

The community perception of Batu Karas mangrove forest preservation in Pangandaran Regency, West Java, Indonesia

¹Dian Yuni Pratiwi, ¹Atikah Nurhayati, ¹Pringgo Kusuma Dwi Noor Yadi Putra

¹ Fisheries Departement, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Sumedang Regency, West Java, Indonesia. Corresponding author: D. Y. Pratiwi, dian.yuni.pratiwi@unpad.ac.id

Abstract. The objective of this research is to analyze the community perception towards Batu Karas Mangrove Forest preservation in Pangandaran Regency, West Java, Indonesia. The analysis was carried out using a questionnaire-multilevel scale based on the Likert scale. The questions were divided into 5 parts, namely: mangrove ecological functions, mangrove economic benefit, the cause of damage to the mangrove ecosystem, community participation, and government regulation. The results revealed that the average public perception towards the ecological functions of mangroves was very good, with a value of 4.32. The public perception about the economic benefits of mangroves was good, with a value of 4.05. The public perception towards the cause of damage to the mangrove ecosystem was good, with a value of 3.72. The public participation was also good, with a value of 3.94. Finally, the public perception towards government regulation was moderate, with a value of 3.18. Based on the results, the highest value was the perception towards ecological functions and the lowest was the perception towards government regulation. It means that the knowledge of the community about mangrove ecological functions was good, but they still need socialization about the government regulation.

Key Words: cause of damage, community participation, government regulation, ecological function, economic benefits.

Introduction. Indonesia has 19% of the world's mangrove area. This puts Indonesia into a country with the largest mangrove area in the world (FAO 2020). The mangrove ecosystem with the various natural resources contained has a high economic value and it can improve the livelihood for the community, especially for the coastal communities (Setiawan et al 2017). Parts of the mangrove plant can be used as various products that can be marketed to the public (Sabana 2014; Theodora et al 2016; Virrayani et al 2013).

Rhizophora apiculata can be used as a fuel (charcoal). *Xylocarpus*, *Heritiera*, *Rhizophora*, and *Bruguiera wood* can be used as a building material. The young leaves of *Nypa fruticans* are used as a tobacco wrapper to make local cigarettes (Ong & Gong 2013). The fruit of *Rhizophora* sp. can also be made into coffee (Nurjanah et al 2020). *Sonneratia* spp. can be processed into lunkhead (Wijayanti et al 2018). Mangrove plants can also be used for medicines, paper raw materials, dyes, and various handcrafts (Nurjanah et al 2020). In the mangrove ecosystem there are various types of fishery commodities such as mangrove crabs (*Scylla* spp.), white shrimp (*Penaeus merguensis*), black tiger shrimp (*Penaeus monodon*), and pomfret (*Pampus chinensis*), white snapper (*Lates calcarifer*) and *Mugil* spp. which can be caught and become a source of income for the community (Ong & Gong 2013).

Mangroves have a function as a deterrent to coastal erosion and reduce sea waves. This can protect the area behind the mangrove from the waves of sea water. Various types of animals such as shrimp, fish, molluscs use mangroves as a place to find food, spawn, and breed. Mangroves are also a resting place for migrating birds (Setiawan 2013).

However, mangrove forests in the world including Indonesia have been damaged. Damage to mangrove areas in the world reached 1.04 million ha between 1990-2020. Meanwhile, the average annual loss in Indonesia was 21.100 ha in the last 10 years (FAO 2020). The causes of mangrove ecosystem damage include conversion of mangrove forests to settlements (Susilawati et al 2018), logging, utilization of mangrove leaves, disposal of organic and inorganic waste and natural factors (Muali 2020).

To prevent damage to the mangrove ecosystem, it's necessary to carry out various conservation efforts. One of the areas that need to be preserved is the mangrove forest in Batu Karas, Cijulang, Pangandaran which was inaugurated by the Department of Marine, Fisheries and Food Security (DKPKP) in 2015 (Kurniawan et al 2017). This mangrove forest is one of the areas that attract tourists from various regions to visit Pangandaran in West Java, Indonesia (Nugroho 2019).

The conservation of the mangrove ecosystem is the responsibility of various parties such as the government, private sector, and the community. If the community understands this responsibility and understands the function of mangroves, it will facilitate efforts to conserve mangroves. According to the literature (Sari et al 2018) positive perceptions from the community were an important factor in efforts to conserve mangrove areas. Knowledge of community perceptions can be used as a basis for designing strategies and management for mangrove area conservation. Therefore, this study aims to determine people's perceptions of the mangrove ecosystem as an effort to conserve mangrove forests in Batu Karas, Pangandaran, West Java, Indonesia.

Material and Method

Time and location. This research took place from February 2021 to March 2021. The research location is around Batu Karas Mangrove Forest, Batu Karas Village, Cijulang District, Pangandaran Regency, West Java, Indonesia (Figure 1). The Batu Karas Mangrove Forest can be also called as Batu Karas Mangrove Restoration and Learning Center. The area of the Batu Karas Mangrove Restoration and Learning Center is estimated to have around 20 hectares (Putri et al 2020).

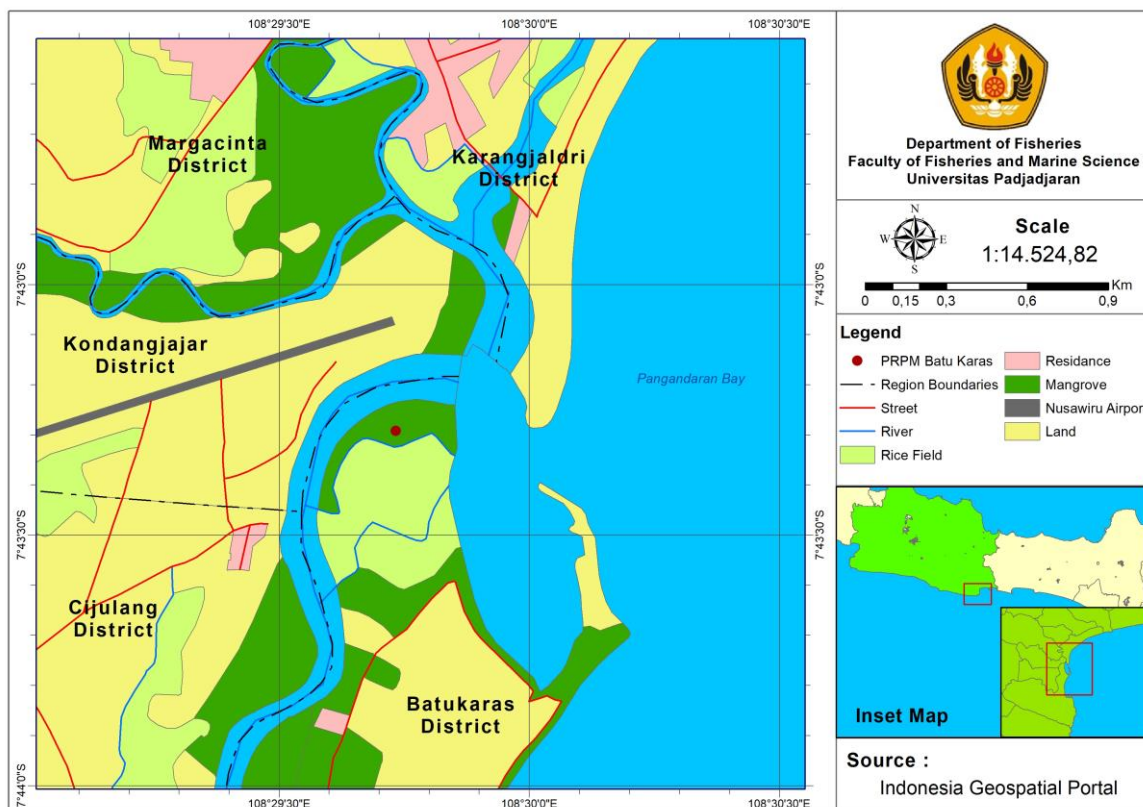


Figure 1. Research location.

Data collection. Primary data collection techniques used in this study were interviews and questionnaires. Secondary data was obtained from institutions, government agencies and literature studies. Questionnaires were distributed to 50 respondents. This number of respondents was taken according to the view of Roscoe (1975) who stated that the basis for determining a decent sample size is between 30 to 500 samples.

Analysis. The results of the questionnaire were analyzed using a Likert scale (Febrianty 2021). Each indicator on the Likert scale consists of five alternative answers as shown in the Table 1.

Table 1

Respondents answer score based on a Likert scale

<i>Respondent answer</i>	<i>Scores</i>
Totally disagree	1
Disagree	2
Quite agree	3
Agree	4
Strongly Agree	5

The preparation of statements on the questionnaire was made based on research from Gumilar (2012) and Sulaiman et al (2019). The questionnaire design was classified into five dimensions as shown in Table 2.

Table 2

Questionnaire of community perceptions

<i>Mangrove ecology function</i>	
<i>No</i>	<i>Statement</i>
1	Respondent already know about the mangrove ecosystem.
2	Mangrove ecosystems play an important role to resisting abrasion, flooding, tsunamis and maintaining the stability of biological resources in coastal areas.
3	The mangrove ecosystem is a place for fish, crabs, and shrimp to find food.
4	The mangrove ecosystem is a place of breeding for birds and fish.
5	Mangrove ecosystems can be used for waste management.
<i>Mangrove economic benefits</i>	
6	Mangrove can provide families with food, medicine, furniture, shipbuilding, and other materials.
7	The mangrove ecosystem can provide food needs for families such as fish, crab, and shrimp.
8	The Batu Karas mangrove forest ecotourism area can be used as a source of income for the local community.
9	The fruit of the mangrove plant has been processed into various foods and beverages.
10	The Batu Karas mangrove forest ecotourism area can increase the number of tourists visiting Pangandaran.
<i>The cause of damage to the mangrove ecosystem</i>	
11	The condition of Batu Karas mangrove forest has been damaged.
12	The damage of Batu Karas mangrove forests was caused by natural factors such as erosion.
13	The damage of Batu Karas mangrove forests was caused by human activity.
14	The damage of Batu Karas mangrove forests was caused by abrasion and economic interests.
15	The damage of mangrove forests was caused by poor law enforcement.

Community participation to mangrove preservation

- 16 Maintaining the conservation of mangrove forests, especially Batu Karas mangrove forests, is a shared responsibility.
 - 17 Respondent have been looking for information about mangroves and their conservation efforts.
 - 18 Respondent participated to provide information about mangroves and their conservation efforts to the community.
 - 19 Respondents are willing to donate for ecotourism conservation activities of Batu Karas mangrove forest.
 - 20 Respondents are willing to attend activities of mangrove conservation.
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Government regulation toward the mangrove forest

- 21 Enforcement of environmental laws for Batu Karas ecotourism is considered sufficient.
 - 22 The government has carried out the task of managing the environment of the Batu Karas mangrove forest properly.
 - 23 The government often conducts regular outreach to the community about the importance of mangroves.
 - 24 The government often provides information about the impact of damage to mangrove ecosystems.
 - 25 The government often gives appeals for the community to participate in preserving mangrove forests, especially Batu Karas mangrove forests.
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The average scoring on the Likert scale for each statement on the five dimensions is then calculated and compared with the perception assessment criteria based on Cahyadinata et al (2019) research, as shown in Table 3 below.

Table 3

Perception assessment criteria

<i>Response score interval</i>	<i>Category of community perception</i>
4.21-5.00	Very Good
3.41-4.20	Good
2.61-3.40	Moderate
1.81-2.60	Bad
1.00-1.80	Very Bad

Results and Discussion

Respondent characteristics. Data was obtained from 50 respondents around Batu Karas Mangrove Forest, Batu Karas Village, Cijulang District, Pangandaran Regency, West Java, Indonesia. Characteristic data observed in this study include age, length of stay and level of education. The reason for collecting the data is because people's perceptions can be influenced by age (Mutanga et al 2015), education level (Setiawan et al 2017), and length of stay (Utami et al 2018).

In this research, questionnaires were distributed to respondents aged 20-60 years. The results show that 90% of respondents aged 20-25 years, 4% 41-45 years old and 6% 51-55 years old (Figure 2). This shows that most respondents are in the productive age range so that their energy and thinking patterns are still very much needed in efforts to conserve mangrove forests. Figure 3 shows the level of education of the respondents, which varies from junior high school to bachelor level. It is recorded that 44% have bachelor education, 18% diploma education, 34% senior high school education, and only 4% have junior high school education. Based on Figure 4, respondents in this research generally have lived in Pangandaran for more than 20 years (58%).

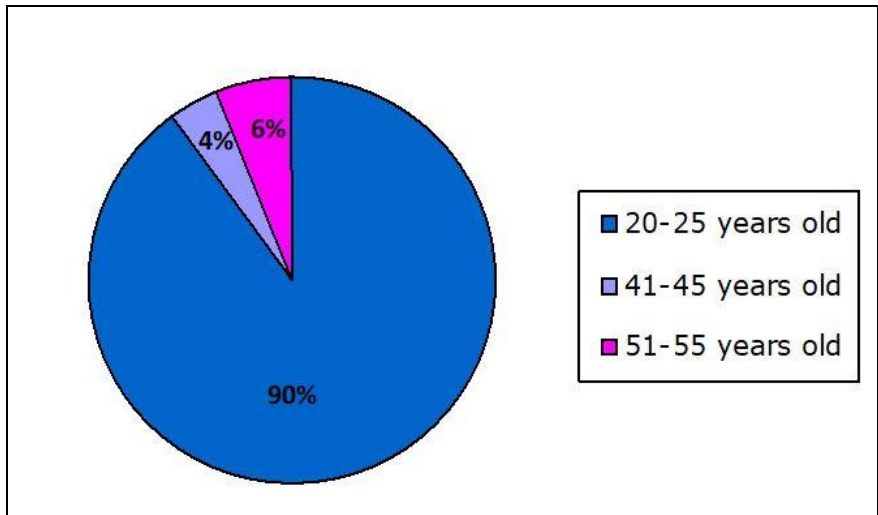


Figure 2. The age of respondents.

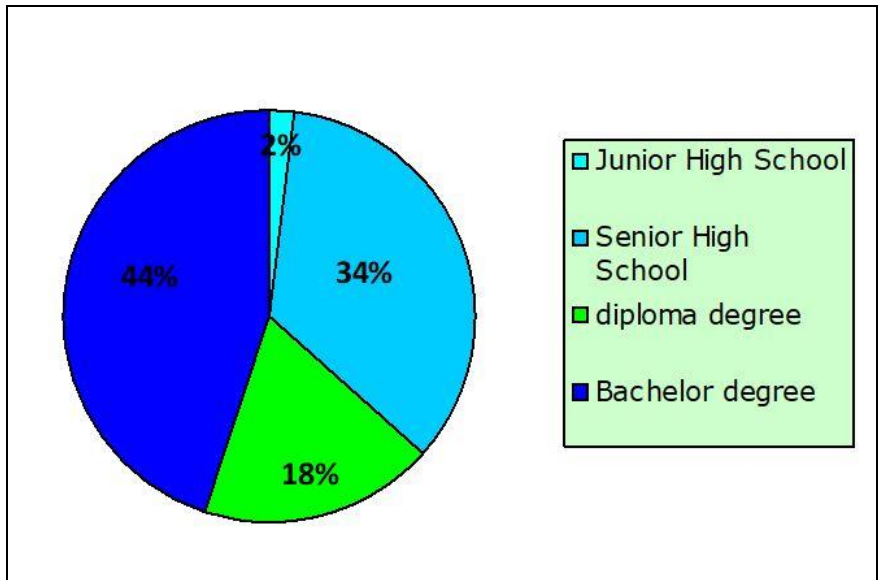


Figure 3. The educational level of respondents.

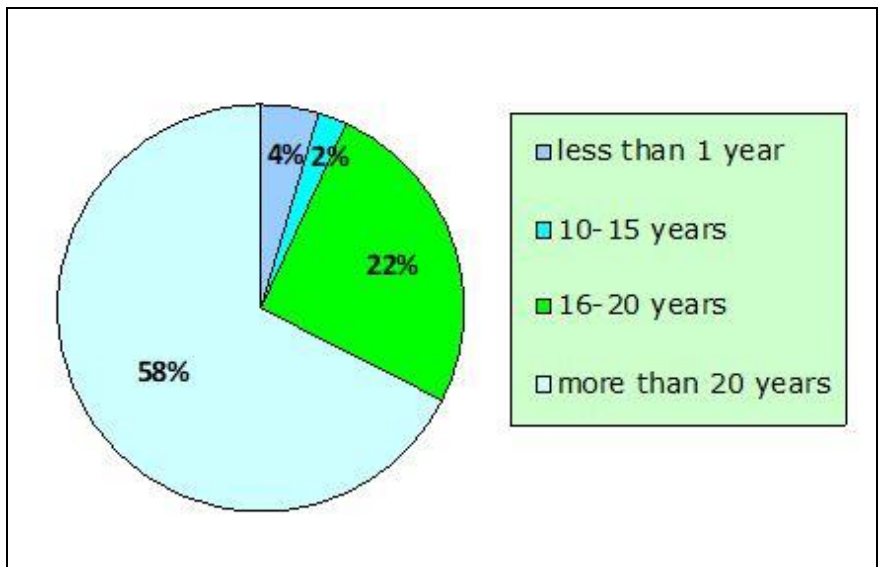


Figure 4. Duration of stay in Pangandaran.

Community perception on mangrove ecology function. Table 4 shows the results of community perceptions of the ecological function of mangroves. Perception is a person's view or assessment of a certain object, which is produced by the ability to organize the sense of observation (Sari et al 2018). The overall average score for the dimensions of community perceptions of the ecological function of mangroves was 4.32 and it was categorized as very good. This means that the community already knows the ecological function of mangroves very well, such as holding back abrasion, flooding, and a place to find food and breeding grounds for some organisms. In addition, the average yield value for community perceptions of the role of mangroves in waste management is 3.66 with a good category. This shows that there are still people who do not know the importance of mangroves in waste management.

The high score of community perceptions of the ecological function of mangroves is due to the general educational characteristics of respondents who have attended higher education at 44%, the length of stay for more than 20 years is 58%, and the age of respondent is at the age of 20-25 by 90%. With these characteristics, the community has obtained sufficient knowledge about mangroves from the education process, life experience, and information from the surrounding environment. This is in accordance with the statement of Utami et al (2018) which states that the level of education will affect the amount of information obtained by the community. The higher the level of education, the easier it is to obtain information. The duration of staying in an area will also affect the experience and knowledge gained so that it has an impact on perceptions of the surrounding environment.

Table 4

Public perception of the ecological function of mangroves

No	Question	Score	Average	Category
1	Respondent already knows about the mangrove ecosystem	219	4.38	Very good
2	Mangrove ecosystems play an important role to resisting abrasion, flooding, tsunamis and maintaining the stability of biological resources in coastal areas.	241	4.82	Very good
3	The mangrove ecosystem is a place for fish, crabs, and shrimp to find food.	227	4.54	Very good
4	The mangrove ecosystem is a place of breeding for birds and fish.	211	4.22	Very good
5	Mangrove ecosystems can be used for waste management.	183	3.66	Good
Total		1081	4.32	Very good

Community perception on mangrove economy benefits. Community's response to the structured questions about mangrove economy benefits is demonstrated in Table 5. The results show that the community's response to three statements about mangrove ecosystems can provide food needs for families; source of income for local communities; and increasing the number of tourists visiting Pangandaran is very good. However, on the other hand, the public's perception of the statement that mangrove fruit has been processed into various foods and beverages received a good response with a score of 3.76. Public opinion about mangroves can meet family needs for food, medicine, furniture, shipbuilding materials and so on, getting a score of 3.62 in the good category. This different result is thought to be because the community has not used many products made from mangroves, such as medicine, furniture, food, and beverages. Further research and counseling on the benefits of mangroves for medicine, furniture, food, beverages, and other products needs to be done to change people's perceptions.

Table 5

Community perception of the economic benefits of mangroves

No	Question	Score	Average	Category
1	Mangrove can provide a family need for food, medicine, furniture, shipbuilding, and other materials.	181	3.62	Good
2	The mangrove ecosystem can provide food needs for fish, crab, and shrimp.	217	4.34	Very good
3	The Batu Karas mangrove forest ecotourism area can be used as a source of income for the local community.	214	4.28	Very good
4	The fruit of the mangrove plant has been processed into various foods and beverages.	188	3.76	Good
5	The Batu Karas mangrove forest ecotourism area can increase the number of tourists visiting Pangandaran.	213	4.26	Very good
Total		1031	4.05	Good

Community perception on the cause of damage to the mangrove ecosystem.

Community perception on the cause of damage to the mangrove ecosystem. Public knowledge about the causes of damage to mangrove ecosystems is an important factor in conservation efforts. The higher public awareness of the causative factors is expected to motivate the community to preserve the mangrove ecosystem. Based on the results of the research, the people around the Batu Karas Mangrove Forest already know the causes of damage to the mangrove ecosystem well. The total average score in the dimension of community perception on the cause of damage to the mangrove ecosystem is 3.72 (Table 6). On average, respondents agreed that the Batu Karas Forest ecosystem had been damaged with an average score of 3.74. According to respondents, the main cause of damage to Batu Karas mangrove forests was due to less strict law enforcement. The second causative factor is human activity, then abrasion and economic interests, and finally due to natural factors.

Table 6

Community perceptions of the causes of mangrove damage

No	Question	Score	Average	Category
1	The condition of Batu Karas mangrove forest has been damaged.	187	3.74	Good
2	The damage of Batu Karas mangrove forests was caused by natural factors such as erosion.	170	3.4	Good
3	The damage of Batu Karas mangrove forests was caused by human activity.	197	3.94	Good
4	The damage of Batu Karas mangrove forests was caused by abrasion and economic interests.	173	3.46	Good
5	The damage of Batu Karas mangrove forests was caused by less strict law enforcement.	202	4.04	Good
Total		929	3.72	Good

Community participation to mangrove preservation. Based on Table 7, the public perception of the desire to participate in efforts to conserve in Batu Karas mangrove forest is in a good category. The highest score is obtained in the statement regarding mangrove conservation is a shared responsibility between the government and the

community with an average score of 4.64 and is in the very good category. This shows that the community has realized that they have a responsibility to conserve mangroves. However, the other four statements are only in the good category. The lowest score was obtained in two statements related to the respondent's efforts to provide information about mangroves and the desire to donate in mangrove conservation activities. This can be caused due to the lack of involvement and low involvement of the community in coordination, program description and administrative activities (Nopiana et al 2021). The low desire of the community to donate and participate in mangrove conservation efforts can also be caused by a lack of information and advice from the government to help conserve mangrove forests (Utami et al 2018).

Table 7

Community participation in mangrove conservation efforts

No	Question	Score	Average	Category
1	Maintaining the conservation of mangrove forests, especially Batu Karas mangrove forests, is a shared responsibility.	232	4.64	Very good
2	Respondent have been looking for information about mangroves and their conservation efforts.	194	3.88	Good
3	Respondent participated to provide information about mangroves and their conservation efforts to the community.	180	3.60	Good
4	Respondents are willing to donate for ecotourism conservation activities of Batu Karas mangrove forest.	180	3.60	Good
5	Respondents are willing to attend activities on mangrove conservation.	200	4.00	Good
Total		986	3.94	Good

Community perception on government regulation toward the mangrove forest.

The results showed that community perceptions of government policies related to mangrove forests were in the moderate category (Table 8). Based on public perception, the government is quite good at managing Batu Karas mangrove forests. The government has also provided counseling regarding the benefits and impacts of mangrove ecosystem damage. The government is also considered sufficient in giving an appeal to the community to participate in preserving the mangrove ecosystem.

Table 8

Public perceptions of government policies related to mangrove forests

No	Question	Score	Average	Category
1	Enforcement of environmental laws is considered sufficient.	157	3.14	Moderate
2	The government has carried out the task of managing the environment of the mangrove forest properly.	164	3.18	Moderate
3	The government often conducts regular outreach to the community about the importance of mangroves.	153	3.06	Moderate
4	The government often provides information about the impact of damage to mangrove ecosystems.	159	3.18	Moderate
5	The government often gives appeals for the community to participate in preserving mangrove forests.	164	3.38	Moderate
Total		797	3.18	Moderate

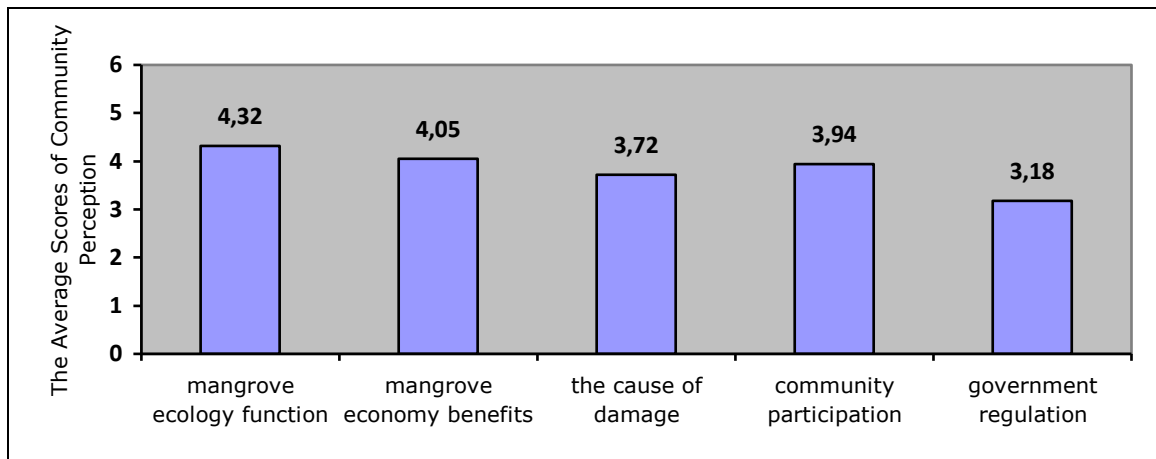


Figure 5. The average scores of community perception on mangrove ecology function, economy benefits, the cause of damage, community participation, and government regulation.

Discussion. The mangrove area is an ecosystem that has many benefits for humans and other organisms in the ecosystem. One of the areas with high economic value is the Batu Karas mangrove forest. This area has the potential to attract local and foreign tourists to come to Pangandaran. Various supporting facilities such as hotels, restaurants and entertainment facilities are also close and easily accessible from the mangrove forest area (Putri et al 2020). Therefore, the preservation of the Batu Karas mangrove forest area needs to be developed.

Sustainable conservation efforts are needed to prevent the spread of deforestation. Factors that affect the sustainability of the function of mangrove ecosystems for human life include community involvement, government policies, and institutions in ecosystem management. This community involvement is influenced by community perceptions. The more positive the community's perception, the easier it will be for the community to be motivated to be involved in conservation efforts (Research and Development Center for Conservation and Rehabilitation, Ministry of Forestry of the Republic Indonesia 2014).

Based on the results of the study, the average public perception of the preservation of Batu Karas mangrove forest is in the good category (average score 3.84). The highest average score was obtained in the section on community perceptions of the ecological function of mangroves, while the average score of public perceptions of government policies received the lowest score. Not all the communities are willing to provide donations and information related to mangrove conservation (Figure 5). This shows that counseling related to government policies, the function and impact of mangrove forest damage, as well as calls to conserve mangrove forests to the community need to be improved.

Based on these results, the government still needs to plan a strategy for developing the preservation of Batu Karas mangroves. Sunyowati et al (2016) describe several strategies that can be carried out in relation to efforts to conserve nature. Several development strategies that can be implemented and increased in intensity to strengthen community perceptions of the preservation in Batu karas mangrove forests are:

1. Planting mangrove seeds. Planting mangrove seedlings can be done by involving the community. This aims to foster a sense of ownership in the community so that people will be motivated to preserve mangroves.
2. Increasing public awareness regarding the importance of the mangrove ecosystem. This increase can be done through increasing the provision of counseling on the various benefits of mangroves for the ecosystem and community economy, as well as the impact of damage to the mangrove ecosystem.
3. Socialization and coordination of programs and regulations related to mangrove conservation to the community and partners.

4. Strict supervision and implementation of law enforcement. Supervision regarding the use and management of mangroves is necessary to prevent exploitation of natural resources. Monitoring also needs to be done regarding the possibility of contamination.

Conclusions. In conclusion, total average value of community perception of Batu Karas Mangrove Forest preservation in Pangandaran Regency, West Java, Indonesia was classified to be good, with a score of 3.84. The highest score of perception was public perception towards the ecological functions of mangroves with average score 4.32. The lowest score of perception was public perception towards government regulation with an average score of 3.18. The public perceptions of mangrove forest conservation can be increased through increased education regarding the benefits and impacts of mangrove damage, community involvement and stakeholders in planting mangrove seedlings, and coordination and socialization of conservation programs.

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Conflict of Interest. The authors declare that there is no conflict of interest.

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Authors:

Dian Yuni Pratiwi, Fisheries Departement, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Sumedang Regency, West Java, Indonesia, e-mail: dian.yuni.pratiwi@unpad.ac.id
 Atikah Nurhayati, Fisheries Departement, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Sumedang Regency, West Java, Indonesia, e-mail: atikah.nurhayati@unpad.ac.id
 Pringgo Kusuma Dwi Noor Yadi Putra, Fisheries Departement, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Sumedang Regency, West Java, Indonesia, e-mail: pringgo.kusuma@unpad.ac.id

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