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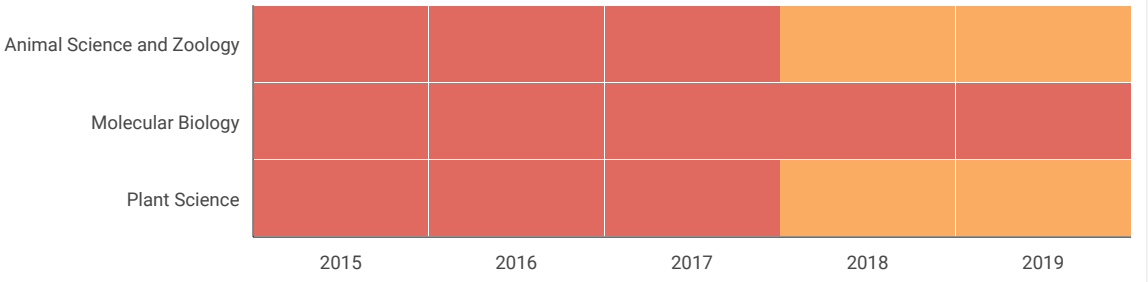

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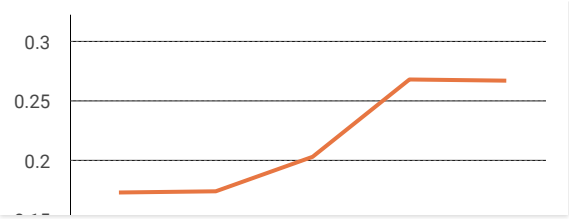

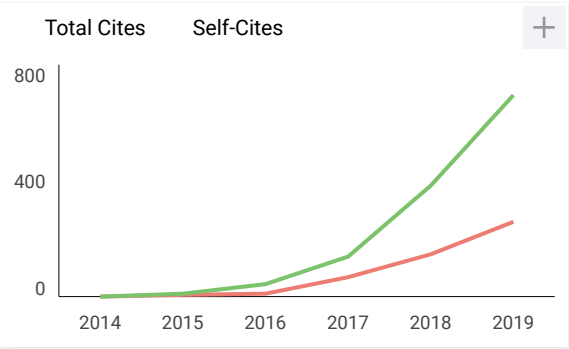

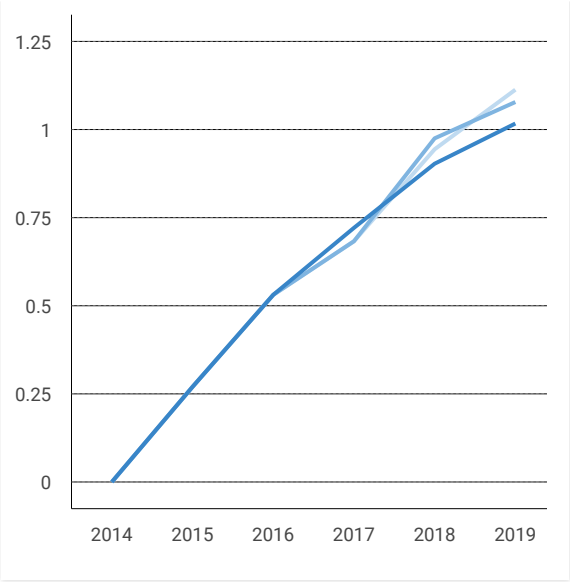

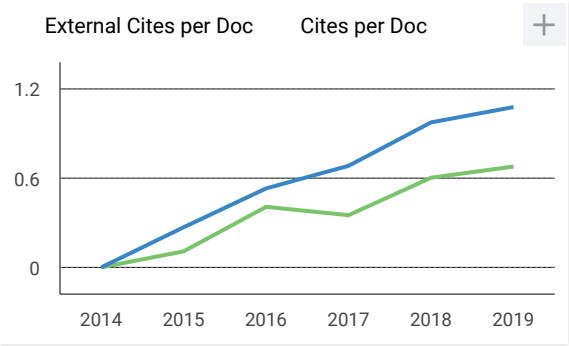

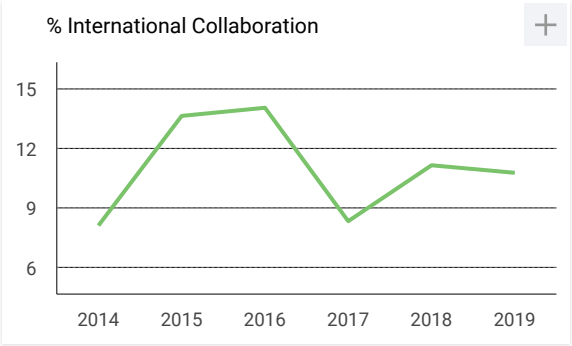

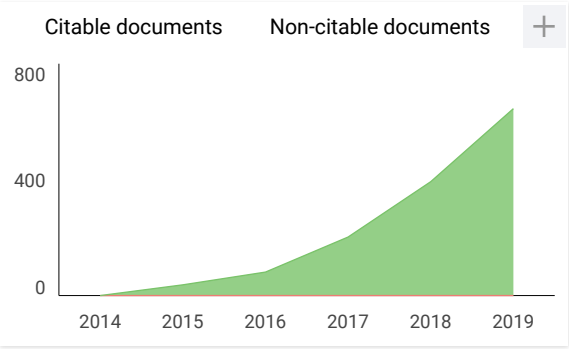

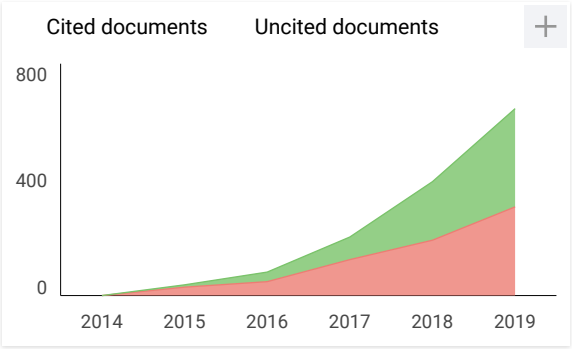

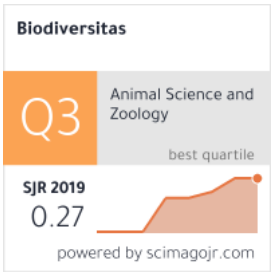

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Management of coastal biodiversity based on social-cultural values in constructing conservation character education

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Abstract. *Katili AS, Utina R, Tamu Y, Nusantari E. 2018. Management of coastal biodiversity based on social-cultural values in constructing conservation character education. Biodiversitas 19: 1763-1768.* Coastal biodiversity is quite high including coral reef, mangrove, seagrass, and fishery resources. Management of coastal biodiversity can be conducted interdisciplinary covering various aspects. Four main aspects can be integrated, i.e., physical-biodiversity, social-cultural, character education, and conservation. This present study aimed to describe: coastal biodiversity in Gorontalo Province, Indonesia community's social-cultural value and local wisdom embodying conservation character of the coastal ecosystem, and character education of coastal ecosystem biodiversity in primary school by learning with a prototype of conservation character-based materials. Specifically, the present study aimed to construct the conservation character education based on social-cultural values. Data were analyzed with descriptive qualitative method by comparing and referring to findings from the previous studies. The procedure used in this research was *four*-D, i.e., (i) Define stage; by doing the identification and exploration of the coastal biodiversity potential. The methods used in this stage was exploration survey method. Focused group discussions were conducted with coastal communities to identify social-cultural values and local wisdom and to analyze the core and basic competence of learners by examining the tools of the lesson and determining the competence. (ii) Design stage; by designing a prototype of learning material to construct the conservation character for learners. (iii) Development stage; by validating the prototype of learning material for constructing the conservation character for the learner. (iv) Dissemination stage, by doing seminars and information dissemination on a prototype of learning material to construct the conservation character. The results showed that in Gorontalo, there were three components of the coastal ecosystem which included mangrove, seagrass, and coral reef. The communities in the coastal area of Gorontalo were prominent in their strengthened social-cultural roots taking the form of ecological awareness. The community in coastal area possessed local knowledge of the natural resources, e.g., plants and animals, and local attribution of such resources in the local language. The conservation character-education based on social-cultural values, specifically local wisdom, is the most appropriate education model to encourage the pattern of biodiversity coastal ecosystem management. Conservation character education was highly relevant to life-enhancing skills, based on the empowerment of skills and coastal biodiversity potential in each region.

Keywords: Biodiversity, coastal ecosystem, social-cultural, conservation character

INTRODUCTION

The increasing demands of the community for goods to fulfill their needs put pressure on the ecosystem of coastal and marine areas in Indonesia. The most significant threat comes from the land conversion of mangrove area into fishponds and coastal reclamation to fulfill the demands of settlement infrastructure, by which the projects profoundly damage the ecosystems of seagrass and mangrove. Coral reefs were destroyed when fish and cyanide bombs were used for catching reef fish. Such damages have further destructed the ecological function of coastal areas that support the life of the locals. Deforestation has always been associated with poverty, especially in the villages located around the forest (Golar et al. 2017).

Damage to the ecosystem and coastal environment depicts the carelessness of human being to the order of ecological system in the environment. Human beings position themselves at the outside of the order of nature and not as a part of the ecosystem and the environment, thus, they claim to be able to exploit the environment to fulfill their needs without realizing that their characteristics and behavior are gradually damaging the nature. By that, it is essential to construct conducive character-building based on social-cultural values to the community starting from the primary education phase, for it is an investment for the future generation. Learning materials discussing ecosystem in Natural Sciences subject in primary school is considered crucial not only to build the students' comprehension of the concept of the ecosystem but also to shape the student's character-building and behavior towards the ecosystem and its environment. An ecosystem is an ecological order consisted of living things and non-living elements within a system that influence each other. One of the teaching methods about ecological system is to involve students directly in discovering the components of ecosystem within their school environments, like inquiry learning process (Glynn et al. 2004). By this method, it is expected that the students will have a more comprehensive understanding and responsibility of their behavior towards the environment. The notion is in line with Piaget who argues that the cognitive development of primary school students experiences operational

and concrete phase, in other words, the logical processing depends on what they see and experience (Utina et al. 2017).

The ecological system in the coastal area is an excellent learning apparatus for primary schools in the coastal area. The schools can benefit from coastal biodiversity, such as mangrove, seagrass, and coral reef. By optimization of the ecosystem and its constituent components into learning material, it is expected that students will not only be able to understand and consider the ecosystems as part of themselves, but also to build intimacy between themselves and biophysical components in the coastal environment. The intimacy developed between the community and nature can lead to the development of social, cultural, aesthetic, and religious values within themselves; this environment awareness is actualized in behavior and local wisdom of the coastal community (Nusantari et al. 2017).

Hence, it is essential to implement social-cultural values in coastal ecosystem education to communities in the coastal area; this is to develop the understanding of the ecosystem and its components and the students' character and awareness towards coastal ecosystem. Moreover, it is significant to put into consideration the contextual of education, in which the learning process of coastal ecosystem needs to relate to the local coastal area (Zeidler 2005; Nuangchalerm 2010). On the other hand, Subiantoro (2011) indicated that in the local coastal area have some values including values of social, cultural, and aesthetics that are developing within the community in the form of local wisdom. The formulation of coastal biodiversity education also needs to involve learning source and media (Navarro et al. 2012).

This present study aimed to describe coastal ecosystem in Gorontalo Province, to describe the community's social-cultural values and local wisdom embodying conservation character of the coastal ecosystem and also to describe character education of biodiversity of coastal ecosystem in primary school by learning with the prototype of learning material to construct the conservation character. With this learning method, the students will have a firm understanding of the concept of ecosystem science and have a character caring for the coastal environment.

MATERIALS AND METHODS

Study area

This study was the coastal area of Northern Gorontalo District, Pohuwato District, and Boalemo District of Gorontalo Province, Indonesia (Figure 1). The potency of the coastal region of Gorontalo is depicted in the map of coastal area and distribution of primary schools in Northern Gorontalo, Pohuwato, and Boalemo. The period of this study was conducted within six months, i.e., from February to July 2018.

Procedures

The study is classified as development research. Development research is a form of research-oriented towards product development. There were four stages carried out in this study called the four-D, namely; definition, design, development, and dissemination (Thiagarajan et al. 1974). The four-D procedures in this study included (i) Define stage; by doing the identification and exploration of the coastal biodiversity potential. The methods used in this stage was exploration survey method. Besides, focus group discussions were carried out involving coastal communities to identify social-cultural values and local wisdom. The social-cultural values and local wisdom will become the basis for constructing conservation characters. Other research activities included analysis of the core and basic competence of learners by examining the tools of the lesson and determining the competence. The competence in question is the ability to generate conservation characters. (ii) Design stage; by designing a prototype of learning material to construct the conservation character for learners. The content of the material and the questions were related to the coastal biodiversity and social-cultural potentials in the research sites. (iii) Development stage; by validating the prototype of learning material to construct the conservation character. This stage involved two validations by experts, i.e., validation of subject material and validation of education and learning. (iv) Dissemination stage, by doing seminars and information dissemination on the prototype of learning material to construct the conservation character (Mappalotteng et al. 2015).

Data analysis

The data were analyzed descriptively employing a qualitative method. The analysis was performed by comparing and referring to findings from three previous studies, i.e., (i) Study about utilization of mangrove ecosystem as media and learning resources biology science in primary school. This is a development of learning material and media of Biology subject in primary schools, particularly in the competence of coastal ecosystem. This study applies the learning of mangrove ecosystems in primary schools with a contextual approach. Mangrove area is used as a material and learning media (Katili et al. 2015); (ii) Study about the management of coastal ecosystem and preservation of local wisdom values of Bajo tribe through the development of environmentally-aware groups. This is an analysis and description about scientific meaning of various local wisdom and ecological intelligence of community in the coastal area (Utina 2017); (iii) Research about education strategy of natural resources conservation in the coastal area of Tomini Bay in Gorontalo. The research explored the varieties of games that contain values of environment preservation within children in the coastal area (Utina 2016).

RESULTS AND DISCUSSION

Description of coastal ecosystem in Gorontalo Province

Among the varieties of the local potential of Gorontalo is mangrove forest. Within the province, there are several regions with vast mangrove forest area, i.e., Pohuwato, Boalemo, and Northern Gorontalo districts. A report of the region's living environment status by the Office of Environmental Issues in 2012 indicated that relatively well-preserved mangrove forest area was found only in Northern Gorontalo District (Balihristi 2012).

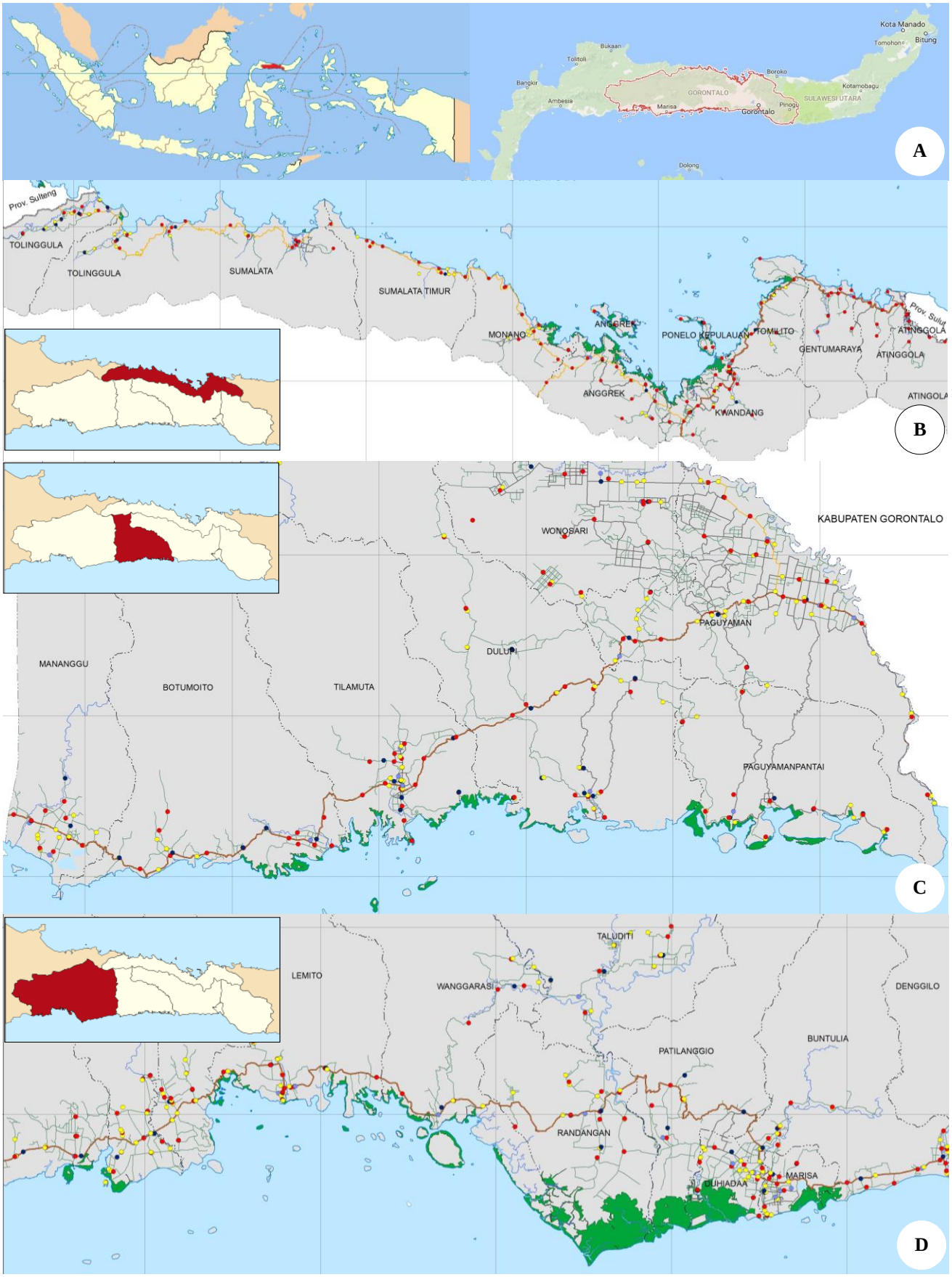

Figure 1. Study area: the map of the coastal area in (A) Indonesia and Gorontalo Province, (B) Northern Gorontalo District, (C) Boalemo District, (D) Pohuwato District. The red areas indicate the region of each district within the province, the green areas show the coastal area of each district, and the red dots indicate the school distribution of each district

Among the diverse natural resource potencies of the coastal environment in Gorontalo are mangrove, seagrass, and coral reef; which are the main components of the coastal ecosystem. On top of that, the communities in the coastal area of Gorontalo are prominent in their strengthened social-cultural roots taking the form of ecological awareness. A study in Bajo tribes in Torosiaje revealed that there was a significant correlation between the availability of natural resources in the coastal environment and the communities' ecological awareness (Utina 2017). The research discovered that the natural resources and ecosystems of mangrove, seagrass, and coral reef nearby Bajo community in Torosiaje Village, Gorontalo Province were well-preserved. The ecological awareness of the Bajo community is in contrast with the condition of the ecosystem within other regions; the community has been building emotional intimacy and awareness of the nature that supports their living, which results in the wise management of natural resources. Local wisdom such as traditions, norms, and prohibition cascaded from generations to generations within the community has developed into the community's legacy of norms.

As extracted from an interview conducted with the school teachers, the research highlighted that the primary schools did not perform an optimal implementation of the potential values of coastal ecosystem as learning material and media in the classroom. On top of that, the learning activity still involved conventional style, not maximizing the potentials of coastal biodiversity as a study object.

Description of the community's social-cultural values and local wisdom embodying conservation character of the coastal ecosystem

The research conducted exploration of potential values of the coastal ecosystem and Focused Group Discussion discussing values of social-cultural and local wisdom, in which the activities provided a significant elaboration of the background of the research problems. This is to say that the potential values of coastal ecosystem conceal diverse possibilities for human beings to harness, e.g., as primary sources of the coastal community's living, as a balance of ecological system within coastal area, and as sources of education innovation.

The community in coastal area possesses local knowledge of the natural resources, e.g., plants and animals, and local attribution of such resources in the local language. The Bajo tribe in Pohuwato District calls different types of mangroves in their local language, i.e., *apapi* (*Avicennia*), *bangkao* (*Rhizophora*), *munto* (*Bruguiera*). This signifies that the community has developed intimacy and awareness of nature, particularly mangrove environment; by which they perform conservation of mangrove area. Another proof is that within the Bajo tribe, it is prohibited to consume sea turtles due to the belief that the sea turtles are their savior during incidents in the ocean. The prohibition reflects that the community possesses high sensitivity of nature conservation. These conservation values need to be implemented in learning activities in schools, for the students to develop intimacy and awareness towards the nature in daily life.

Moreover, the community in the coastal area of Dulupi, Boalemo District possesses hereditary knowledge of fishing seasons, i.e., *tahulo, ewela, munggiyango,* and *pahi*. *Tahulo* season begins when smaller fish like *duwo* (smaller anchovies that only appear during the end of the month) and anchovy appear. *Ewela* season starts when medium-sized fish begin to appear. *Munggiyango* in local terms is a kind of shark and predator fish, while *pahi* is a term for fish who has venomous poison at the tip of its tail. The seasons of fish appearance depicts the food chain in the marine ecosystem. Smaller fish like *duwo* and anchovy are the prey of medium-sized fish (the second level predators in the food chain), while bigger predators like the shark are on top of the food chain; this clarifies that shark and other predators only appear after medium-sized fish. Such local knowledge of the community in Dulupi illustrates that the hereditary knowledge and awareness of marine conservation is recommended to be applied in learning activities in schools.

Description of conservation character education of biodiversity of coastal ecosystem in primary school

It is believed that by developing a lesson plan that involves coastal ecosystem as the material learning, one can provide an alternative to preserve the ecosystem. This is to embed sensitivity and awareness to the students of changing phenomena in the coastal area. At further phase, development of local content-based learning materials encourages the students to perform preservation and maintenance of the coastal ecosystem. It is crucial to implement such innovation to shape the students' critical thinking, considering that an environmentally-aware community is significant to the ecosystem. There are four core elements of education, formal or informal, i.e., learn to know, learn to do, learn to understand one self's identity, and learn to live together and get along with the community based on principles of equality and tolerance.

The optimization of potential values of coastal ecosystem as learning materials in primary school is categorized as an effort to build the students' critical thinking and character of awareness of nature conservation and an effort of instilling integrative values of ethics and norms of interaction between human and nature within the students. Character education is expected to be actualized in the students' behavior towards the environment and performing conservation of natural resources. Learning source from nature, e.g., coastal biodiversity, can be implemented as an alternative to support learning activities since it provides direct interaction between the students and nature as the learning object. Further, the interaction is capable of fostering the students' knowledge in identifying, analyzing, and formulating conclusions of the learning object; this is to encourage the students to perform scientific research from their early ages. The previous notion elaborated that the students are expected to be able to express opinions based on truth and to formulate solutions based on observed problems or phenomena; in

another word, the students can perform scientific approach in learning activities.

Learning activities that implement the scientific approach, that is a process of learning designed to actively foster the students' construction of concepts and principles of the learning materials by certain scientific processes towards a phenomenon or an event (Utina 2016). The approach is included in the core elements of learning strategies in the 2013 curriculum employed to enhance the students' competence. The Regulation of the Ministry of Education number 65 in 2013 about standards of the learning process in primary and secondary education highlights the significance of the application of scientific approach principles in learning activities. Moreover, the learning activities are recommended to involve not only books as the primary learning source but also environment exploration as the learning source. By implementation of the coastal ecosystem as a learning source, this research expected that the students are capable of conducting scientific observations and explorations to enrich their knowledge by experiencing direct involvement with nature. Direct instruction could result in direct knowledge and skill acquisition, also known as the instructional effect (Ruutmann et al. 2011). As a branch within Natural Sciences subject that studies about interactions between living beings and the environment, studying Biology does not always engage traditional learning by reading and memorizing only; it also does not only involve one-way communication between teachers and students. Learning activities of Biology subject should also include direct interaction between the students and the learning objects, such as the coastal ecosystem.

Discussion

Two marine waters surround Gorontalo Province with a notable potential of natural resources and biodiversity, i.e., Tomini Bay in the south and Sulawesi Sea in the north. The marine waters are included in mega-marine biodiversity and the center of the world's marine biodiversity also known as the Earth's Coral Triangle. Gorontalo Province consists of five districts and one capital city, i.e., Boalemo District, Bone Bolango District, Gorontalo District, Pohuwato District, Northern Gorontalo District, and Gorontalo City as its capital. Based on the report of regional environment status Gorontalo Province in 2012 (Balihristi 2012), Pohuwato District is included in the province's protected forest area, which also includes mangrove forest and marine aquaculture. The activities of aquaculture ponds tended to result negatively to the coastal ecosystem; the converted mangrove forests were highly unproductive to provide sustainable support for the community's living in the coastal area in this district.

Further, this research finding depicted that the damage to the coastal ecosystem is the after-effect of inefficient management of coastal and marine ecosystem. The inefficient decision could result from the lag of policy, in which the existence of a coastal ecosystem is only considered as a minor variable compared to the exploitation engaged in squeezing economic benefits from the ecosystem. As the key stakeholder that plays a vital role in policy formulation and implementation, the local government faces various problems, e.g., the ineffective coordination between offices related to coastal biodiversity conservation, thus producing policy that lacks synergy. The government lacks institutions that specify its focus on coastal biodiversity management and conservation, which leads to not optimal management of coastal ecosystem employed by the government and the community.

Moreover, another factor that contributed to the damage of coastal biodiversity is lag of community, as a result of the community's poor competence in addressing environmental problems and poor capabilities and capacity to put pressure on the sides responsible for environment preservation. The local community's participation in design and implementation of coastal biodiversity management policies is less optimal; thus they cannot be accounted responsible for their economic orientation of the ecosystem's exploitation without being aware of its sustainability. The management of coastal biodiversity preservation should emphasize the balance between aspects of biophysical, socioeconomic, cultural, and administration to engage in optimal management. The balance is only possible if the government implements regulatory devices of coastal biodiversity management as a part of governance formulated integrative between the government, the community, and related sectors.

The result of this study can give an employs comprehensive approach from the three previous aspects to produce formal regulations that lighten the ecological burden of coastal ecosystem in Gorontalo Province. Development of governance model of coastal biodiversity management based on the local wisdom of the coastal community is crucial in implementing comprehensive and optimal resource management of coastal biodiversity; this is to formulate regulations of coastal biodiversity in Gorontalo. The diversity of ethnic within a region provides multicultural local wisdom to the community, as is the case in Pohuwato featured with various inter-ethnic interactions. The local wisdom progresses through time and is passed on generations thus it roots within the community's way of life. By reconstructing cultural values and local wisdom and implementing in daily life, the community is able to preserve their culture from the interference of massive modernization (Utina et al. 2017).

Thus, the efforts undertaken by the coastal community in Pohuwato District is to re-actualize the culture, since the community has the potency and wealth of local wisdom; the wisdom is adopted and maintained within the value systems. The local wisdom is essential to be developed in school to foster the value of the character conservation, especially since early childhood, to encourage children to love the nature. This is parallel with Katili et al. (2017) that the strategy applied would be able to overcome the social-economics problems of society as well as planning the development of regional spatial. One of the things that can be done for example is maintaining the natural conditions of mangroves in the coastal area and making its ecosystem as a buffer zone, while still involving the people around the areas. Other ways are introducing the use of learning material activities in schools around the coastal area; and

also hatcheries management while considering the suitability of environmental factors such as the type of substrate and salinity.

The synergy of perception between government and society in conducting conservation character education will encourage the learners to take care of their local wisdom and continue the legacy of the community's way of life. For instance, the learners are introduced and promoted to take care of the environment. Consequently, the learners will develop the sense of belonging and care towards the nature based on local wisdom within the community. Hence, the implementation of local wisdom in character education in school is actualized by providing contents that emphasize mutual interaction between human and nature. Furthermore, Katili et al. (2015) said that educational approach by coastal biodiversity as learning media and resources in learning and incorporating learning material of coastal biodiversity in the national curriculum of primary education and the society management activities through reforestation, training, and extension, and non-formal education, can make the conservation character sustainable.

The government's capability of managing local development to address the environmental problems contributed significantly to the acceleration of regional development and the trickle down effect for the community's state of welfare. The study considers that by implementing local wisdom in character education from the students' early ages, it provides the correct solution to the environmental problems. Moreover, this research argues that character education employed within primary schools will result in future generations of Indonesia that embody Conservation character. The utilization of coastal biodiversity based on social-cultural values in the learning activities at the most basic level of education will result in a comprehensive scientific understanding and conservation character. This is due to the model of conservation character education that involves the learners to study and provide the solution for the surrounding environment, in this case, the coastal area. By implementing coastal ecosystem learning in primary schools with a social-cultural and local wisdom approach, it is hoped that the character of conservation and environmental friendly will be formed in the students. This is a character capital that contributes to the management of coastal biodiversity.

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