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15

Perspectives on seagrass ecosystem services from a coastal community

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Abstract. Seagrasses are marine flowering plants, which form extensive meadows mostly in shallow water marine environments. They provide a wide range of ecosystem services, which can be grouped into four broad categories: provisioning (e.g. food production); regulating (e.g. controlling climate and disease); supporting (e.g. nutrient cycles and oxygenation); and cultural (e.g. spiritual and recreational benefits). These services directly or indirectly benefit humans. Seagrass have contributed to the fulfilment of human needs for a very long time, before the term “ecosystem services” was coined. However, there is a lack of knowledge regarding public awareness on seagrasses and the benefits they provide. In this study, we conducted a workshop in Selayar Archipelago, South Sulawesi, Indonesia, an area with extensive seagrass meadows. The workshop focussed on seagrass meadows in the context of coastal community livelihood-related activities. The 50 workshop participants came from a variety of backgrounds, mostly related to the marine and fisheries sector (e.g. fishermen, vocational high school students, conservation agency staff, district government fisheries officers, and fisheries extension staff). The workshop revealed that many marine and fisheries stakeholders have a high level of awareness regarding seagrasses and the basic ecosystem services they provide. Some key points were identified from the workshop: 1) seagrasses were recognised as a resource; 2) the most and least frequently mentioned ecosystem service types mentioned were “provisioning” and “cultural”, respectively; 3) threats to seagrass meadows were identified and practical recommendations to minimize the threats were formulated.

20

1. Introduction

Ecosystem services (ES) are essential goods and services provided by an ecosystem that support the health, livelihoods, well-being, and survival of humans {Formatting Citation}. The term ES was initially used in 1997 to represent the benefits human population derive, directly or indirectly, from ecosystem functions [2].

Seagrass meadows are one of the most productive marine ecosystems on earth, providing valuable ecosystem services such as feeding and nursery grounds for many ecologically and economically



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important species, contributing significantly to shoreline protection from erosion, trapping sediment and maintaining water quality in near shore ecosystems, and mitigating climate change impacts [3–6]. Seagrasses are a group of angiosperms that have adapted to living fully submerged in the marine environment. They are true plants (i.e. plants with true stems, leaves, and roots) recognized for their ability to help stabilize coastlines and to provide food and shelter for marine organisms. There are about 72 species of seagrass worldwide [7]. Of the 15 seagrass species recorded in Indonesian waters, 11 seagrasses have been found around Sulawesi: *Enhalus acoroides*, *Thalassia hemprichii*, *Thalassodendron ciliatum*, *Halophila ovalis*, *H. spinulosa*, *H. sulawesii*, *Halodule uninervis*, *H. pinifolia*, *Cymodocea rotundata*, *C. serrulata*, and *Syringodium isoetifolium*. Most seagrass species occupy shallow water coastal habitats; however, *H. sulawesii*, discovered at 10 – 30 m depth around reefs in the Spermonde Archipelago, South Sulawesi [8], is considered a deep water seagrass. Indonesian seagrass meadows are mostly multispecific (with more than one species of seagrass growing together), with few monospecific meadows [9].

In the Indo-Pacific region, around 407 species of fish have been recorded as utilizing seagrass meadows for food or refuge; more specifically, around Sulawesi at least 210 species of fish are found in seagrass meadows [10,11]. Of particular concern to Sulawesi, and other areas in Indonesia and beyond, is the fact that a number of valuable fisheries commodities (penaeid prawns, blue swimming crab, sea cucumber *Holothuria scabra*, siganids, the seahorse *Hippocampus barbouri* and *H. kuda*) are dependent on seagrass meadows for food and protection during at least one stage of their life cycle [9,11,12]. Tanakeke Islands and the Selayar Archipelago in South Sulawesi have long been known for their seahorse and siganid fisheries, both of which rely on and take place in seagrass meadows. The Pangkajene Islands, Spermonde Archipelago, South Sulawesi were a popular fishing ground for holothurians and prawns in the 1990's, and blue swimming crabs are still an important fisheries commodity from this region. In addition to their economic importance, seagrass ecosystems around the Sulawesi coast and small islands provide critical habitat for the endangered charismatic marine mammal *Dugong dugon* [13].

A range of ecosystem services naturally provided by seagrass beds has directly or indirectly benefited human needs and contributed to human livelihoods from prehistoric times to the present day. However, very few studies have been done on seagrass ecosystem services globally [14], and there is a lack of studies conducted on ecosystem services in Indonesia [15]. Moreover, a recent study found that gaps in community understanding of the seagrass ecosystem services concept due to the lack of knowledge on seagrasses in general and the benefits they provide in particular [16]. Therefore, we conducted this study with the objective of gaining information on the ways in which one particular coastal community perceives seagrass meadows and views the seagrass ecosystem services concept.

2. Methods

2.1. Study Site

The study was conducted in Selayar Archipelago, South Sulawesi Indonesia on the 9th August 2018. Selayar is a very popular place in Indonesia for its beautiful marine scenery (in Takabonerate Marine National Park) and a wide variety of fisheries activities generally taken place in seagrass beds such as gleaning fisheries, seaweed cultivation, fences fisheries, etc. Most of the population also lives close to the shore. Therefore, they have a high dependency to the sea and the seagrass ecosystems for their livelihoods.

2.2. Data Collection Methods (Workshop)

We conducted a workshop attended by 50 participants with relatively similar background from marine and fisheries fields (i.e. fishermen, fisheries high school student, staff from conservation agency, staff from ministry of marine and fisheries, staff from marine and fisheries extension program). Ahead of the workshop, we did a presentation to introduce the concept of seagrass and ecosystem service (ES). After the presentation, participants were mixed and divided into four groups, then each group

answered questions provided related to seagrass awareness, seagrass ecosystem service, seagrass threats, as follow: 1) Have you seen seagrass?; 2) Do you know the importance of seagrass? If yes, write down five reasons why seagrass is important; 3) List five fishes or marine organisms that utilize seagrasses; 4) Are the seagrass beds important for your life as a human? If yes, please write down your reasons in more detail; 5) Is the seagrass bed in your area in a threatened condition? If yes, please write down the kind of threats; 6) Do we need to protect the seagrass? If yes, how could we contribute to the action?; 7) Is there any conservation program that protects seagrass in Selayar? If yes, please write down the name of the program and how it works.

The participants worked in their group to discuss the questions together and found collective answers for each question that they agreed to. They wrote down all the answers on a flip chart. After 1 hour of individual group discussions, another 1 hour plenary session was held, where each group presented their main outcomes.

2.3. Data Analysis

All the data from the workshop were compiled, categorized, and input to excel spread sheets to analyse seagrass awareness and perception on seagrass importance. For analysing seagrass ecosystem service (SES) perception, we compiled the data according to the ecosystem services category, namely provisioning, regulating, supporting, and cultural services. The percentage of each ecosystem service category was calculated in order to evaluate the proportion of each seagrass ecosystem service category that had been discussed and presented by the participants.

3. Results and discussion

3.1. Seagrass Awareness

The results showed that the awareness of seagrass in general and of their importance was high in the community, most of whom were from a marine and fisheries-related background. All participants had seen seagrass and could describe well what seagrasses looks like. They mentioned that seagrass is important for marine organisms as nursery habitat and as a hiding place from predators. They also mentioned that seagrasses provide food for human consumption and also pharmaceutical material to make drugs. Moreover, they noted that seagrasses could prevent beach abrasion and are good for water purification (Figure 1).

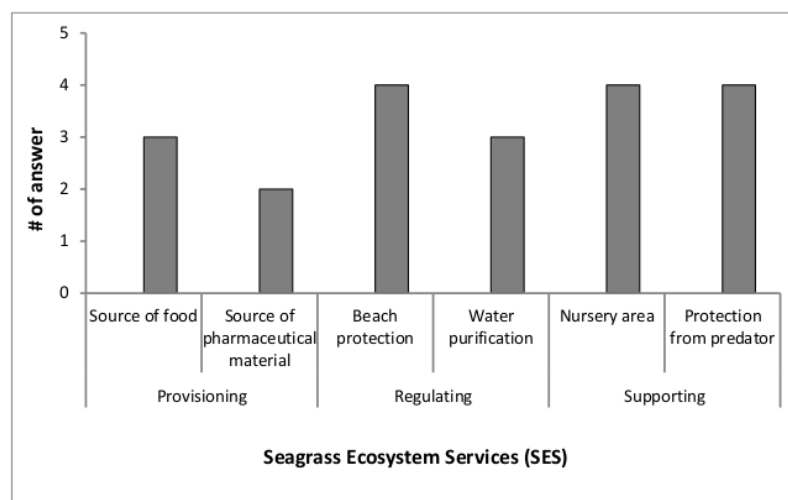


Figure 1. Seagrass Ecosystem Services (SES) listed by the workshop participants.

3.2. Seagrass Ecosystem Function and Seagrass Ecosystem Services (SES)

When we translated the ecosystem function data to the context of seagrass ecosystem services (SES), it was observed that the terms SES and its category is not yet well understood by all participants. This phenomenon is not surprising because as we said before that the study on seagrass ecosystem services is lacking in Indonesia [15]. We grouped the information on seagrass ecosystem function collected from the workshop into the context of seagrass ecosystem services, as follow: 1). Seagrass is important for marine organisms for nursery habitat and as a hiding place from predators (i.e. supporting services); 2). Seagrass provide food for human consumption and also pharmaceutical material to make drugs (i.e. provisioning services); 3). Seagrass is preventing beach from abrasion and the seagrass is also good for water purification (i.e. regulating services). However, no one mentioned that seagrass is also important for cultural services (Figure 2). Furthermore, the participants were able to identify threats to seagrass beds in the area including boat anchoring, gleaning activities, seagrass trampling, fish fences, and marine debris (Figure 2). These kind of threats have also been identified in some studies as factors causing seagrass decline [17–22].

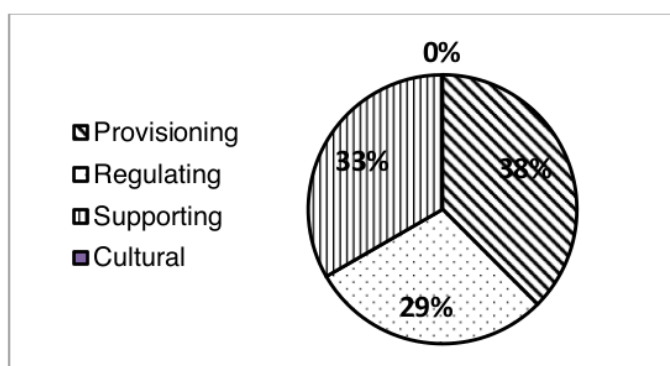


Figure 2. Repartition of the seagrass ecosystem services (SES) known to the workshop respondents into the four basic ES categories

4. Conclusion

This study shows that seagrasses are known and recognised as valuable resources for coastal community members with marine and fisheries backgrounds. The respondents were well aware of the importance of seagrass and able to identify threats to seagrasses. However, these community members were not well informed regarding the concept and terms of seagrass ecosystem services, although, in fact, they know the seagrass function in some detail.

5. Acknowledgement

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