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Nutrition Value, Feed Efficiency and Species of Seagrass as a Feed of Wild Dugong (*Dugong dugon*) in Lingayan island, Tolitoli, Central Sulawesi

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Abstract

Dugong are endangered herbivorous marine mammals, which one of the causes of extinction is degradation of seagrass as main feed of the dugong to survive. Aim of this study was to measure the quality of seagrass of wild dugong in Lingayan island, Central Sulawesi. The results showed proximat analysis value of Halophyla sp, Halodule sp and Cymodocea sp as seagrass species respectively showed values crude protein of 6.86%, 7.69% and 8.79%, crude fiber of 10.77%, 18.36% and 24.26 %, crude fat of 0.99%, 1.81 and 1.5%, calcium of 0.79%, 2.12% and 1.89%, phosphorus of 0.34%, 0.34% and 0.26 and gross energy of 163.4 cal / kg, 300.5 cal / kg and 319.5 cal / kg. Cymodocea sp is the best feed for dugong because it contains high energy of 319.5 cal/kg and high protein 8.79%, if compared with Halophyla sp of 1622 cal/kg) and Halodule sp of 3014 cal/kg) furthermore Cymodocea sp has a fairly high crude fat content of 1.44% which will increase fat levels under the skin (subcutaneous) dugong as insulators of changing environmental conditions. Nutrient content contained in Cymodocea sp found in Lingayan Island is worthy of being the main feed for dugong.

Key words: *Dugong, nutrition value, proximat, Lingayan island, seagrass*

Introduction

Indonesia, well-known as one of the countries the greatest country which has a great biodiversity potential in the world. One type of marine mammal found in Indonesian island, namely dugongs or dugong (*Dugong dugon*), which almost found in all Indonesian island (Marsh *et al.* 1982). The spread of dugong populations in Indonesia includes northern Irian Jaya, North, South, and Central Sulawesi, Sumatra, East Timor, West Maluku, Southeast Java, the south coast of East Java and the southern coast of Kalimantan (Allen *et al.* 1976).

Dugong dugon is in the sirenia order and dugong genus, is a marine mammal classified into endangered animals by The World Conservation Union (Nishiwaki *et al.* 1979). In 1970 the dugong population in Indonesia reached 10,000, but in 1994 the population was only 1,000 (Marsh *et al.* 2003). Dugong has been classified as a 'Vulnerable' category according to IUCN

2006. This mammal has a very unique nature because it is classified as a beach grass (*seagrass*) eater. Dugongs usually live on the Indo-Pacific ocean coast. Dugongs are also commonly referred to as sea cows (Nair and Mohan 1977).

Dugong population has declined since dugong has a reproductive capacity of 5% per year (Iskandar et al. 2006). Dugong breeding is very slow and only gives birth to a child in each pregnancy so that the development of the population will be slow too. The number of dugong populations is increasingly diminishing due to hunting and habitat damage (Anderson 1981). Other contributing factors are human activity on the coast and infectious disease events (Campbell and Ladds 1979).

Dugong use seagrass as a main feed and doing habitat for foraging with the seagrass (Preen 1993). Decline of seagrass population will certainly affect the life and livelihood of dugongs, especially in the supply of feed. Dugong's main feed is seagrass which according to research results more than 90% of the stomach contents of the dugong consist of seagrasses. The rest are some types of algae (seaweed) (Marsh 1982).

Tolitoli Regency is one area that has seagrass habitat that is still healthy and abundant. The abundance of seagrasses in the area can be a very good habitat for the dugong's living location and also become a conservation area for the dugong in the future.

Dugong rescue efforts covering information on the health aspects of dugong have not been widely carried out because some researchers still focus on observing biological aspects, habitat evaluation, as well as searching methods for calculating populations in the high seas (Sheppard *et al.* 2007). This research will be conducted to identify the value of seagrass nutrition contained in Tolitoli Regency as a superior feed for dugong as indicators of health assessment of dugongs that live wild.

Materials and Methods

This study used 1 dugong which was found during the study time. Dugong is maintained for 14 days for the stabilization process and adaptation to the new environment with an average sea water temperature of 32 ± 0.83 ° C and an average temperature of 30 ± 0.15 ° C. Animals are kept in a conventional cage in a circle with a diameter of 10 m and a depth of 2-5 m which is designed by considering aspects of animal welfare. Dugong is given seagrass food that has been identified and then analyzed to see its nutritional value in the area around the study site

The sampling technique using wild dugong in Lingayan island. Seagrass was identified by the quadratic transect method using a 100 m transect rope. The rope is drawn perpendicular to the coastline and a square of 0.5x 0.5 m is placed on every 3 m of the transect. The distance between the substations in the study area is 50 m based on McKenzie and Yoshida (2009).

Dugong was restrained and left it to eat in the seagrass beds which were identified after the dugong feeding track was observed. Selection of feeding trail is done by selecting the longest trail. Seagrasses around the selected trail will be collected at 3 points randomly using 1x1 m2 transect and then weighed wet weight and averaged and calculated the area of seagrass, average observation station (RSP), consumption per 4.5 hours shows the speed of feeding which can describe the level eating preferences (palatability) (Roslinda and Afdal 2005).

Seagrasses with the highest level of palatability were analysis by proximate analysis to measure its nutritional value. Proximate analysis is a chemical test to find out nutrient content of a feed or feed raw material. Proximate analysis method first developed by Henneberg and Stohman

in 1860 on a research laboratory in Weende, Germany (Hartadi *et al.* 1997). McDonald *et al.* (1995) explained that the proximate analysis was divided into six nutrient fractions namely water content, ash, crude protein, crude fat, crude fiber and extract material without nitrogen (BETN).

Feed efficiency analysis used dugong's faecal samples and seagrass species which were used as feed sources for dugong. After 24 hours of feeding, feces are taken at the bottom of the cage and put into a plastic sample, labeled and then weighed in the wet weight. Specifically, we can see the type of seagrass consumed by dugong from the condition of feces. The collected faeces are then taken and examined for the remainder of seagrass (roots, stems, and remaining leaves) that are not completely digested in the dugong digestive tract. The collection of seagrass samples given as dugong feed and collecting dugong feces was carried out for 3 days of observation. Stool samples in each observation day were taken 20-30 g, then homogenized. The collection of seagrass samples given as dugong feed and the collection of dugong feces was analyzed the levels of proximate (water, ash, fat, protein and crude fiber), minerals (calcium and phosphorus), and gross energy (Giri 2013).

The data obtained in the species of seagrass and proximate analysis data of feed efficiency will be presented in table and then analyzed descriptively by displaying the species of seagrass and proximate analysis data and value of feed efficiency of wild dugong.

Results and Discussions

Identification of Seagrass

The results showed in Table 1 that there were 9 types of seagrass in the research location. In Table 1 it can be seen that the highest level of palatability is the type of seagrass *Cymodocea sp* with palatability value reached (++++), followed by *Halodule sp* with palatability reached (+++) and *Halophila sp* with (++), whereas *Enhalus acroides* and *Thalasia hemprichii* types are two types of seagrass that are not consumed at all by dugongs indicated by the absence of traces of feeding tracks that appear. Therefore, dugongs as herbivorous animals will depend on the distribution of seagrasses. Seagrass beds are the main food source habitat for dugongs in search of primary feed in the form of seagrasses (Marsh *et al.* 1977; Lanyon *et al.* 2002; Preen 1993). Damage to seagrass habitats will have an impact on the life cycle of the dugong in terms of providing food sources.

Table 1. Identification of seagrass species and level of palatability

NO	Seagrass Species	Species Percentage	Palatability Level
1	*Enhalus acroides*	100	-
2	*Thalasia hemprichii*	100	-
3	*Syringodium isoetifolium*	100	-
4	*Cymodocea rotundata*	80	++++
5	*Cymodocea serrulata*	20	
6	*Halophila ovalis*	70	++
7	*Halophila minor*	30	
8	*Halodule uninervis*	70	+++
9	*Halodule Pinnifolia*	30	

Description : (-) indicated no trace of feeding track ; (+) showed ± 1m² feeding track area; (++) showed ± 2m² feeding track area; (+++) showed ± 3m² feeding track area; (++++) showed ± 4m² feeding track area

Analysis of feed at the location of study showed that dugong select their feed based on the level of palatability to certain seagrass species. Dugong's feeding behavior is to do grazing or feeding by pulling out the seagrass up to the roots, so that the dugong feeding's track will be clearly

visible. Dugong trail feeding length varies depending on the age of the dugong and seagrass type density. Dugong's that consume seagrasses with short morphological structures such as *Halodule* and *Halophila*, will see their feeding grooves with a width of 19-26 cm and a length of 8 m (Anderson and Birtles 1978). The dugong were observed which can spend as much as 12199.2 g of wet seagrass every day (Wake 1975). Giri (2013) stated that the dugong had greedy eating habits, where adults could consume 25-30 kg of wet seagrass every day.

Seagrass Nutrition Value

Nutritional analysis of three seagrass species showed that *Cymodocea sp* had a higher protein and gross energy content than *Halophila sp* and *Halodule sp* (Table 2). *Cymodocea sp* is a good feed for dugong because dugong consume seagrass that contains high energy and nitrogen (De Longh *et al*. 2007). *Cymodocea sp* also had crude fat (1.44%) and BETN (34.84%) higher descriptively than *Halophila sp* (0.98% and 22.90%). The fat of dugong, especially under the skin (*subcutaneous*) functions as an insulator of heat and cold (Linder 1992), while BETN is a source of carbohydrates (Marlina and Askar 2004; Anggorodi 1979).

Tabel 2. Seagrass nutrition value

Composition (%)	Seagrass Species		
	Halophila sp	Halodule sp	Cymodocea sp
Dry Weight	19.95 ± 0.11	25.11 ± 0.14	28.05 ± 0.27
Crude protein	6.86 ± 0.1	7.695 ± 0.21	8.79 ± 0
Crude fat	0.995 ± 0.02	1.81 ± 0.28	1.5 ± 0.08
Crude fiber	10.77 ± 0.45	18.365 ± 1.05	24.26 ± 1.41
BETN	22.705 ± 0.8	43.835 ± 0.12	35.98 ± 1.61
Ash	57.475 ± 0.9	29.37 ± 0.1	29.97 ± 0.44
Calsium	0.795 ± 0.05	2.12 ± 0.14	1.895 ± 0.12
Phosphorus	0.34 ± 0	0.345 ± 0.02	0.260 ± 0
Gros energy (kal/kg)	163.4 ± 1.7	300.05 ± 1.91	319.5 ± 3.54

The digestive process in dugong's intestine, a high fiber concentration can help in holding the filtration rate of water as long as food passes in the intestinal tract, so the dugong will release feces with greater and softer consistency (Murray *et al*. 2003). When viewed from the phosphorus content of *Halodule sp* has a higher content of 0.76% than *Cymodocea sp* and *Halophila sp* (0.26% and 0.33%). Phosphorus serves as a source of high-energy phosphate (especially ATP) which is needed to energize all bodily functions (Murray *et al*. 2003). Therefore, *Halodule sp* can be a supplement for dugong feed in meeting mineral needs. This is in line with research conducted by (Sheppard *et al*. 2010) which states that dugong consumes seagrass that contains high energy and nitrogen.

Feed Efficiency

The feed efficiency analysis of dugong feed are shown in Table 3, where dugong has a very good metabolism for the efficiency of *Cymodocea sp*. This is indicated by the percentage of feed efficiency more than 90%. Research conducted on dugong using seagrass type *Syringodium isoetifolium* at Seaworld Indonesia (SWI) also showed the results of feed efficiency greater than 90% (Giri 2013). These results explain that the digestibility of dugong feed in SWI would be better if given food found in its natural habitat. Mammalian bodies, including dugongs, need adequate amounts of nutrients to provide free energy (Goto *et al*, 2003).

In general, the results of research conducted at Sea World Indonesia (SWI) show different values compared to the results of the research conducted. This value difference may occur, because of

the different types of seagrass consumed and the effect of seagrass habitat itself. Seagrass in this study had a percentage of crude fiber digestibility of 12.01%, crude protein of 61.03%, ash of 51.09%, BETN of 57.03%. and crude fat of 95.08%, it shows that seagrass species Cymodecea sp is very well used as the main feed of dugong in the waters of Lingayan Island, Tolitoli Regency.

Tabel 3. Feed efficiency of *Cymodocea sp* in wild dugong

Analysis Type (%)	Efficiency (%)
Dry ingredients	43.06
Ash	51.09
Crude protein	61.03
Crude fiber	12.01
Crude fat	95.08
BETN	57.03
Calsium	99.19
Phosporus	97.04

Seagrass *Zostera marina* in Toba Aquarium captive research in Japan has a crude protein content (in dry weight) of 16.3% (Goto *et al.* 2008), while seagrass *Cymodecea sp* in this study has a crude protein content (in dry weight) of 19.07%, It showed that the seagrass of *Cymodecea sp* was very good to be used as a dugong feed in the waters of Lingayan Island, Tolitoli Regency.

Conclusion

Seagrass species found in Lingayan Island, Tolitoli, Central Sulawesi are *Enhalus acoroides*, *Thalasia hemprichii, Cymodocea rotundata, Cymodocea serrulata, Halophila ovalis*, *Halophila minor*, *Halodule uninervis*, *Halodule pinnifolia*, and *Syringodium isoetifolium*. The results of seagrass nutrition value analysis showed that *Cymodocea sp* had the best nutritional and palatability values. The levels of nutrients in *Cymodocea sp* which found in Lingayan island deserve highest nutritious feed of dugong.

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