Seagrass, dugong, and people: Lessons learned from community-based conservation in Tolitoli Regency, Sulawesi Tengah, Indonesia

C Amany1, M M Kamal1, F Kurniawan1,2 and V Sabila1

1Department of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, IPB University (Bogor Agricultural University), Jl. Agatis Darmaga Bogor, Bogor 16680, Indonesia
2Center for Coastal and Marine Resources Studies, IPB University (Bogor Agricultural University), Jl. Raya Pajajaran Kampus IPB Baranangsiang, Bogor 16127, Indonesia

*Corresponding author: cheptiaamany22@gmail.com

Abstract. Dugong (Dugong dugon) is a protected mammal in Indonesia. Hunting for dugongs is still very high, so that the status of this animal is threatened, one of which is in Tolitoli Regency, Central Sulawesi. Hence, conservation efforts need to be carried out, both species and habitat area. Based on observation and interviews, dugong conservation in Tolitoli Regency was community-based habitat management. Kelompok Masyarakat Pengawas or Monitoring Community Group (Pokmaswas) was a form of community-based management in charge of maintaining, protecting, and preserving the existence of dugong and seagrass protection. From a community perspective, significant indicators in the management of dugong habitats were community awareness, seagrass percentage, and management quality. There was 11 kind of seagrass species have been identified in Tolitoli Regency. Seagrass conditions in all three villages were characterized by less than 60% of seagrass cover, especially seagrass that was close to the shoreline. The appearance of dugongs is based not only on good seagrass conditions but also on sea conditions and ship traffic.

Keywords: dugong; indicators; management; seagrass

1. Introduction

Dugong (Dugong dugon Muller, 1776) is one of 35 species of marine mammals belonging to the order Sirenia. These organisms can be found in Indonesian territorial waters, although dugongs are found with relatively low frequencies, the spread of dugongs is widespread in Indo-Pacific waters in tropical and subtropical waters. The spread of dugongs in Indonesia is one of them is in Tolitoli Regency, Central Sulawesi. Whitten et al. [1] mentioned that naturally, most of the coasts of Sulawesi Island and the surrounding islands, including Central Sulawesi, are surrounded by productive tropical aquatic ecosystems, including seagrass fields where dugong populations are widespread and relatively abundant. The existence of dugongs is inseparable from seagrass fields as a place to forage. The status of dugong scarcity makes the government issue a government regulation for the protection of dugongs and seagrasses, its PP No. 7 of 1999 and makes dugongs and seagrasses as a priority for conservation of fish resources of the Ministry of Marine Affairs and Fisheries in 2014-2019.

Reproductive biology, hunting by humans, and threatened habitat conditions are some of the factors that cause the scarcity of dugongs in Indonesia [2]. Dugongs have a very complex life threat. One of the causes of the decline in the dugong population is slow reproduction, the time it takes to become an adult is about 10 years and it takes 14 months to give birth to one new individual at intervals of 2.5-5 years. Other threats, pollution of coastal and coastal areas originating from land and sea, damage and reduced seagrass fields, destructive fishing, accidental dugong catching (by catch), dugong hunted by local communities and hit by ship [3].
2. Method
Data retrieval was conducted from December 24, 2019 until January 24, 2020. The research locations were located in three villages, namely Malala Village, Ogotua Village and Santigi Village, Tolitoli Regency, Central Sulawesi. Data collection has done by observation and interview. The total of respondents were 60 people. The selection of respondents in this study used purposive sampling. Purposive sampling is a sampling technique with special consideration so that data from the results of a study become more represented [4].

Data analysis has been used the descriptive statistical method and ISM (Interpretive Structural Modeling) method. Descriptive statistical methods aimed to provide an overview of the results of community perspective data so that there could be seen a correlation between respondents’ answers and respondent characteristics. While the ISM method as a tool to analyzed and assessed the extent of management in a marine conservation area to achieve the purpose by identifying several problems and making a model for some decisions. The location of research shows in figure 1.

3. Results and discussion
3.1 Overview of research location
Tolitoli regency has 43 small islands in coastal areas of which 13 are inhabited and 30 islands are uninhabited and have 10 sub-districts with nine of them are sub-districts that have coastal areas. The location of Tolitoli Regency which is dominated by coastal areas makes this region has a variety of resources that have the potential to be developed. Potential resources include coral reefs, seagrass, mangroves, estuaries and have rare biota protected such as green turtles, kima and dugongs.

Based on the observations, seagrass species in the three villages were Halophila major, Halodule pinifolia, Thalassia hemprichii, Enhalus acoroides, Cymodocea rotundata, Syringodium isoetifolium, Halophila ovalis, Enhalus acoroides, Cymodocea rotundata, Halophila major and Thalassia hemprichii. This type of substrate was dominated by sand and mud substrates. Seagrass conditions in all three villages were characterized by seagrass cover that was less than 60% especially seagrass that was close to the shoreline. This was due to the amount of garbage and seagrass eroded due to fishing boat.
Seagrass fields in each observation site had mixed vegetation character and in general seagrasses found at all observation sites were *Enhalus acoroides*, *Cymodocea rotundata*, *Syringodium isoetifolium*, *Halophila ovalis*, *Halodule pinifolia*, *Thalassia hemprichii* and the new species *Halophila major*. Seagrasses at each location in Malala Village was dominated by seagrass species *E. acoroides* and *T. hemprichii*. Although the type of *E. acoroides* dominates in Malala Village, but dugongs did not tend to make seagrass this type as its main food because seagrass type *E. acoroides* have tannin content which has a bitter taste [3].

Seagrass distribution in Santigi Village was dominated by small seagrass species, among them *T. hemprichii* and *C. rotundata*. High dominance by seagrass type *T. hemprichii* because seagrass is the most widespread and dominant seagrass species in Indonesia, has a high tolerance and can be found in muddy sand substrates, sandy and coral [5]. The types of seagrass that dominate ogotua village were *T. hemprichii*, *C. rotundata* and *Halophila sp*. Small seagrass species were still found in this station, although there were sources of nutrient input from the ground. The condition of the mud and rough sand substrate remains a good habitat for these seagrasses.

3.2. Management of dugong habitat and seagrass conditions in Tolitoli Regency

The management of seagrass and dugong conservation in Tolitoli is community-based conservation. This means that in the management of seagrass and dugong the community is involved and given knowledge on how to prevent and overcome seagrass damage resulting in the reduction of dugongs. People in Tolitoli Regency are also given the knowledge to manage fishery products to support the economy in coastal areas. This form of community-based management is characterized by the presence of a supervisory community group (POKMASWAS) to protect dugong from the hunter and seagrass damage.

Based on the observations, the management of dugong habitat in Malala Village, Santigi Village and Ogotua Village is considered quite good. This is based on the public's awareness to maintain dugong habitat and not hunt dugongs. However, there are no legitimate village regulations to regulate dugongs and seagrass. Monitoring conducted by POKMASWAS is also voluntary because there is no budget to conduct regular monitoring. This indicates that the public has begun to realize and understand to maintain the sustainability of dugongs and seagrass.

Dugong is the only herbivor mammal to live in the sea and makes seagrass its main food [6]. The appearance of dugongs is not only based on good seagrass conditions, but the condition of the sea is polluted or not and ship traffic is also a factor in the appearance of dugongs. Based on field observations and interviews, the appearance of dugongs often occurs in Ogotua Village precisely in Tanjung Dusun Jalele. This is because the percentage of seagrass cover is better than the other two villages and the relatively low level of ship traffic. The coastal area of Tolitoli has large river estuaries and small tributaries and the water conditions are sloping so that the characteristics of seagrass distribution will differ in each region [7]. Interview session with people shows in figure 2.

According to respondents, the problems that often encountered were the destruction of seagrass as a place of dugong habitat, weak supervision in terms of dugong protection and habitat, dugongs trapped in sero and fishing trawls, lack of socialization related to dugongs and consequences when catching or killing them, cases of dugong deaths due to fish species that can tear the skin of dugongs even though this is not yet certainly valid or not and ineffective zoning that can protect seagrasses and dugongs from human activities such as fishing boat traffic or fishing in destructive ways that can damage seagrass.

3.3. Indicators of dugong habitat management

Important aspects in the management of dugong habitats were the ecological aspects consisting of the number of dugongs, the number of fish, the uniqueness of the ecosystem, the quality of the environment and the percentage of seagrass. The social aspect consists of public awareness, community knowledge, community participation and community attitudes. The governance aspect consists of the quality of management, regulation, and threat level.
In the ecological aspect, seagrass percentage was the most important indicator and had a high influence on dugong life. Seagrass ecosystems were very vulnerable to human activities either directly or indirectly [8]. The percentage of seagrass would be high if the quality of the environment is maintained so that it will increase seagrass productivity and have an impact on increasing the number of dugongs and fish numbers and increasing the value of unique ecosystems.

The priority indicator on the social aspect was the awareness of the community. This indicator was also a key variable on the social aspect. Public knowledge was the most affected indicator, the higher the public knowledge would have an impact on community attitudes, there must be community participation so that the integration between community knowledge, community participation and community attitudes will support high or better public awareness. Malala Village, Santigi Village and Ogotua Village already have a supervisory community group (Pokmaswas) in charge of supervising and educating other communities so that dugongs and seagrasses can continue to be preserved.

In the governance aspect, the management quality indicator becomes the most influential criterion and as a key variable in the governance aspect. The most affected indicator was the threat level, when the threat level was low it indicates good regulation, when existing regulations can suppress the threat level then the quality of management will be good. Strict regulations and clear consequences can suppress the decline of dugong populations as well as seagrass damage.

4. Conclusion
Dugong habitat management strategy in tolitoli community-based district is the proper management. Very influential indicators in the management of dugong habitats from a community perspective are community awareness, seagrass percentage, and quality of management. Seagrass conditions Tolitoli Regency was less than 60% of seagrass cover. Seagrass identified in Tolitoli Regency as many as 11 species.
References

[1] Whitten T, Henderson G S and Mustafa M 2002 The Ecology of Sulawesi (Singapore: Periplus Editions)

[2] Citra S U D, Beginer S, Donny A and Sukandar 2018 Distribusi habitat pakan dugong dan ancamannya di pulau-pulau kecil Indonesia JFMR-Journal of Fisheries and Marine Research 2 128-136.

[3] Helene M, Helen P, Carole E and Joanna H 2002 Dugong Status Report and Action Plan for Countries and Territories (UNEP: Early warning and assessment report)

[4] Sugiyono 2016 Metode Penelitian Kuantitatif, Kualitatif dan R&D (Bandung: PT Alfabet)

[5] Nontji A, Kuriandewa T E and Harryadie E 2012 National Review of Dugong and Seagrass: Indonesia (GEF/UNEP: Project on the Dugong and Seagrass Conservation)

[6] B Louise C, Steven D, Nicholas J G, Dave K H, Ivan R L, Helene M and Anthony R P 2004 Diving behaviour of dugongs (Dugong Dugon) Journal of Experimental Marine Biology and Ecology 304 203-240.

[7] Yuliani P H 2016 Keberadaan dugong dan lamun di Perairan Tolitoli, Sulawesi Tengah (Jakarta: Bunga Rampai Konservasi Indonesia)

[8] Neliyana 2016 Pelestarian populasi dugong dan habitat lamun berdasarkan kelembagaan hukum adat panglima Laut Aceh (Jakarta: Bunga Rampai Konservasi Indonesia)