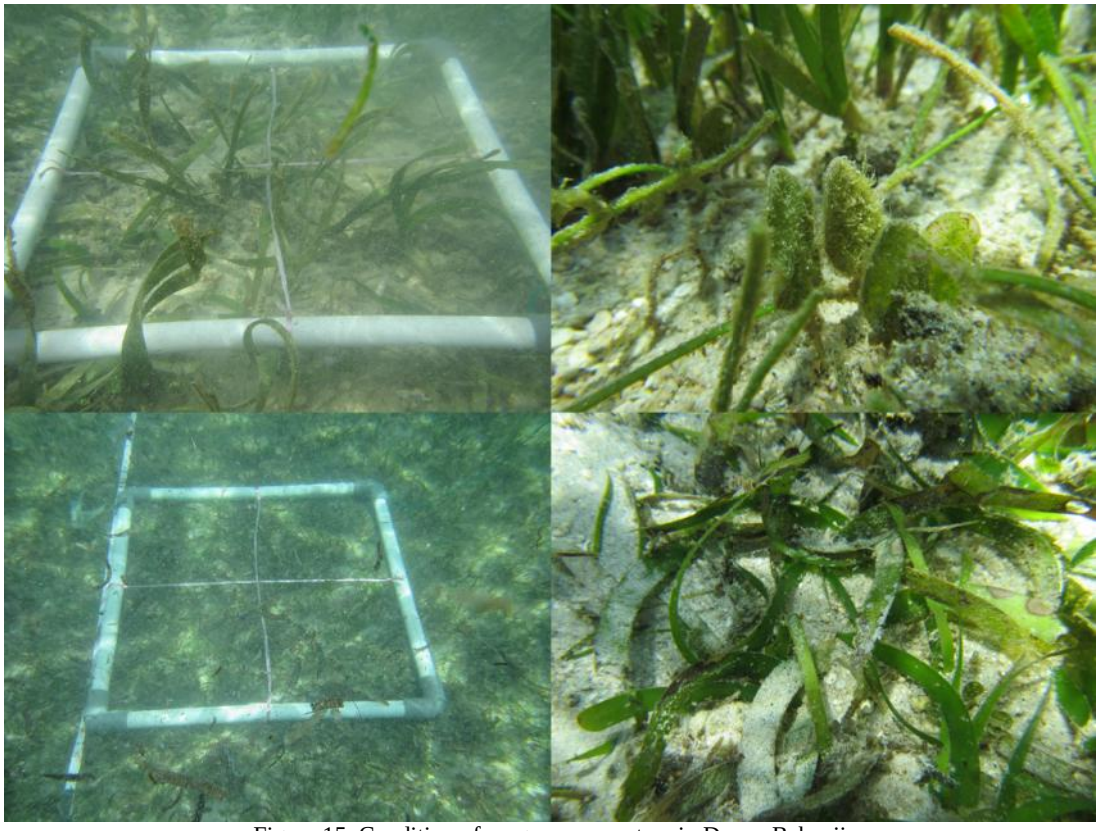

Figure 15. Condition of seagrass ecosystem in Dusun Babanji

Dusun Jaleje located in the mainland ofOgotua village, as well as Dusun Babanji. Seagrass in Dusun Jaleje located close to the harbor, the settlement residents, and estuaries. Pressure on the seagrass in Dusun Jaleje is higher than inDusun Babanji and Lingayan Island. However, according to the residents, dugongs were often seen around seagrass ecosystem inDusun Jaleje. The observation also found the feeding trail of dugong. Seagrass species of*Cymodocea serrulata* and *Halophila pinifolia* dominating seagrass ecosystem in the Dusun Jaleje. This is consistent with dugongs feeding trails found in the seagrass ecosystems. Up to 20 m from the first appearance of the seagrass, seagrass ecosystem is dominated by *Halophila pinifolia* and some*Halophila decipiens*. Substrate in this area are fine sand, hence more suitable as dugong feeding habitat. Seagrass ecosystem in Dusun Jaleje is not veryextensive, which is merely up to ± 60 m. After 60 m, the waters bed have a steep slope of sand to the deeper waters. Drastic changes in water depth isthe reason why the seagrass is not widespread (Figure 16). Seagrass pioneer species of *Halophila mayor*dominates the ranks of the deepest seagrass ecosystem in this hamlet (dusun).

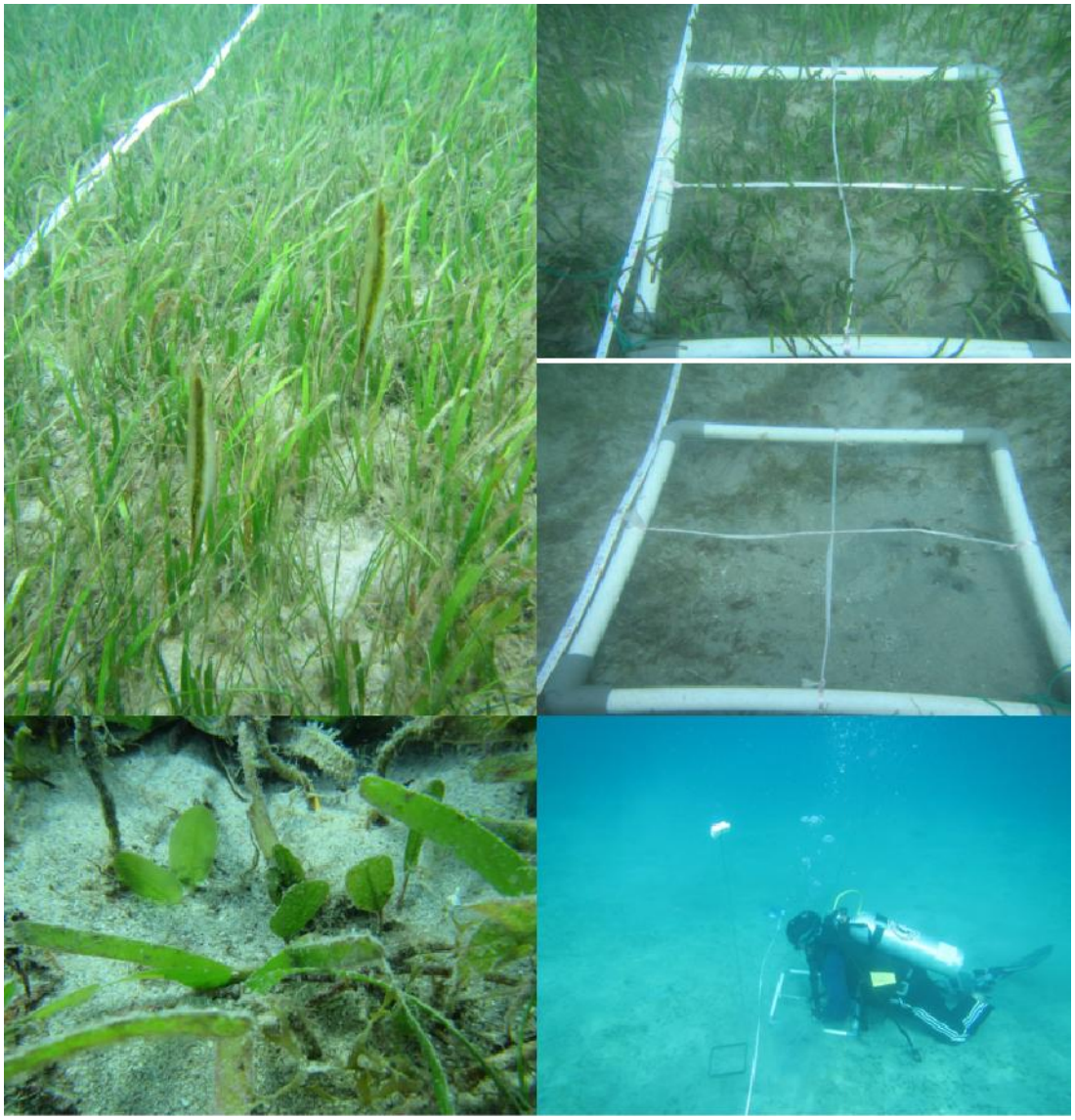

Figure 16. Condition of seagrass ecosystem in Dusun Jaleje

Based on the density, seagrass species of*Halodule pinifolia* in Dusun Jaleje has the highest density value, which reached 1244 individuals/m². While *Enhalus acoroides* in Dusun Babanji has the lowest density with a value of 29 individuals/m² (Figure 17). Dusun Jaleje is the location of the feeding habitat of dugong proofed by theirfeeading trail in this seagrass ecosystem. The type of seagrass which is the main food of dugong also has a high density.

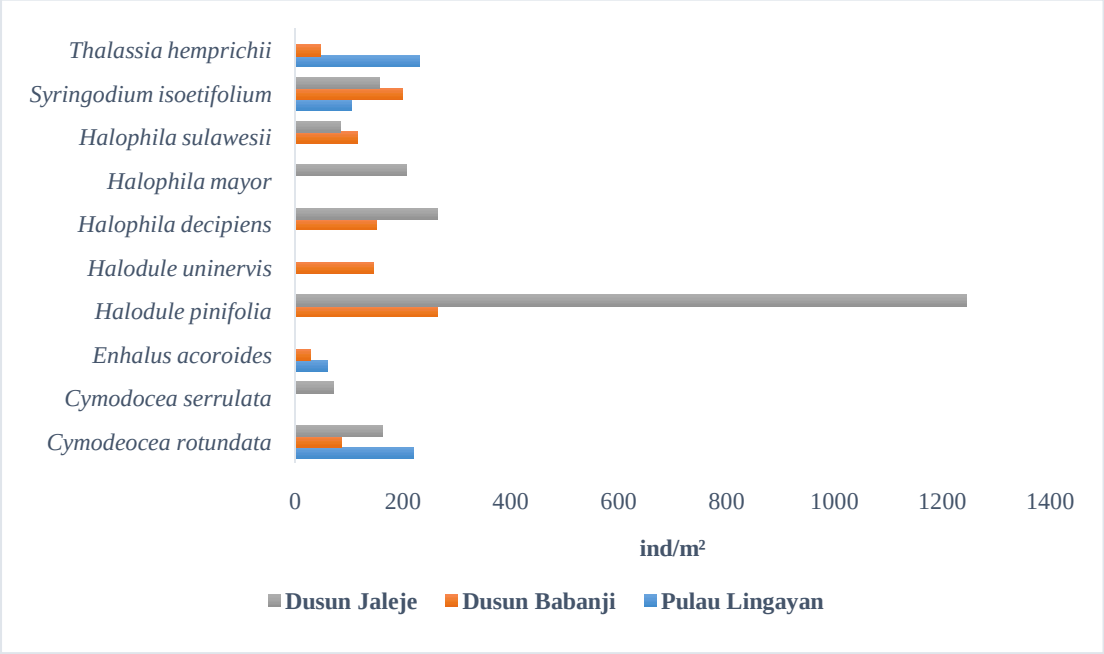

Figure 17. Seagrass denisity at the seagrass ecosystem in Tolitoli

The role of seagrass as a dugongs feeding habitat can not be separated from the seagrass biomass produced by these ecosystems. At first, the grazing activity by mega-herbivores such as dugong and turtle is suppose to be a threat to the existence of seagrass. However, the results of further research proved that grazing activities do not constitute a threat to seagrass. In contrast, the grazing activity of mega herbivores may increase biomass production of seagrass. Based on the weight of dry biomass from the observations as shown in Table 6, seagrass species of*Enhalus acoroides* has the highest amount of biomass (517 ± 340.32 gBK/m²), while *Halophila decipiens* has the lowest biomass (2.00 ± 0.14 gBK/m²).

The highest seagrass biomass of seagrass ecosystem in Lingayan Island is owned by the type of*Enhalus acoroides*with a total weight ranges between 141.9 to 959.64 gBK/m². Seagrass *Cymodocea rotundata* types has the lowest biomass with the total dry biomass weight ranges between 6.59 to 111.43 gBK/m². Seagrass species that has the highest biomass on seagrass ecosystem in the Dusun Babanji is *Enhalus acoroides* (142.28 ± 68.70 gBK / m²) with a range between 84.59 to 244.53 gBK/m². While seagrass species of*Halophila decipiens* has the lowest total dry weight of biomass in that seagrass ecosystems, i.e. 3.81 ± 4.49 gBK/m² with a weight ranges between 0.11 to 9.67 gBK / m².

Table 6. The average of dry biomass weight of seagrass

Location	Species	Lower Biomass (gBK/m²)	Lower Biomass (gBK/m²)	Total Biomass (gBK/m²)
Lingayan Island	*Cymodocea rotundata*	26,55 ± 20,60	12,84 ± 13,44	39,39 ± 33,50
	Enhalus acoroides	412,23 ± 337,04	105,74 ± 105,81	517,96 ± 340,32
	Thalassia hemprichii	248,91 ± 150,22	92,68 ± 49,70	341,59 ± 177,84
Dusun Babanji	*Cymodocea rotundata*	32,59 ± 34,24	25,05 ± 36,24	57,64 ± 67,07
	Enhalus acoroides	111,04 ± 48,84	31,24 ± 22,00	142,28 ± 68,70
	Halodule pinifolia	48,85 ± 17,81	9,04 ± 6,68	57,89 ± 23,26
	Halodule uninervis	27,63 ± 26,60	4,54 ± 3,31	32,17 ± 29,91
	Halophila decipiens	-	-	3,81 ± 4,49
	Halophila sulawesii	-	-	16,14 ± 15,29
	Syringodiun isoetifolium	80,09 ± 31,25	22,89 ± 15,06	102,98 ± 46,31
	Thalassia hemprichii	79,19 ± 60,67	26,63 ± 22,12	105,81 ± 80,64
Dusun Jaleje	*Cymodocea rotundata*	21,54 ± 30,27	46,89 ± 78,76	68,43 ± 108,57
	Cymodocea serrulata	32,95 ± 33,49	15,23 ± 15,55	48,18 ± 46,77
	Halodule pinifolia	32,229 ± 37,05	6,57 ± 3,55	37,21 ± 41,00
	Halophila decipiens	-	-	2,00 ± 0,14
	Halophila mayor	-	-	15,42 ± 7,83
	Halophila sulawesii	-	-	5,12 ± 0
	Syringodiun isoetifolium	47,18 ± 33,96	24,79 ± 28,58	71,96 ± 62,54

Seagrass ecosystem in Dusun Jaleje has a lower biomass production than Lingayan Island and Dusun Babanji, even though many feedingtrailswere found in this seagrass ecosystem. The highest and the lowest seagrass biomass weight in this ecosystem respectively owned by seagrass species of*Syringodium isoetfolium* and *Halophila decipiens*. The average of total biomass of*Syringodium isoetifolium* reaches 71.96 ± 62.54 gBK/m² with a weight ranges between 27.74 to 116, 185 gBK/m². While *Halophila decipiens* has a total biomass weight of 2.00 ± 0.14 gBK/m² and a weight ranges between 1.90 to 2.09 gBK/m². Biomass ofthe seagrass at the top is lower than the bottom or closed substrates. This shows that most of seagrass biomass production is at the bottom which is enclosed by the subsrate.

If Table 5 (seagrass cover percentage) and Table 6 (seagrass biomass) are compared, it can be seen there are different types of seagrass, especially in seagrass ecosystems of Lingayan Island. This is because the seagrass biomass samples were taken with the smaller square transectsthan the square transects used to observe the types and percentages of seagrass cover. So it is possible that not all types of seagrass are represented in the collection and measurement of biomass samples. Based on the percentage of cover and biomass of seagrass,

it can be concluded that the seagrass ecosystem in Lingayan Island is a playground for dugongs, seagrass ecosystem inDusun Babanji potentially to be feeding habitat for dugong and seagrass ecosystem inDusun Jaleje to be a feeding habitat for dugongs around the Ogotua Village and even maybe around the waters in Tolitoli.

The suitability of seagrass in the Dusun Jaleje as a dugong feeding habitat is reinforced by the presence of dugong feeding trailson this seagrass ecosystems. Samples of seagrass biomass at 6 dugong feeding trailswere taken to identify their feeding trends/habits. Based on observations and measurements of biomass on the inside and outside of the feeding trails, the type of seagrass which became the main food for dugong in seagrass ecosystem inDusun Jaleje is the seagrass species of*Halodule pinifolia* and *Halophila decipiens* (Table 7). However, *Halodule pinifolia* dominates more in dugong feeding area. This type of seagrass biomass only weighed a total of 31.95 ± 38.57gBK/m² inside the feeding trails and amounted to 100.51 ± 61.93 gBK/m² outside the feeding trailon the seagrass ecosystem inDusun Jaleje.

Table 7. The average of seagrass dry biomass on dugong feeding trails in seagrass

Location	Species	Position	Lower Biomass (gBK/m²)	Upper Biomass (gBK/m²)	Total Biomass (gBK/m²)
Dusun Jaleje	*Halodule pinifolia*	Inside	31,78 ± 38,67	0,18 ± 0,45	31,95 ± 38,57
		Outside	85,54 ± 63,00	14,97 ± 6,99	100,51 ± 61,93
	Halophila decipiens	Inside	-	-	-
		Outside	6,49 ± 5,79	1,74 ± 0,93	8,23 ± 5,93

Seagrass biomass in the inside offeeding trail is recorded smaller than in the outside the feeding trail. On the inside of the feeding trail, seagrass biomass upper part has a very small weight on seagrass species of*Halodule pinifolia*, even nothing at all to seagrass species of*Halophila decipiens*. Based on the results of biomass, we can conclude that the dugong take the top and bottom of seagrass without exception, even if there is fruit in a series of seagrass rhizomes are also eaten (Figure 18).

Figure 18. Sample of seagrass biomassmain food of dugong (Halodule pinifolia)

Based on the criteria for the condition of seagrass in Woutuyzhen (2009), seagrass ecosystem in Lingayan Island and Dusun Babanji is in good condition, while seagrass in the Dusun Jaleje is in the medium condition (Table 8). The seagrass ecosystem conditions are based on the criteria of number of species of seagrass found, seagrass cover, as well as the weight of the biomass of the seagrass.

Table 8. Condition of seagrass ecosystems in Tolitoli

Location	Scor				Seagrass
	Number of species	Cover	Biomass	Total	Condition
Lingayan Island	2	2	3	7	Good
Dusun Babanji	4	2	1	7	Good
Dusun Jaleje	3	2	1	6	Medium

References

Supriyadi, H.I. 2010. Pemetaan Padang Lamun di PerairanTelukToli-TolidanPulauSekitarnya,Sulawesi Barat. OseanologidanLimnologi di Indonesia, 36(2): 147-164.

Wouthuyzen, S. 2009. RisetuntukPenyusunanRencanaPengelolaanSumberdayaLamundanEkosistemterkait di Wilayah PesisirBintanTimur, Riau Kepulauan. Program RisetKompetitif LIPI Sub-Program EksplorasidanPemanfaatanSumberdayaHayati (DaratdanLaut)Indonesia - Lembaga IlmuPengetahuan Indonesia (LIPI). Jakarta.

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

1. Methods

1.1. Interview

Preliminary survey activities was carried out in Tolitoli, Central Sulawesi Province on September 19-26, 2016. Data were collected through interviews with key informants. The interview was conducted in seven locations: Ogotua, Sese, Bambapula, Malala, Lalos, Sabang, and Santigi (Figure 19 and Table 9).Target respondents are fishermen, citizens, and government officials around the study site.

The interview of key informant interviews was conducted by referring to the questionnaire about presence of dugongs and perceptions related to the conservation of the Dugong and seagrass habitat. The questionnaire isin Bahasa Indonesia and it was developed and adopted fromConservation on Migratory Species (CMS) (http://www.cms.int/en/project/cms-unep-dugong-questionnaire -survey). The list of questions is then inputted into Akvo Flow, so that the input data can be done by using a smart phone or android-based tablets.Data which has been inputted can be downloaded on: https://wwfid.akvoflow.org/./.

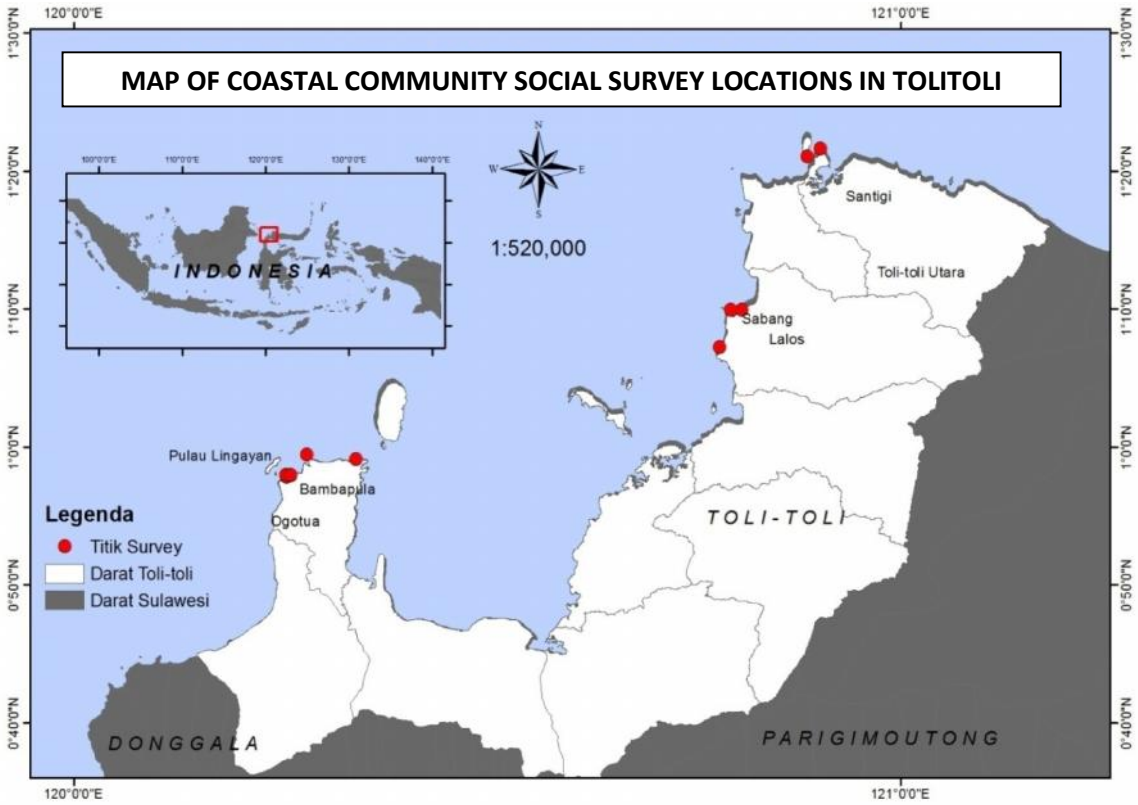

Figure 19. Map of data collection sites in Tolitoli

Table 9. Data and Location of Data Collection

Date	Sub-District	Village/ Island
September 20, 2016	Dampal Utara	P. Lingayan, Ds. Ogotua
September 21, 2016	Dampal Utara	Ds. Sese
	Dondo	Ds. Malala
September 22, 2016	Tolitoli Utara	Ds. Santigi
	Dampal Utara	Ds. Bambapula
September 23, 2016	Dampal Utara	Ds. Sese
		Ds. Ogotua
	Dondo	Ds. Malala
September 24, 2016	Galang	Ds. Lalos
		Ds. Sabang

1.2. Focus Group Discussion (FGD)

In addition to the interview with key informants, the survey team also conducted Focus Group Discussion (FGD) with the communities on the island Lingayan, Ogotua Village, Sub-district of North Dampal, intended to gather information openly and objectively. The discussion was held on 19 September 2016 from 20:30 to 21:30 pm.

Th main points of the discussion are as follow:

1) Dissemination of information in regards to the conduct of survey on dugong and its habitat
2) Exploring the public's understanding of dugong
3) Knowing the myths/ legends of dugong
4) Confirming the existence and threat of dugong
5) Exploring the public expectation on dugong presence
6) Exploring local handicrafts which can be developed

2. Result and Discussion

2.1. Key Informant Interview

2.1.1. Respondents Background

Survey team has successfully interviewed 29 key informants (Table 10) who are domiciled in the village Ogotua (12), Santigi (5), Lalos (3), Sese (4), Malala (3), Sabang (1) , and Bambapula (1). The majority of key informants are male (96.55%).

Table 10. Name, age, sex, and key informants' island/village origin

No	Nama	Usia (tahun)	Jenis Kelamin	Origin (Island/Village)
1	Ismail	37	Male	P. Lingayan, Ogotua
2	Hamzah	40	Male	P. Lingayan, Ogotua
3	Sukri	36	Male	P. Lingayan, Ogotua
4	Musir	41	Male	P. Lingayan, Ogotua
5	Asri	40	Male	P. Lingayan, Ogotua
6	Rrusmany	44	Male	P. Lingayan, Ogotua
7	Abdul Manan	72	Male	P. Lingayan, Ogotua
8	Muhammad Amin	50	Male	P. Lingayan, Ogotua
9	Ali Nasrun	38	Male	P. Lingayan, Ogotua
10	Wahab	30	Male	P. Lingayan, Ogotua
11	Sakar	40	Male	P. Lingayan, Ogotua
12	Mading	48	Male	Ogotua
13	Suharto	45	Male	Santigi
14	Rabil	47	Male	Santigi
15	Mardiah	47	Female	Santigi
16	Maruf Endang	38	Male	Santigi
17	Mayudding	39	Male	Santigi
18	Adi	31	Male	Sese
19	Kone	45	Male	Sese
20	Aco	24	Male	Sese
21	Kaisar	25	Male	Sese
22	Samang	56	Male	Lalos
23	Sabda Alam	36	Male	Lalos
24	Rizal	36	Male	Lalos
25	Ruslan	37	Male	Malala
26	Anwar	59	Male	Malala
27	Syamsir	36	Male	Malala
28	Abubakar	58	Male	Sabang
29	Imran	44	Male	Bambapula

Seven key informants (24%) states that they have completed the interview related to marine protected areas, fisheries, Lingayan Island area, and the 71stIndependence Day of Republic of Indonesia. Regardingconservation of dugongs and seagrass, the activity of the interview has not been done except for public consultation on DSCP conducted by the Ministry of Maritime Affairs and Fisheries.

A small portion of the key informants (10%) said that they had received informal education / training related to finance technical assistance ofthe village, about illegal fishing and protected animals including napoleon fish, turtles, and sea lions, as well as the training of fisheries. The last training was conducted around 1990 to 2015. The organizer wasgovernment official of Ministry of Village,Development of Disadvantaged Regions, and Transmigration (abbreviated as KPDT), and Departement of Marine and Fisheries (abbreviated as DKP) Tolitoli.

The majority of key informants (62%) stated often use mass media to gain information. Type of media used include television, newspapers, radio, village information boards, and direct communication from residents / relatives. This shows that the interviewed key informants relatively open with information and interaction with the outside world, as well as access to adequate information. However, the information received is general information and not on particular matters related to conservation.

The majority of key informants (62%) stated that there has never been conservation activities on dugong and seagrass (or conservation of the environment and other natural resources), while 31% of key informants said that they had been such form of safeguard community, planting mangroves, fisheries, transecting seagrass and handling stranded marine mammals (Figure 20), and the rest 7%said did not know. Regarding the dugong and seagrass conservation activities, it was carried out by DKP Tolitoli.

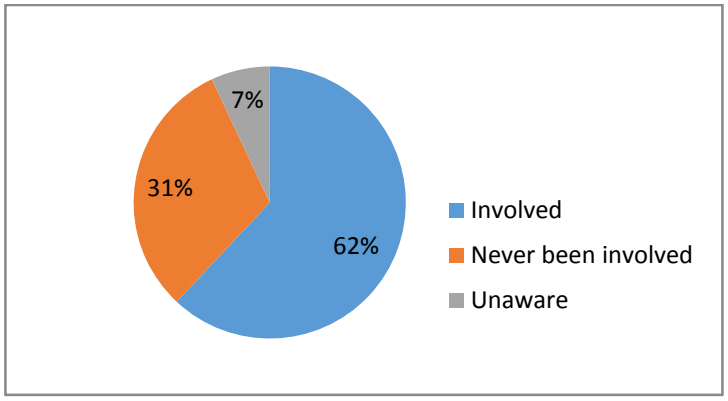

Figure 20. Public response of the previous dugong and seagrass conservation (or conservation of the environment and other natural resources) before

The majority of key informants (93%) had a primary job as a fisherman, while the rest have other jobs such as sub-district officials, farmers and housewives. Of these (89%) stated that fishing is the only available work. Some also become farmers, farm laborers, construction workers, and fish traders as a side job. Respondents have experience for 4-45 years working as fishermen. Apparently, this is supported by (86%) of them, who have a background as a fisherman with a (86%) had parents who used to be fishermen and (68%) had a grandfather as who was formerly a fisherman. It shows that key informants have a dependency on the sea as a major source of income to support their livelihood.

Based on the information collected, there was no (seasonal) benchmark for key informants who work as fishermen in catching fish. The majority of key informants (65.5%) answered every month because they are fishermen who use only traditional fishing gear as fishing rod. But for those who use net as their fishing gear, the right season for fishing is in January-October when the wind shade or south wind. Inversely, the fishermen do not to fish in season which occurs from November to December when there is a hurricane or north wind. Althought the fishermen can not go fishing during bad season (hurricane frequently occurs), they still earn income from side jobs such as farming, farm workers, and construction workers.

2.1.2. Knowledge on dugong

The whole key informants (100%) claimed to have seen dugongs in its territorial waters and (96.5%) can distinguish between dugongs and dolphins. Dugong and seagrass habitat are scattered throughout the survey area (Figure 21).

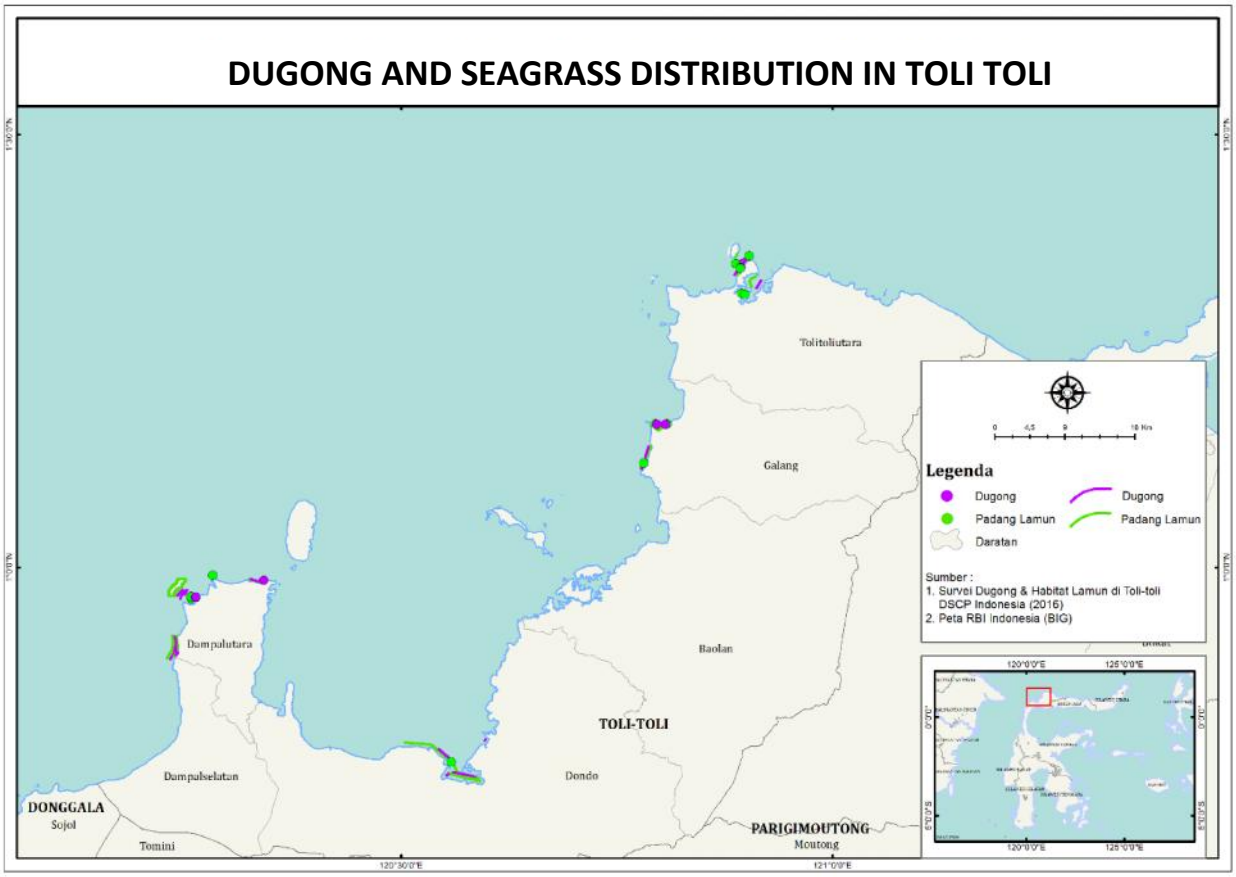

Figure 21. The distribution of Dugong and Seagrass habitat

For fishermen in Sese village, dugong is a marine demon that appeared suddenly near their boat when fishing and had a creepy voice. Another case in the village of Santigi, fishermen call dugong "*dieuh*" inTolitoli Tribe language. While society in Lalos call dugong as "*bagau*", and some are calling the dugong as "*baronang*"Lingayan Island. Although some villagers call it differently, but in general, they are more familiar with "*duyung*"term.

The majority of key informants (65.5%) did not know how long dugong can live. Some (34.5%) stated that the dugong long-lived as a human with maximum age range 20-100 years. In Figure 22 and 23, it is explained that, in almost all villages (83%) dugong commonly observed incidentally during fishing, when shipping to fishing spot (10%), and when the dugong incidentally caught in nets or other fishing gear other (7%).

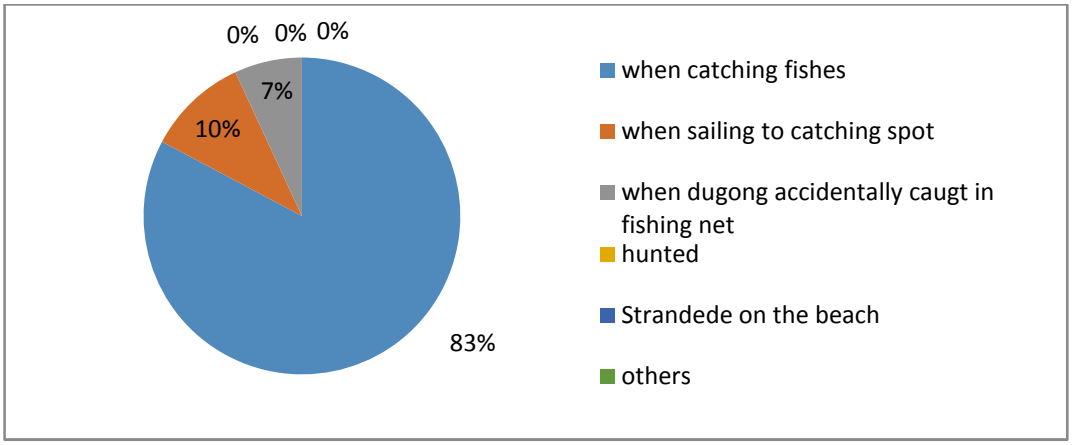

Figure 22. Response of moments when Dugong was sighted

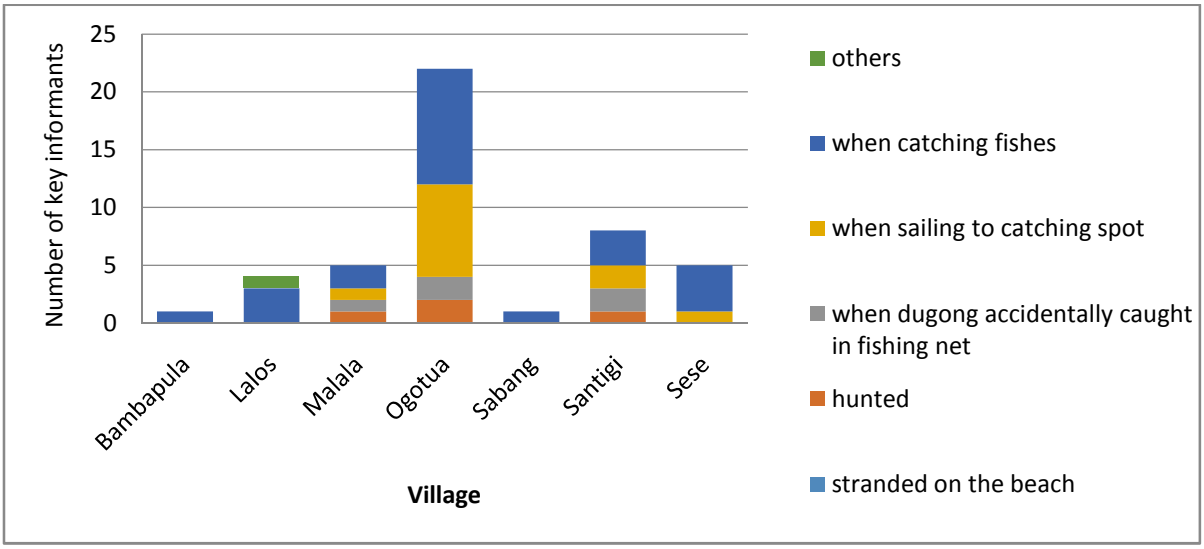

Figure 23. Response of moments when Dugong was sighted in each village

The majority of key informants stated that they often see the emergence of dugong (38%), even some (20.6%) stated that they see dugong every month (Figure 24). There is particular time or season to see the dugong, 58.6% of informants described from January to December or every month through the yearDugong is always visible. Sometimes emergence occurs during the full moon in the night, morning and afternoon time when the sea was calm. During the full moon, society explains that it is the time of high tide so dugongfreely forage in the seagrass.

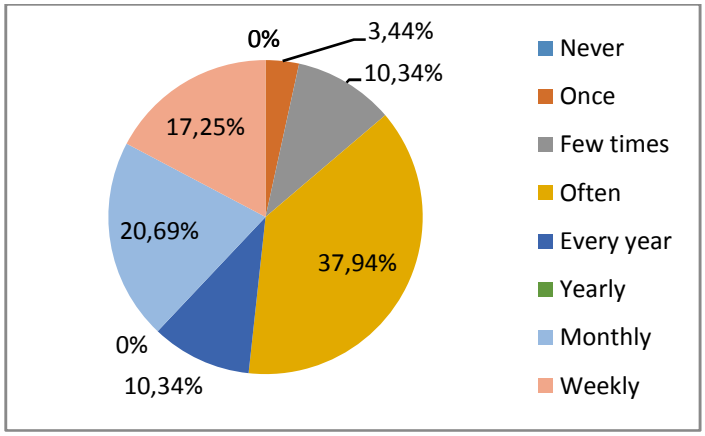

Figure 24. Response on the sighting intensity of Dugong

Based on the respondents' description, in the village of Ogotua, Dugong is commonly seen between the islands of Lingayan and the island of Sulawesi. intensitas kemunculan yang ditemui masyarakat di daerah laut dalam antara kedua pulau tersebut. However, it had been seen once in the East Sea of Lingayang Island, dugong was playing in a large group (approximately 10 individuals). In Sese village, dugong was spotted along the coast of Sese village. In the village of Bambapula, precisely in Dusun Babanji, there are some spot in which dugong often seen emerge. In the village of Malala,the intensity of dugong emergence dugong is more often than other locations in the survey. Along the coast of Malala bay is dugong emergence spots, almost every day in a week. Meanwhile, in Lalos village, Sabang village, and Santigi village, dugong emerge not far from their villages. The conclusion is all village (survey site) are included as distribution area of dugong. Regarding the location of the emergence of dugong, majority of key informants stated that the location of the dugong appeared to change over time (44.8%), while the changes are still in the area around the village. Meanwhile, the remainder (34.4%) reported there is no change or only look at one point, and the rest (20.8%) did not know whether the site is changed or not over time (Figure 25).

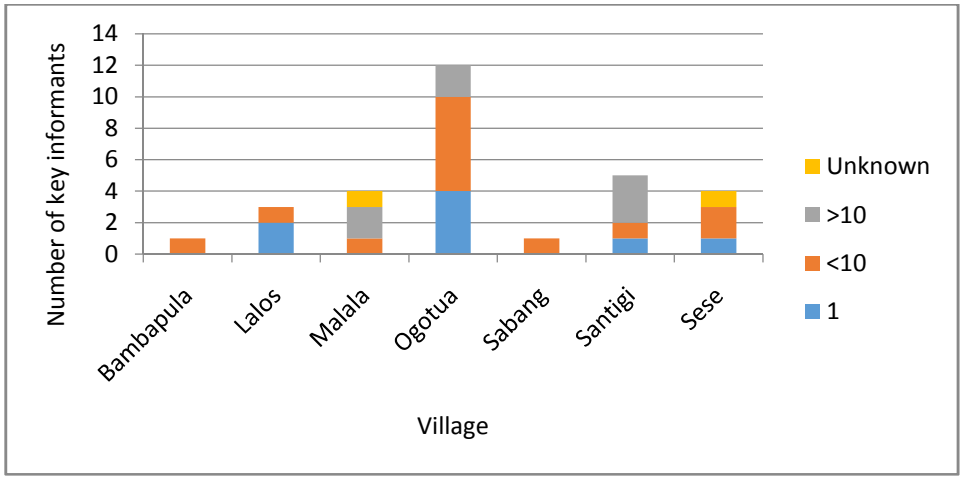

Figure 25. Response on the expected number of dugong

The majority of key informants (34.5%) claimed to have seen baby dugong; seen by 5 informants in the village Ogotua, two informants have seen in Santigi village, and one informant from each Malala village, Lalos Village, and BambapulaVillage. Regarding the time seen, Dugongwas seenonce in 2003 in Ogotua village and other villages during period 2015-2016. The occurrence of baby dugong is not only in seagrass beds, but also as they are passing and playing in "Napu tenga"which means "centered sand signage", and in Batu Mandi which means which means a rock which arise during low tide.

At least there are three informants who have seen a dugong been caught. In the village of Santigi, dugongs which accidentally caught in nets were then maintained for 9 years by tying and tethering its tail to two logs in the seaside. Dugong was maintained since 2004 to 2015, before it was finally released by the Regent of Tolitoli. Similar to what has occurred in the village of Sabang, dugongs in the village of Malala has also been caught unintentionally due to trapped into "*serok*" which is a traditional fishing gear which tak form of nets and is hung on a wood as its pole in the middle of the sea. Dugongs which caught accidentally in the village of Malala as a bycatch, were released back into the sea. On the other hand, in Sabang village, Dugong was deliberately captured, and the incident occurred in 70s. In the village of Ogotua, dugong is also intentionally captured and become a livelihood for one informant named Rusmany.

Rusmany (44 years old) are familiar with the sea as he fished since childhood. As the children, he spent most of his time to help parents who also worked as fishermen. Not only that, the background to catch fish is also derived from the grandfather. Until now, the sea has become a vital source of his livelihood. In regard todugong and seagrass, Rusmany have a

better understanding than the other residents in Lingayan island. This is because his grandfather, his father, and he himself was a former specialist of catching dugong. To catch dugong, he was not alone, there were friends who have helped him. In one year he used to catch more than ten dugongs. Since the prohibition of catching dugong established, he never catches the species again.The remnants of the tusks and bones from dugongs that he had caught before are still stored (Figure 26).

Figure 26. Rusmany, a former specialist of catching dugong.

There is another information about accidental catch which occured on 16 September 2016 in Dusun Babanji, BambapulaVillage waters. The presence of DSCP survey team (CTF, LIPI, IPB, Balitbang, DKP and WWF) which are known by the citizens of Ogotua, was in the nick of time as one of the resident named Mr. Haikal accidentally captured dugong. After a week, the dugong was finally reported to the survey team. Following that, after medical examination and morphological data collection on 23 September 2016, dugong was released again. The release was attended by Head of Departement of Marine Affairs and Fisheries Tolitoli, the head of sub district North Dampal, the head of Bambapula village and residents as well asDSCP Survey Team (figure 27).

Figure 27. A dugong was released in Bambapula village

Stranding event had occurred in the village of Santigi in July 2016 and at time the Dugong died. Another Dugong has also been found dead in the waters of Santigi village in 2010, which was then brought to the land for consumption because the meat was still fresh. Not only that, in Sese village, there wasanother dugong that diedbut left alone by the informants who discovered it. In those three events, only one dugong found in each stranding location.

If there are strandeddugongs, people will report the incident to DKP Tolitoli, police, head of the village and other community members. The public usually try to rescue the species by returning it to the sea if it is still alive. If the species died, it will be buried or left. Nevertheless, there are some people who will take the tusk to be sold or used it assmoking pipe.Some people eat the meat if it is still feasible.

2.1.3. Knowledge on seagrass ecosystem

Almost all key informants (96.5%) claimed to have seen seagrass meadow. The meadowis scattered around the Lingayan island, Ogotua village, along the coast of Sese village and the Bambapulavillage. Malala village which is geographically located in the bay also has seagrass beds scattered along the Gulf of Malala. While in the village Lalos, Sabang Village, and Village Santigi there are only a few seagrass distributions (Figure 3).

People of Tolitoli call seagrass as"Nambo/rumbut Nambo". Estimates of the number of seagrass by key informants ranged from 1-4 types (Figure 28) with the majority (96.5%) of seagrass found at a depth of 0-5 m (Figure 29).

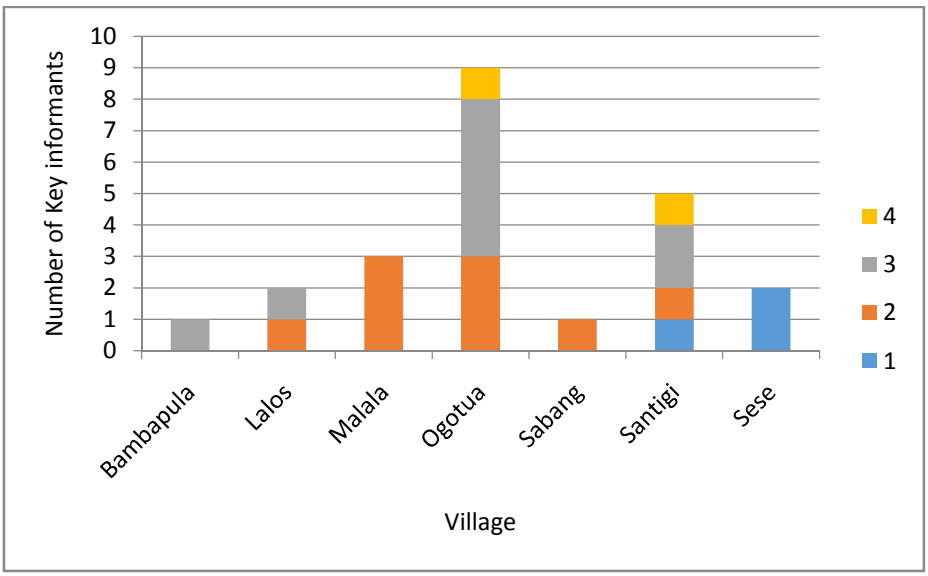

Figure 28. Response on the number of known seagrass species

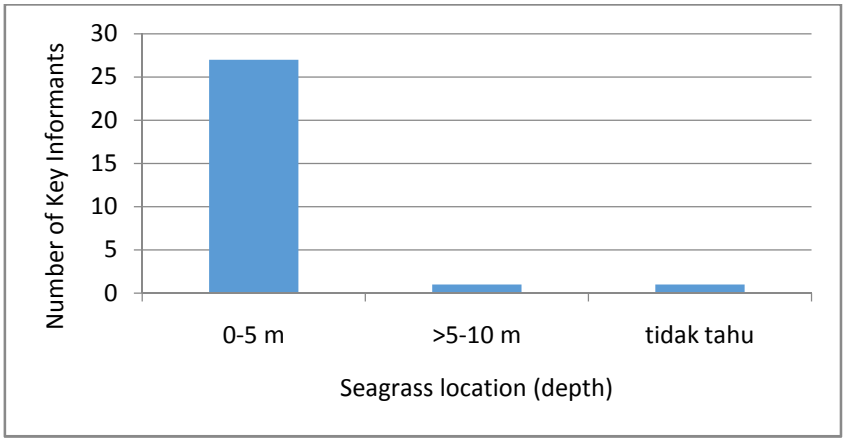

Figure 29. Responses regarding water depth in which seagrass is discovered

Based on physical characteristics, key informants explained that there are long, short, small and fruitful seagrass. A healthy seagrass habitat provides abundance of resources which has high economic value / essential nutrients for marie biota such as seahorses, sea cucumbers or clams. A total of 44.8%the key informants stated that seagrass habitat is not only used to catch fish, but also seahorses, sea cucumbers or scallops, and squids (Figure 30)

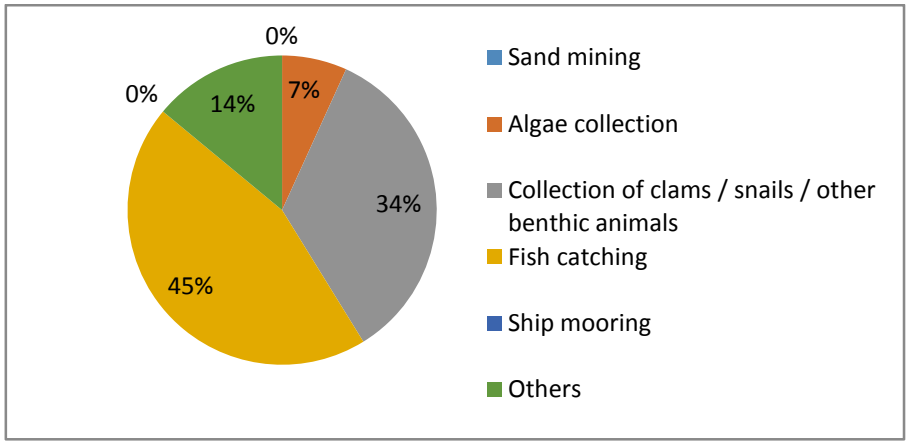

Figure 30. Responses regarding the utilization of the seagrass

Fishing gear used by key informants is still quite traditional in the form of nets, lines, and arrows (used during daytime) as well as spears and flashlights (used during night time).

2.1.4. Community perception

Dugong

The level of public awareness of coastal on the existence of dugongs in the region Tolitoli is quite high. This can be seen from fact that the majority of key informants (93%) argued that dugong had to live freely in the sea However, there are some people who still also assume that dugong can be nurtured as in the television show and some said they want to pet the species. Regarding its existence, key informants explained that the dugong also attracts small fish around it and this can be a tourist attraction as in the village of Santigi when dugong was maintained for 9 years.

In addition, the level of awareness is also demonstrated by the majority (75%) of key informants who argued that the existence of dugong is critical dugong, 3.4% thought not, and the rest do not know the answer (Figure 31).

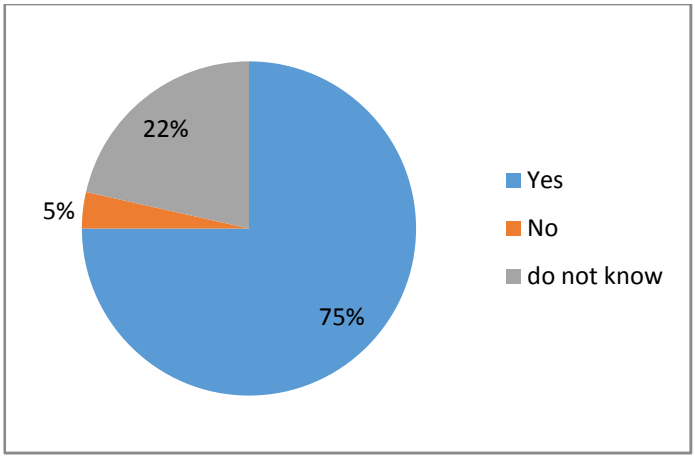

Figure 31. The public perception of the importance of dugongs

Public's understanding of dugong as one of the protected animals is still not evenly distributed. While the majority of key informants (76%), including from Bambapula (1), Sese (4), Ogotua (7), Malala (3), Santigi (4), Sabang (1) and Lalos (2 people) said catch dugong deliberately is against the law (Figure 32). However, among the interviewee, there are 24% who did not know about it. In case of accidental catch (eg: in the net), the majority (62%) of key informants stated that such action was not illegal (Figure 33).

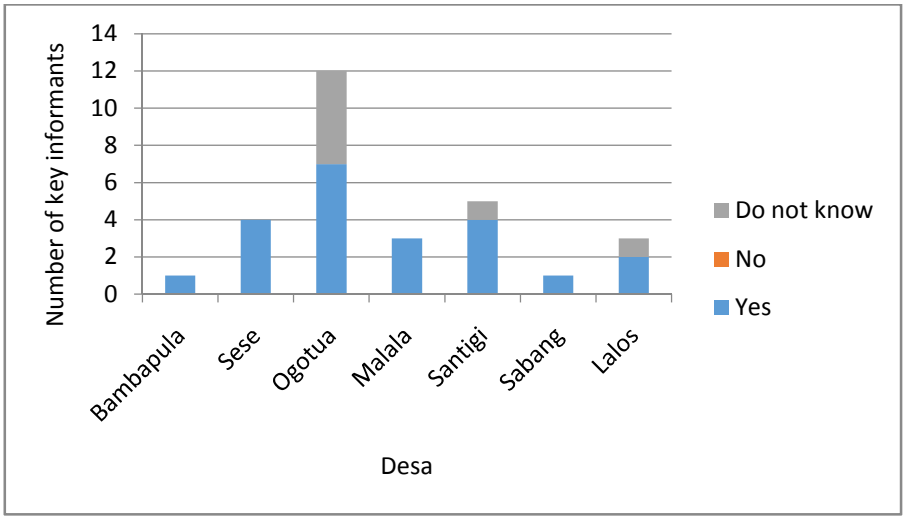

Figure 32. Response on the legal status of catching dugongs

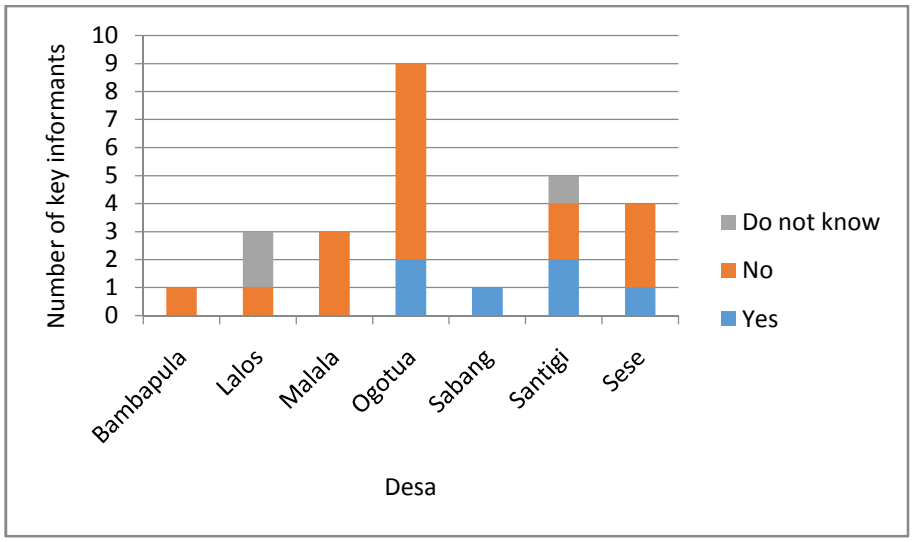

Figure 33. Response on accidental catch

The majority of key informants (72%) said they would report stranding events to the related authorities. A report will be addressed to the Village Administrative, DKP, and Police office (Figure 34). Therefore,it is very important if local officials to have adequate knowledge.

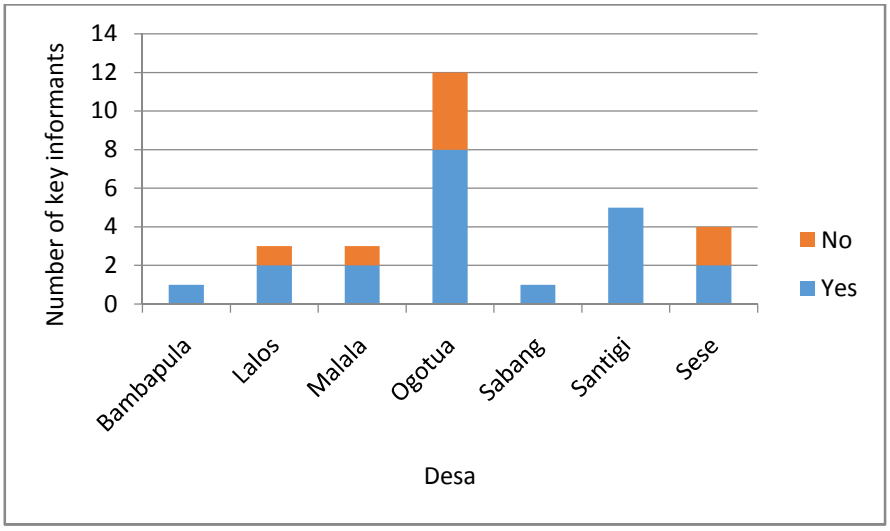

Figure 34. The public perception of the willingness to report dugong accidental catch to local officials

The majority of key informants (47.8%) stated that there was never a patrol activities in the region (Figure 17). If there was, it was just a regular monitoring activities conducted by the public, PSDKP, Navy, and Polair to prevent foreign boats with illegal fishing materials and fishing gear which are not environmentally friendly.

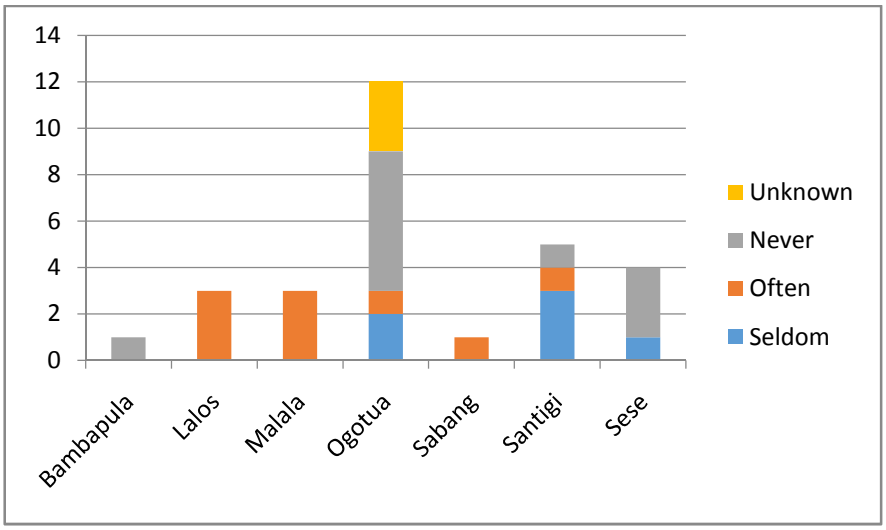

Figure 35. Responses regarding oversight activities or routine patrol in the waters

Seagrass

The majority of key informants (89%) stated that the presence of seagrass essential to sustainability of dugong. Informants understood that seagrass is the feeding habitat of dugongs and turtles, and provide shelter for fish. Therefore, the majority (82%) assume that the presence seagrass is important as it is one of the locations in which fishermen can catch

fish and other resources that have nutritional and economical value. Until now the majority of key informants (39%) stated that the condition of seagrass has not changed compared to the previous years (Figure 36).

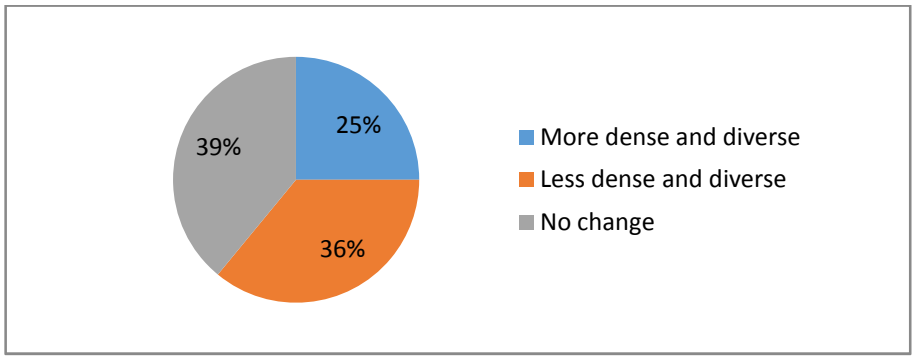

Figure 36. Public perception of the changing conditions in the seagrass habitat

The existence of seagrass impacts the availability of particular resources such as seahorses and clams or sea cucumber. This was disclosed by the majority of key informants (78%). They assume that fishing those kinds of marine resources do not have devastating effects on seagrass habitat.

Regarding customs, beliefs, culture, fairy tales or local ritual and / or traditional knowledge associated with dugong and / or regulate the relationship between human life and its environment the majority (72%) of key informants stated there is no relation. As for the rest stating that some believe that dugong is an animal that was once human. The myth was about a pregnant woman who craves fruit seagrass. Every day when the water recedes the woman into the sea to eat the fruit of seagrass. One day she fell asleep because when the tide is full and she was washed into the sea and become a dugong.

General information

The majority of key informants (72.4%) stated that the government, community leaders, community organizations, and / or the private sector (for example: tourist resort) support towards sustaining the coastal environment, especially for the dugong and seagrass habitat (Figure 19). A total of 82.7% of key informants will also be involved in disseminating information, control, and report if there is s a crime against wildlife, especially dugong. This demonstrates the high public enthusiasm when the conservation of dugongs and seagrass take place in Tolitoli.

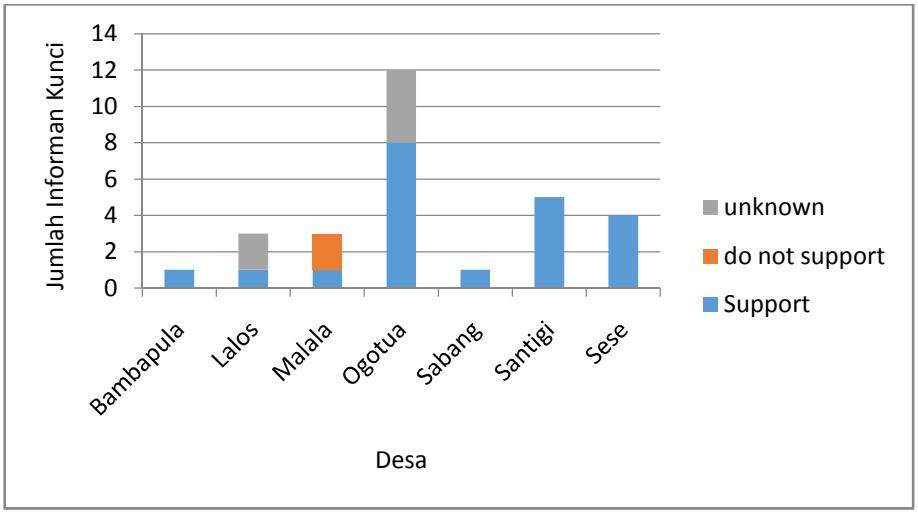

Figure 37. The public perception on the role of government, community leaders, community organizations, and / or the private sector (for example: tourist resort) towards sustaining coastal environment (especially against the dugong and seagrass habitat)

Figure 38 shows the public perception of the conservation of dugongs and seagrass habitat. The majority of key informants (70%) said the increasing population has no effect on the conservation of dugongs and seagrass habitat. Some informants stated adversely; it may leave impact if dugong protected area is established as people willalso use it for their personal purpose. Thus, it may attract civil migration to the protected area (Figure 38a).

The majority of key informants (69%) said there was an effect of the increased facilities / travel activity (Figure 38b). With the conservation of dugongs and seagrass, communities realize that the territory became the tourism target. This can be seen from the act of captivating dugong in the Santigi Village for 9 years before it was released in 2015. Economical impacts of dugong increased sales of merchandise in small stalls since it was regularly visited by tourists who want to see the dugong in Santigi village. No tickets or a special entrance fee applied to see the dugong, but sometimes visitors giving a small donation to the owner of the dugong. This shows the potential of theconservation-basedtourismis extremely high and is supported by the community.

The majority of key informants (44.8%) stated that industrial activities/ mining will affect dugong and seagrass habitat (Figure 38c). The community aware of the detrimental impact of such activities on the environment. In some survey locations, sand mining has never been established.

The majority of key informant (58.6%) explained that illegal dumping or the absence of waste management program will leave impact on dugong and seagrass habitat (Figure 38d). The informants further argued that the community awareness to manage their waste properly is still poor.

A total of 58.6% key informants thought that climate change has no impact on dugong and seagrass habitat (Figure 38e). In addition, they also stated that cruise or boat also does not affect the species (55%) and its habitat as they put the mooring buoy out of the seagrass meadows. There is no specific passanger ship and boat available in survey location (Figure 38f).

The majority of key infomants (62%) stated that the destructive fishing activity will affect the dugong habitat and seagrass habitats (figure 38g). They further stated that they only use traditional fishing gear, never use any material or fishing gear that is not environmentally friendly. In each village there issafeguard (monitoring) groups and fishing communities who have the responsibility for maintaining marine and coastal villages. In the village of Malala, according to Mr. Amin, Chairman of the Supervisory Society (Pokmaswas) Malala bay, they even had directly capture illegal fishing activities. Each section of the community was built directly by DKP Tolitoli.

The majority of key infoman (72.8%) stated that ignorance of society will affect the dugong and seagrass habitat (Figure 38h). Although key informants have to have a good awareness related to dugong and seagrass, dugongs related knowledge is still far from adequate. For that reason, we need program which build public awareness.

The majority of key informants (62%) stated that the presence of protected area will affect dugongand habitat condition (Figure 38i). Consequently, the species and the habitat will be protected even better. Dissemination of information regarding sustainable use to the public is essential to be conducted.

The majority of key informants (58.6%) said that patrol and law enforcement affect dugong and habitat existence (Figure 38j). In District of Tolitoli, the role of society is involved by DKP effectively. However, this has not been parallel with the response expected from police officials which considered slow in giving response.

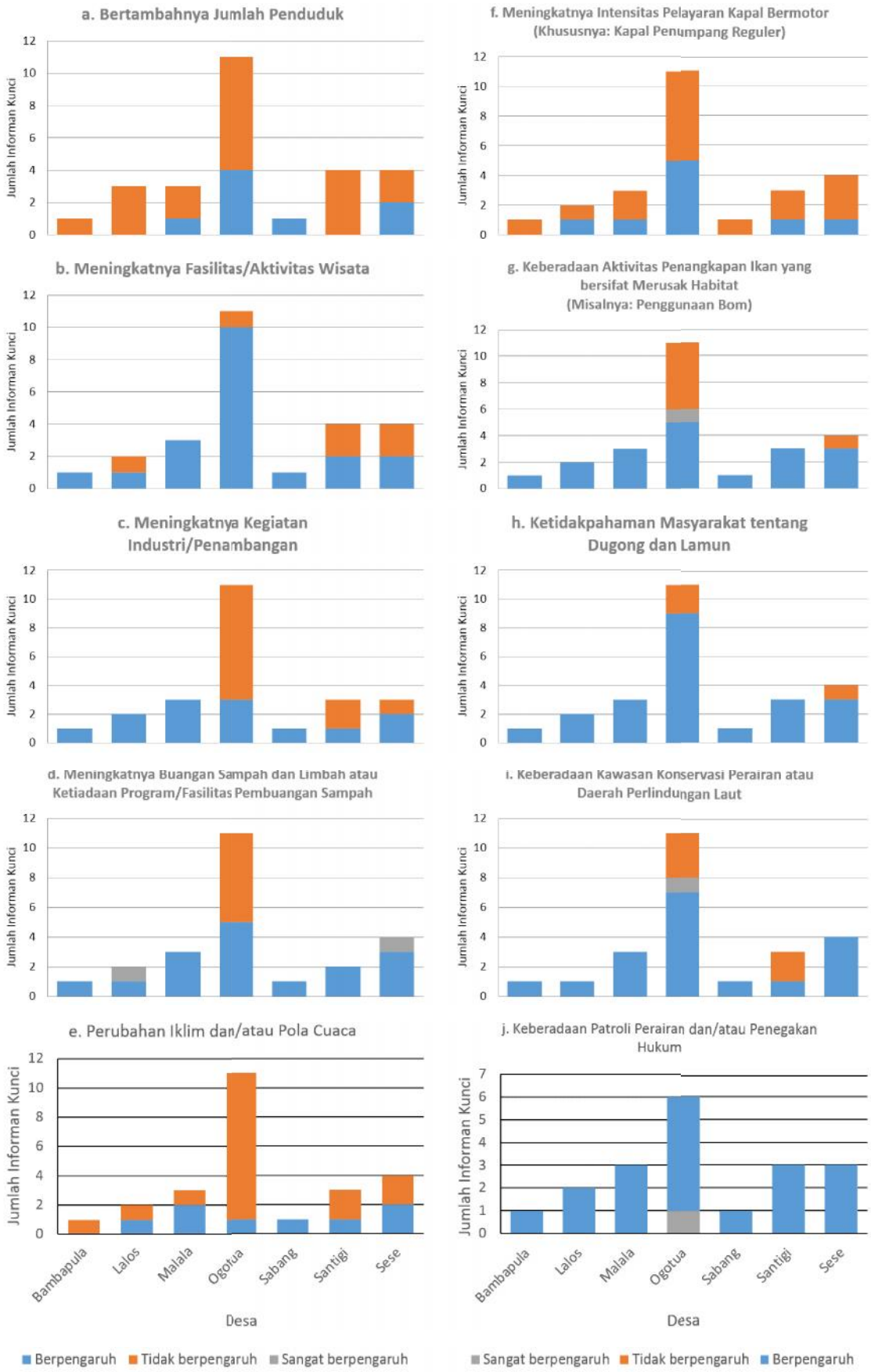

Figure 38. Public perception on several fctors that may affect conservation of Dugong and Seagrass Habitat

Figure 39 shows the public perception on infrastructure development planning and village development. The majority of key informants (51.7%) agree, and 44.8% agree with motor way construction (Figure 39a). The informants (72.4%) also agree with boat motorization (conversion of traditional to motorized boat) (Figure 39.b) and construction of hotels/ resorts (Figure 39c). additionally, the informants hope that in the future, hotel and resort will not turn into red-light zone or bordello.

Regarding mall/ shopping center construction, key infomants (79%) said agree to the plan (Figure 39d). The majority (68.9%) also agree to construction housing complex. In regard to bar/ night club construction plan, 82.7% of key informants said disagree as it will bring more negative impact to the community (Figure 39f).

The majority of key informants (82.7%) said that development on local wisdom is necessary, especially it this can be in lined with conservation based tourism (Figure 39g). For this reason, the public expect any development program that may improve their knowledge on tourism management.

A total of 72.4% of the community agree to close/ shut down particular area in order to recover sea grass habitat from destructive use and coastal area (regional marine protected area). However, the rest of the informants (27.6%) disagree, as they wish to keep using the area to catch fish. If there is any solution to sort out the problem and fulfill both needs, the community tend to agree (Figure 39h).

The majority of key informant (86.9%) agree with marine tourism development which support the efforts of dugong and seagrass conservation (Figure 39i). They (82.7%) also agree to home industry development which support marinetourism and dugong and seagrass conservation (Figure 39j).

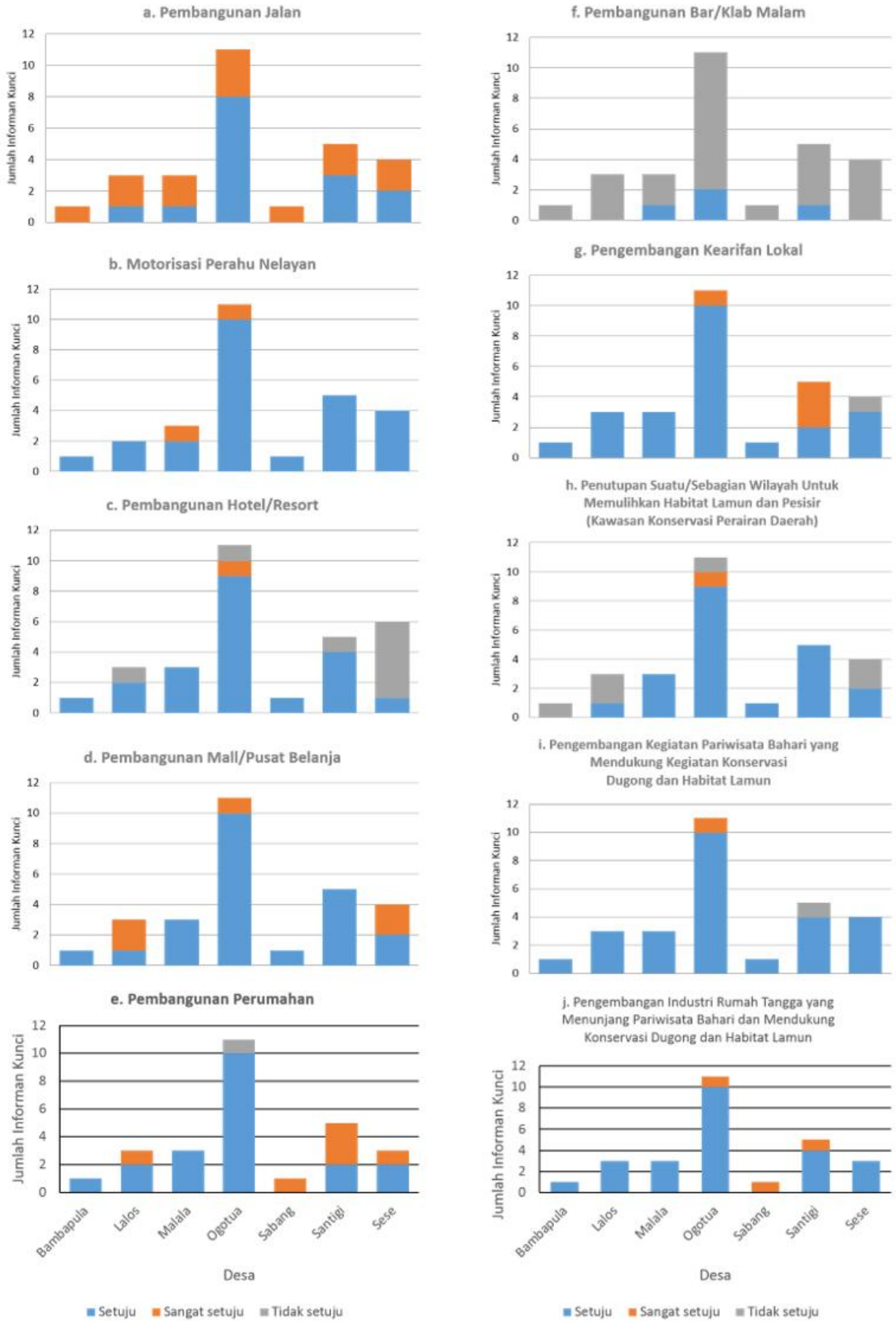

Figure 39. Public perception on Development Planning in their Territory

2.2. Focus Group Discussion andPublic Visit in Lingayan Island

Adapun hasil kesimpulan yang diperoleh dari FGD tersebut yaitu:

1. Public is lacking knowledge on dugong and seagrass habitat as dissemination of information and training has not been conducted adequately.
2. In regard to dugong, 75% of the society has seen, touched, and consumed dugong. This occurred before the probihition to use this species was ratified in 2012. Although some of the community has gained awareness on the protection of dugong, the threats may occur anytime.
3. The threats in Lingayan Island was mainly due to the need of living, as Dugong and seaturtle are the source of income for some people. The other possible threats in Lingayan Island are as follows:
   - Bycatch, due to entanglement to fishing nets or in tidal trap (*sero*)
   - Illegal dumping which accumulated in the ocean may affect the health status of seagrass meadows.

   For these reason, solution to tackle the limitation on protected species use has to be established.

4. Due to the myth in Lingayan Island, Dugong was haunted as the society believe that Dugong is the incarnation of pregnant woman whose tear can bring good luck and appeal (function as a love poison).
5. The communities expect development in fishing gears from related government agencies so that they can raise their income better than before.
6. There is handmade handicraft that has a potential to be developed, such as dried fish. However, training and development to improve the societies' skill on shipping the product in some pilot locations is necessary to be conducted to raise the skill and productivity of the community itself.

References

Marsh, H. 2002. Dugong: Status Report and Action Plans for Countries and Territories. UNEP/Earthprint.

Marsh, H. & 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. Diunduh pada 9 September 2016.

CONCLUSION

The whole key informants had seen dugongs and they can differenciate dugong from dolphins. Nowadays, dugong is no longer hunted, but the threat to the existence of dugongs is still exist in the form of bycatch (bycatch). If the dugong is still alive, then it will be reported and released together with the relevant officials. Of the seven villages of survey location; Ogotua, Sese, Bambapula, Malala, Lalos, Sabang, and Santigi, dugong is dsitributed in all villages. So far there is no particular use of dugong after prohibition established, but the key informants from Lingayan Island and Village Ogotua complained because government provides no solution of as an alternative. One of those is Mr. Rusmany, a former dugong specialist since the days of his grandfather and father. He hopes the government may help by providing fishing gear. Similarly, the presence of dugongs, seagrass are also scattered throughout the survey area. No particular use of a seagrass habitat, and there were not also a threat to the existence of seagrass.

So far in every village where a survey was conducted,there are community groups who participate in disseminating information that dugong is a protected animal and participated in the supervision of the crime that is done in the marine area. However, the group which consists of Group Supervisory Community (Pokmaswas) and Fishermen Group has not sufficiently equipped with the knowledge related to it.

The public perception of the expected development are more likely to tourism destination. They are aware that the natural resources are abundant and have not been exposed. For this reason it has been a challenge promote their area in order to appeal the visitors. The existence of dugong and seagrass cannot be separated from such a development. Conservation-based marine tourism needs to b, supported by local wisdom in the coastal areas of society Tolitoli. Another point is regarding handicrafts products that have not been marketed to the fullest.

MANAGEMENT ADVICES

- Need to develop interventions to reduce bycatch of dugong, either through modification of fishing gear (eg by mounting pinger that emit sounds that can repel dugong) and the timing and location of the installation of nets and “kelong” (a modified fishing gear installed in the ocean). If a location has been identified as an important dugong habitat, it is necessary to regulate the type of installation, location, and time for installation of fishing gear.
- Regulation on improvements related to the use of environmentally friendly fishing gear (friendly Dugong) such as fish traps and fishing rods are necessary. The use of environmentally friendly tool that can be increased by the mechanism of 'Eco-labeling'.
- Public awareness and development program, especially the groups that exist in the marine and coastal community related to conservationof dugong and seagrass needs to be conducted more.
- Partnership with other pary is needed to develop conservation based community which has been hoped by the community.
- Looking at the pattern of distribution, an establishement of tourism destination with Dugong as its icon regardless of its uncertain appearance. Example: Tourism village in Thailand called Tran has set Dugong as its icon.
- A better communitation anc coordication among central government, province, district, and village officials is needed to support DSCP Program.

Appendix 1. Interview, FGD, and visitation activities

Interviewing key informant in Ogotua

Interviewing the key informant in Bambapula

Interviewing key informant in Malala

Interviewing key informant in Santigi

Interviewing key informant in Sabang

Interviewing key informant in Lalos

Interviewing key informant in Sese

Visit to DKP District of Tolitoli

Focus group discussionin Lingayan Island, Ogotua

Focus group discussionin Lingayan Island, Ogotua

Visit to DANLANAL Tolitoli

Visit to DKP of Central Sulawesi Province

Appendix 2. Dugong Monitoring in Tolitoli

Date :20/09/2016

Location:Lingayan Island

No	Method	Time	WP	Speed	Finding	Environmental condition	Photo	Video
		(a-b)	(c-d)			#behavior, individual		
	Start	5:30						
1	Drone	6:00-6:20		6-8 (m/s)	2 rays, flying fish		+	+
2	Hydrophone	9:53-8:58	TL Barat	-	-	-	-	-
3	Visual	9:15	022	-	-	-	-	-
4	Mantataw	9:20-9:40	MT1-MT2	-	-	-	+	-
5	Mantataw	9:50-10:40	MT2-MT3	-	-	-	+	-
6	Hydrophone	5:04-5:14	TLBR	-	-	-	-	-
7	Drone	5:04-5:24	TLBR	6-8 (m/s)	Hawksbill turtle	Towards the island	+	+
8	Drone	5:31-5:55	TLBR	6-8 (m/s)	-	Towards lighthouse	+	+
9	Hydrophone	6:06-6:17	TLTG	-	-	-	-	-
	Finish	6:20						

Date :21/09/2016

Location: Lingayan Island

No	Method	Time (a-b)	WP (c-d)	Speed	Finding	Environmental condition #behavior, individual	Photo	Video
	Start	6:00						
1	Drone	6:10-6:30	DRMG	4-6 (m/s)	-	-	+	+
2	Mantataw + Visual Binocular	8:30-8:40	023-025	3 (km/h)	024 FT			
3	Mantataw + Visual Binocular	8:45-9:00	026-028	3	027 FT			
4	Visual Binocular	9:05-9:15	028-030	3				
5	Mantataw + Visual Binocular	9:20-9:30	031-033	3	032 FT			
6	Mantataw + Visual Binocular	9:35-9:50	033-036	4,4	034 FT, 035 FT			
7	Mantataw + Visual Binocular	10:05-10:20	037-038	3,8				
8	Mantataw + Visual Binocular	10:23-10:43	038-039	3,8				
9	Mantataw + Visual Binocular	10:44-10:55	039-040	3,8				
10	Hydrophone	17:22-17:25	041					
11	Hydrophone	17:37-17:43	041		5.20,9.40			
	Hydrophone	17:49-17-56	042					
	Hydrophone	18:00-18:27	043		2.20			

Date :22/09/2016

Location: Dusun Babanji, Bambapula Village, Sub district Dompal

No	Method	Time	WP	Speed	Finding	Environmental condition	Photo	Video
		(a-b)	(c-d)			#behavior, individual		
1	Drone	8:50-9:06	045	-	-	-	+	+
2	Hydrophone	9:36-9:56	045	-	2.52 , 3.19, 4.46, 5.10, 5.15, 5.45, 6.15, 6.22, 6.7, 08.07	-	-	-

Date :23/09/2016

Location: Dusun Jaleje, Sub district. Ogotua

No	Method	Time	WP	Speed	Finding	Environmental condition	Photo	Video
		(a-b)	(c-d)			#behavior, individual		
1	Drone	6:39-6:47						
2	Drone	7:24-7:41						
3	Hydrophone	6:29-7:50	046		5.49, 7.24, 16.07, 17.33, 19.54			
4	Visual Binocular	6:29-7:50						
5	Visual Binocular	7:50-7.59	047		Sea turtles			
6	Drone	7:05-8:20						
7	Hydrophone	7:03-8.23						
8	Visual Binocular	7:03-8.23	048		2 sea turtles			

9	Dive	8:52-9:40						
10	Hydrophone	8:55-9:40	049					
11	Visual Binocular	6:39-6:57			4 dugongs			
12	Drone	6:39-6:58				group, playing, grazing	+	+
13	Hydrophone	6:39-6:59	052					

Date :24/09/2016

Location: Dusun Jaleje, Sub district. Ogotua

No	Method	Time	WP	Speed	Finding	Environmenta condition	Photo	Video
		(a-b)	(c-d)			#behavior, individual		
1	Visual binocular	7:36-7:41			2 dolphins			
	drone							
	hydrophone		053					
2	drone	7:55-8:06						
	hydrophone	7:56-8:06						
	Visual binocular	7:56-8:06	054		Sea turtles			
3	Visual binocular	16:44-17:34	035(lamun)		dugong			