



Fishermen's Adaptation Strategy to the Impact of Climate Change in Lamanggau Village, Tomia Sub-district, Wakatobi Regency

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Abstract

This study aims to (1) determine the types of livelihoods of fishermen in Lamanggau Village, Tomia District, Wakatobi Regency, (2) determine the perception of fishermen towards climate change and its impacts in Lamanggau Village, Tomia District, Wakatobi Regency, and (3) determine the adaptation strategies of fishermen to the impacts of climate change in an effort to maintain the sustainability of their livelihoods in Lamanggau Village, Tomia District, Wakatobi Regency. The population in this study was the fishermen in Lamanggau Village, 150 people. The determination of the research sample was carried out using the Slovin formula, so that 35 respondents were obtained. The research analysis used qualitative descriptive analysis and a Likert scale. The results of the study showed that the types of livelihoods of fishermen in Lamanggau Village were trolling, octopus fishing, squid fishing, drag nets, and gill nets. Then the perception of fishermen towards climate change and its impacts in Lamanggau Village is still very bad. And the fishermen's adaptation strategy to the impacts of climate change in an effort to maintain the sustainability of community livelihoods is carried out in a good way, whether in the form of using environmentally friendly fishing gear, changing the location or fishing to anticipate climate change, diversifying livelihoods outside the fishing profession and participating in training on sustainable fishing techniques.

Keywords: Adaptation Strategies; Climate Change; Perceptions.





INTRODUCTION

Southeast Sulawesi is a province with 38,140 km² of land, islands and ocean that has many strategic resources, including mining, agriculture, fisheries and tourism. In the fisheries sector, management is focused on maintaining fish catch areas and limiting fishing to sustainable potential to maintain the abundance of catches. The development of fisheries areas is directed at improving fishing technology and aquaculture management (Halkis, 2020). Wakatobi Regency, which is included in the Wakatobi National Park, is famous for its marine biodiversity and has great potential in the marine and fisheries sector, which is the main source of income for local coastal communities (Ramaddin, et al., 2019).

Fishing communities as coastal communities are often excluded from development and technology because government policy priorities focus more on the agricultural sector or the mainland. The lives of fishermen who still depend on marine products are still at a simple level with livelihood patterns using traditional technology (Belda and Christanto, 2012).

The current climate change is causing global warming to coastal areas, especially the daily lives of fishing communities. Rising sea surface temperatures, extreme weather intensity, changing rainfall patterns, and large waves are all negative impacts of climate change (Freduah, et al., 2017). Climate change has a significant impact on fishing numbers as most fishers depend on weather and environmental conditions to find fish and other food. Some of the effects of climate change that impact fishermen in Lamanggau Village include changes in air temperature, changes in rainfall, extreme weather intensity and changes in ocean current patterns (BPS Wakatobi Regency, 2023). In particular, the impacts of climate change have also increased the vulnerability of the region, with fishermen panicking about their catches, and declining fish populations which have an impact on fishermen's income. Not only in Lamanggau Village, the problem of vulnerability of coastal communities due to climate change is not new to the community. To reduce the adverse impacts, various efforts have been made early on. One of the efforts is to adapt to changes in the physical and social environment that occur temporally. Until now, the government has been involved in conducting counseling efforts related to adaptation steps that should be taken by fishermen. Adaptation is a system of ongoing interactions between humans and humans, and between humans and their ecosystems (Helmi and Satria, 2012).

Traditional fishermen in Lamanggau Village, Tomia Sub-district, Wakatobi Regency, use simple fishing gear and depend on the timing of fish arrivals, which is influenced by sea breezes, especially between August and September. However, climate change has made it difficult for fishermen to time their fishing, which impacts their productivity and income. To overcome this challenge, fishing families, both women and men, work together and implement various strategies



to sustain their lives (Pattinama, 2020). During the lean season, fisherwives help their husbands by diversifying their work to fulfill family needs and improve the economy, as is the case in Lamanggau Village (Candrakuncaraningsih, 2020).

Based on the above phenomenon, the researcher is interested in further examining how the adaptation strategies of fishermen to the impacts of climate change in Lamanggau Village, Tomia Sub-district, Wakatobi Regency. In addition, the things that underlie the author to choose the title because the issues raised are social issues concerning the adaptation behavior of fishing communities to the impacts of climate change.

METHOD

The population in this study is all people of Lamanggau Village who work as fishermen, totaling 150 people. The sample in the study was taken based on a minimum of 10 years of experience as a fisherman and settled and depended on his life in the coastal area in Lamanggau Village which was taken using the *simple random sampling* method. Types and sources of data came from primary data and secondary data. The data collection techniques were observation, interview, and documentation. Data analysis in this research was carried out using qualitative descriptive analysis and referring to the Likert scale with the help of the Method of Successful Interval approach. The criteria classification is formulated based on the Sturges Formula with the following formula:

$$Z = \frac{A - B}{K}$$

Description:

Z= Class interval

A= Highest score

B= Low score

K= Number of classes or categories

Based on the formula above, the class interval is as follows:

$$Z = \frac{5-1}{3} = 1,33$$

With the interval (z = 1.33), the following categorization is obtained:

1.00 - 2.33 = Low

2.34 - 3.67 = Fair

3.68 - 5.00 = High

RESULTS AND DISCUSSION

Types of Livelihoods of Fishermen Communities in Lamanggau Village

Livelihoods are activities or activities that people engage in with the aim of earning income to fulfill their needs, either through permanent employment, seeking work, or temporary employment. These activities vary between regions, depending on the ability of the population and local environmental conditions. In Lamanggau Village, the livelihoods of the fishing community are strongly influenced by the natural resources around the waters where they live. These types of livelihoods include various activities that utilize local marine and fisheries wealth, as listed in Table 1.

Table 1 Types of Livelihoods of Fishermen Communities in Lamanggau Village, Tomia Subdistrict, Wakatobi Regency in 2024

No.	Types of Livelihoods	Number (Soul)	Frequency (%)
1.	Tonda fishing rod	13	37,1
2.	Octopus Fishing Rod	2	5,7
3.	Squid Fishing	6	17,1
4.	Tensile Net	10	28,5
5.	Gill Net	4	11,4
	Total	35	100

Table 1. shows that the types of livelihoods of fishing communities in Lamanggau Village vary, consisting of tonda fishing which amounted to 13 people or 37.1%, where tonda fishing is a fishing technique pulled by a boat using artificial or natural bait to attract fish such as tuna, skipjack, tuna and so on. This technique requires special skills in choosing the right bait, regulating boat speed, and handling heavy fishing equipment. According to Sulandari (2011), the construction of a tonda fishing rod consists of a *hook*, fishing line, roller, *swivel* and artificial bait. Fishing rods consist of two main components, namely the *line* and the *hook*.

Fishermen's Perceptions of Climate Change and Its Impacts

Fishermen's Perception of Climate Change

Perception is the result of interpretation of the stimulus sensed by the individual, where this perception can be influenced by internal factors, such as individual characteristics, and external factors, which come from the environment. According to Robbins and Judge (2013), one of the factors that influence perception is situational factors, which include aspects of time, place, and

social circumstances. These situational factors cause individuals who experience the same event to give different interpretations. In the context of fishermen, time as a situational factor of perception relates to their experience in doing fishing activities that affect the way they interpret their work and environment.

The following fishermen's perception of climate change in Lamanggau Village, Tomia Sub-district, Wakatobi Regency can be seen in Table 2.

Table 2 Fishermen's Perception of Climate Change in Lamanggau Village, Tomia Sub-district, Wakatobi Regency in 2024

No.	Variables	Answer Scale					Average Total Score	Category
		SS	S	N/R	TS	STS		
	(a)	35		0	0	0	5	High
	(b)	26	9	0	0	0	4,74	High
	(c)	31	4	0	0	0	4,88	High
	(d)	29	6	0	0	0	4,82	High

:
 (a) *I realize that climate change can affect my daily life*
 (b) *I have felt the changes in weather patterns affecting my fishing activities.*
 (c) *Sea level rise has occurred in my place*
 (d) *The calm wind season and hard wave season are getting harder to predict*

Table 2 shows that in general, fishermen in Lamanggau Village have a very poor perception of climate change affecting their daily lives. A total of 35 respondents strongly agreed with an average score of 5 in the high category. This indicates that the fisher communities' perception of climate change has a negative impact on their daily lives. They feel the impact of climate change that worsens working conditions, such as erratic and extreme weather changes, as well as a decrease in catches due to changes in wind patterns, so they have to go to sea further, namely towards the camel reef or towards lantea with greater risk. This is in line with research conducted by Isdianto and Lutfi (2020) which researchers observed that climate change is a result of global warming and has a negative impact on coastal areas and the daily lives of fishing communities. Rising sea surface temperatures, extreme weather intensity, changes in rainfall patterns, and large waves are negative impacts of climate change.

Changing weather patterns greatly affect fishing activities for fishermen in Lamanggau Village, with 26 respondents strongly agreeing and 9 respondents agreeing, resulting in an average score of 4.74 in the high category. Climate change causes major challenges, such as changes in

wind patterns that affect fish migration pathways and catches that become less certain. Extreme weather such as storms, high waves and erratic rainfall increase fishermen's safety risks. This is in line with a study by UNEP (2009) which found that changes in wind patterns impact fish abundance and make it difficult for fishermen to predict when to go to sea. In addition, sea level rise causes serious impacts with 31 respondents strongly agreeing and 4 agreeing, an average score of 4.88 in the high category. The impacts include coastal erosion, reduction of land for fishing activities, and threats to critical infrastructure such as houses and roads. Indrawasih's (2012) research also shows that sea level rise causes erosion, flooding, and damage to coastal and marine ecosystems. Fishermen also face the challenge of difficulty in predicting the season of calm winds and strong waves, which causes uncertainty in fishing. A total of 29 respondents strongly agreed and 6 respondents agreed with an average score of 4.82 in the high category. Previously, seasonal patterns were reliable, but climate change makes weather predictions increasingly uncertain, as found in the study of Sagala, et al. (2016).

Fishermen's Perception of the Impact of Climate Change

Fishing communities' perceptions of climate change impacts generally focus on how such changes affect marine resources and their livelihoods. Climate change, caused by human activities such as fossil fuel use and land use change (Hukom, et al., 2012), is a significant issue for fishers. They face difficulties in predicting the seasons that usually guide their fishing activities, so their daily activities are disrupted. Fishermen have to work harder and longer to get the same or even less catch than before. Changes in seawater temperature and erratic fish migration make it harder to find fish populations. In addition, operational costs have increased due to the need for more sophisticated equipment and more fuel, further adding to the burden on fishermen.

The following is the perception of fishing communities on the impact of climate change in Lamanggau Village, Tomia Sub-district, Wakatobi Regency can be seen in Table 3.

Table 3 Fishermen's Perception of the Impact of Climate Change in Lamanggau Village, Tomia Sub-district, Wakatobi Regency in 2024

No.	Variables	Answer Scale					verage	Category
		TT	ST	KT	JT	TTSS	Total Score	
A. Impact on the Environment								
	(a.1)	31	4	0	0	0	4,88	High
	(a.2)	35	0	0	0	0	5	High
Ket:								

(a.1) I feel the increase in seawater temperature affecting fish habitat.								
(a.2) I have noticed an increase in extreme weather events (such as storms and large waves) in my fishing grounds.								
B. Impact on Livelihoods								
	(b.1)	35	0	0	0	0	5	High
	(b.2)	21	8	6	0	0	4,42	High
Ket:								
(b.1) I feel that the fishing season has changed due to climate change								
(b.2) I experience increased safety risks at sea due to climate change								
C. Economic Impact								
	(c.1)	35	0	0	0	0	5	High
2	(c.2)	35	0	0	0	0	5	High
Ket:								
(c.1) Climate change leads to higher operating costs, such as higher costs for fuel.								
(c.2) Changes in fish stocks cause price fluctuations that affect fishermen's income.								
D. Impact on the Village								
	(d.1)	35	0	0	0	0	5	High
	(d.2)	21	9	5	0	0	4,45	High
:								
1) Sea level rise and flooding threaten homes and infrastructure in coastal communities								
2) The impacts of climate change, such as heat waves, have affected the health of fishing communities.								

Based on the data in table 3 above, the authors can describe it as follows;

1. Table 3 shows that the perception of fishing communities in Lamanggau Village towards the impacts of climate change, particularly the increase in seawater temperature, is in the high category with an average score of 4.88, where 31 respondents stated that the impacts have occurred and 4 respondents experience it frequently. The increase in seawater temperature causes fish to move to cooler waters, both deeper and farther from shore, so fishermen have to go to sea farther and longer to get the same catch. These temperature changes also impact marine ecosystems, affecting fish reproduction and diet, so some fish species such as the new pogo fish that were once abundant are now rare. These results are in line with research by Mora and Ospina (2001) which showed that rising seawater temperatures affect reef fish, which are unable to move to other areas. In addition, 35 respondents stated an increase in extreme weather events such as storms and large waves had occurred, with an average score of 5 in the high category. More frequent storms damage coral reefs, reduce catches and increase safety risks for fishers. Research by



Badjeck, et al. (2010) supports these findings, showing that climate variability and change disrupts fishers' operations and reduces efficiency and catch.

2. In terms of impacts on livelihoods, climate change has changed the fishing season, with 35 respondents stating this has happened with an average score of 5 in the high category. Weather patterns that were once predictable have now become erratic, making it difficult for fishermen to determine the right time to go to sea. Increased sea water temperature, changes in wind patterns, and irregular rainfall result in a shift in the fishing season, so the peak fishing period no longer guarantees abundant results. This finding is supported by Patriana and Satria (2013), who found that traditional fishing calendars have become irrelevant due to climate change, making it difficult for fishermen to determine the right time to go to sea. In addition, increased safety risks at sea due to extreme weather are also a concern, with 21 respondents stating this has happened, 8 stating it happens often, and 6 stating it happens sometimes, with an average score of 4.42. Climate change is causing more frequent storms, high waves and strong winds that make going to sea more dangerous. Fishermen in Lamanggau Village face the threat of large waves and strong winds that appear suddenly, threatening their safety and that of their boats. Research by Yogiswara and Sutrisna (2021) supports this, showing that high wind speeds and rainfall affect fishermen's safety, increasing the risk of accidents at sea and damaging fishing boats.
3. The impact of climate change on the economy of fishers in Lamanggau Village can be seen in the increase in operational costs, especially for fuel, where 35 respondents stated this had occurred. This increase in cost is due to changes in seawater temperature and damage to fish habitat, which forces fishermen to sail farther and longer to reach productive fishing areas. Research by Purnomo, et al. (2015) supports this finding, showing that climate change impacts the economic performance of fishers, especially in terms of business inputs-outputs. Fishers have to travel more but catch less, which risks reducing their income. In addition, fluctuating fish prices are also a challenge, with 35 respondents stating that this is due to declining fish stocks caused by changes in fish migration patterns and damage to marine habitats such as coral reefs. Declining fish stocks lead to unstable supply, resulting in sharply fluctuating fish prices and affecting fishermen's income. Ridha's (2017) research confirms that fluctuations in fishermen's income are often caused by seasonal changes and a decrease in the number of catches, especially during the lean season, which results in price instability in the market.





4. The impact of climate change on villages in Lamanggau Village is evident in rising sea levels that threaten homes and infrastructure, with 35 respondents stating that this has already happened. More frequent and severe sea level rise poses serious risks to coastal villages, including damage to homes adjacent to the coast as well as infrastructure such as roads and public facilities. Research by Joesidawati (2013) supports these findings, showing that the Tuban region experienced inundation of 417.9 ha of land due to sea level rise, causing shoreline changes and disruptions to transportation. In addition, the impacts of climate change also extend to public health, with 21 respondents stating that heatwaves have occurred, followed by 9 respondents stating often and 5 respondents sometimes. More intense heatwaves increase the risk of dehydration and fatigue, especially for fishermen who work under the hot sun for long periods of time, disrupting productivity and increasing serious health risks. This statement is in line with research by Laws, et al. (2015) which showed that climate change affects occupational safety and health, especially for outdoor workers such as fishermen, farmers, and construction workers who perform physical activities for long periods of time.

Fishermen's Adaptation Strategy to the Impact of Climate Change in an Effort to Maintain Livelihood Sustainability in Lamanggau Village

Adaptation is a strategy used by humans to deal with environmental changes, both physical and social (Alfian, 2012). For fishers, these strategies include measures to reduce the negative impacts of climate change on marine ecosystems and livelihoods. The ultimate goal is to maintain the sustainability of fisheries resources and the well-being of fishing communities. These measures include diversification of income sources, sustainable fishing practices, utilization of technology, collaboration among fishers, participation in government programs, and restoration of the marine environment. With this strategy, fishers can more effectively address the challenges of climate change and maintain their livelihoods.

The following adaptation strategies of fishermen to the impacts of climate change in an effort to maintain livelihood sustainability in Lamanggau Village, Tomia Sub-district, Wakatobi Regency can be seen in Table 4.



Table 4 Fishermen's Adaptation Strategies to the Impact of Climate Change in an Effort to Maintaining the Sustainability of Fishermen's Livelihoods in Lamanggau Village, Tomia District, Wakatobi Regency in 2024

No.	Variables	Answer Scale					Average Total Score	Category
		M	SM	KM	M	TM		
1	(a)	35	0	0	0	0	5	High
2	(b)	28	0	7	0	0	4,8	High
3	(c)	0	0	0	0	35	1	Low
4	(d)	27	0	0	0	8	4,08	High
5	(e)	35	0	0	0	0	5	High

:
 (a) Do you use more environmentally friendly fishing gear?
 (b) Are you changing your fishing location in anticipation of climate change?
 (c) Do you utilize early warning systems for extreme weather
 (d) Do you diversify your livelihood outside of fishing?
 (e) Have you attended training on sustainable fishing techniques, and adaptation to climate change?

Table 4. shows that the results of interviews with fishing communities related to fishermen's adaptation strategies to the impacts of climate change in an effort to maintain the sustainability of fishermen's livelihoods in Lamanggau Village related to the use of environmentally friendly fishing gear, 35 respondents stated that they did so with an average score of 5 in the high category. This indicates that fishermen's adaptation strategies to the impacts of climate change in an effort to maintain the sustainability of fishermen's livelihoods have a positive impact on the use of environmentally friendly fishing gear. Because the adaptation strategy to use more environmentally friendly fishing gear is an important step in dealing with the impacts of climate change and maintaining the sustainability of fisheries. Traditional fishing gear that is not selective can damage marine habitats and cause overfishing.

Fishermen are starting to use more selective and environmentally friendly fishing gear, such as nets and fishing rods, to reduce negative impacts on marine ecosystems. This is supported by the research of Arimoto, et al. (1999) which states that environmentally friendly fishing gear does not damage the environment and biodiversity. In addition, 28 respondents changed the location or time of fishing to adjust to changes in sea temperature and fish migration, avoiding extreme weather for better catches. However, utilization of early warning systems for extreme weather is still low, with 35 respondents claiming not to use them, indicating the need for better education and access to technology to improve fishers' preparedness.

A total of 27 fisher respondents have diversified their livelihoods outside the fishing



profession as an adaptation strategy to face economic uncertainty due to climate change, such as farming or trading, while 8 respondents did not do so due to limited skills. In addition, 35 respondents attended training on sustainable fishing techniques and climate change adaptation, organized by the Wakatobi fisheries office. The training helped fishers adopt environmentally friendly practices, such as selective fishing gear, and prepared them for weather and environmental changes. This supports the sustainability of fisheries resources and the welfare of fishing communities amidst the challenges of climate change, in line with research by Shaffril, et al. (2017), which emphasizes the importance of minimizing risks, strengthening social relationships and improving adaptation skills.

CONCLUSION

Based on the results of the research on fishermen's adaptation strategies to the impacts of climate change, it can be concluded that the types of livelihoods of fishing communities in Lamanggau Village consist of tonda fishing rods, octopus fishing rods, squid pacing, drag nets, and gill nets and fishing methods by fishermen are very diverse and are influenced by various factors, including local knowledge, technical skills, environmental conditions, and the economic value of the catch obtained.

The perception of the fishing community towards climate change and its impacts in Lamanggau Village is very bad. They feel the negative impacts in their daily lives, such as changes in weather patterns that interfere with fishing activities, rising sea levels, and windy and rough wave seasons that are increasingly difficult to predict and also the impacts of climate change are felt to be very detrimental from various aspects, including the environment, livelihoods, economy, and village life. Fishing communities are experiencing difficulties in dealing with the growing uncertainty in their daily environment.

Fishermen's adaptation strategies to the impacts of climate change in an effort to maintain livelihood sustainability are carried out in a good way. The fishers conserve fish resources and marine ecosystems by using environmentally friendly fishing gear such as nets and fishing rods. They also adjust fishing locations to climate change to ensure adequate catches and to reduce dependence on marine products, livelihood diversification is done by finding additional sources of income outside of fishing work, such as farming or others. In addition, fishers attend ongoing training on fishing techniques to improve their skills and knowledge. Overall, fishermen in Lamanggau Village make various efforts to adapt to climate change to maintain their welfare.





REFERENCE

- Arimoto TSJ, Choi, dan YG Choi. 1999. Trends and Perspectives for Fishing Technology Research Towards the Sustainable Development. *Proceeding of 5th International Symposium on Efficient Application and Preservation of Marine Biological Resource*. OSU National University.
- Badan Pusat Statistik (BPS). 2023. Kecamatan Tomia Dalam Angka 2023. Tomia. BPS Wakatobi.
- Badjeck M, Allison E, Halls E. 2010. Impacts of climate variability and change on fishery-based livelihoods. *Marine Policy*. 34: 375-38.
- Belda F, Christanto J. 2012. Strategi Penghidupan Nelayan Dalam Peningkatan Ekonomi Masyarakat Di Kecamatan Sasak Ranah Pasisie Dan Sungai Beremas.
- Candrakuncaraningsih V. 2020. Kontribusi Istri Nelayan Terhadap Pendapatan Keluarga Pada Musim Baratan. *Jurnal Bisnis dan Manajemen Islam*. 8(1).
- Freduah G, Fidelman P, Smith T. F. 2017. *The impacts of environmental and socio-economic stressors on small scale fisheries and livelihoods of fishers in Ghana*. *Applied Geography*. 89: 1-11.
- Halkis M. 2020. Diplomasi Pertahanan: Kedaulatan dan Investasi (Implementasi BRI Cina dan Dinamika Masyarakat Sulawesi Tenggara). *Prosiding Seminar Kulia Kerja Dalam Negeri*.
- Helmi A, Satria A. 2012. Stratei Adaptasi Nelayan Terhadap Perubahan Ekologi. *Jurnal Sosial Humaniora*. 16(1):68-78.
- Hukom E, Limantara LM, Andawayanti U. 2012. Pengaruh Perubahan Iklim Terhadap Optimasi Ketersediaan Air Di Irigasi Way Mital Provinsi Maluku. *Jurnal Teknik Pengairan*. 3(1):24-32.
- Indrawasih R. 2012. Gejala Perubahan Iklim, Dampak dan Strategi Adaptasinya Pada Wilayah dan Komunitas Nelayan di Kecamatan Bluto Kabupaten Sumenep. *Jurnal Masyarakat dan Budaya*. 14(3).
- Isdianto A, Luthfi OM. 2020. Persepsi dan Pola Adaptasi Masyarakat Teluk Popoh Terhadap Perubahan Iklim. *Jurnal Ilmu Kelautan SPERMONDE*. 5(2).
- Joesdiwati IM. 2013. Kajian Perubahan Iklim dan Kenaikan Muka Air Laut di Kawasan Pesisir (Studi Kasus: Kabupaten Tuban). *Jurnal Ilmiah Ilmu Dasar dan Lingkungan Hidup*. 13(2):17-24.
- Mora C dan Ospina A. 2001. Tolerance to high temperatures and potential impact of sea warming on reef fishes of Gorgona Island (Tropical Eastern Pacific). *Marine Biology*. 139: 765-769
- Patriana R, Satria A. 2013. Pola Adaptasi Nelayan Terhadap Perubahan iklim: Studi Kasus Nelayan DusunmCiawitali, Desa Pamotan, Kecamatan Kalipucang, Kabupaten Ciamis, Jawa Barat. *Jurnal Sosial Ekonomi Kelautan Dan Perikanan*. 8(1): 11-23.
- Pattinama E. 2020. Strategi Bertahan Hidup Keluarga Nelayan Hadapi Perubahan Iklim Prespektif





- Gender di Desa Seri, Silale dan Dusun Waimahu Kecamatan Nusaniwe Kota Ambon. *Jurnal Masohi*. 1(2):58-70.
- Purnomo AHS, H. Suryawati I, Radjawane M dan Sembiring KO. 2015. *Perubahan Iklim di Wilayah Pesisir*. Konsep dan Aplikasi Strategi Adaptasi. Bandung (ID). Penerbit ITB
- Ramaddin, Tadjuddah M, Oetama D. 2019. Karakteristik Biologis Ikan Kerapu Di Perairan Karang, Tomia Kabupaten Wakatobi Provinsi Sulawesi Tenggara. *Jurnal Manajemen Sumber Daya Perairan*. 4(3):266-273.
- Ridha A. 2017. Analisis Faktor-Faktor Yang Mempengaruhi Pendapatan Nelayan di Kecamatan Idi Rayeuk. *Jurnal Samudra Ekonomi Dan Bisnis*. 8(1): 646-652.
- Robbins SP, dan Judge TA. 2013. *Organizational Behavior, 15th edition*. New Jersey (USA): Pearson Education, Inc.
- Sagala SA, Argo TA, Asirin A, Adhitama P, dan Yamin D. 2016. Strategi adaptasi nelayan terhadap dampak perubahan lingkungan (Studi Kasus: Pemanfaatan teknologi penangkapan ikan laut). *Jurnal Penataan Ruang*. 11(2): 22-35.
- Shaffril HAM, Samah AA, dan D'Silva JL. 2017. Climate Change: Social Adaptation Strategies For Fishermen. *Marine Policy*. 81:256-261.
- Sulandari. 2011. *Teknik Penangkapan Ikan*. Jakarta: Rineka Cipta.
- UNEP. 2009. Climate Change Science Compendium. United Nation Environment Programme.
- Yogiswara IGNA dan Sutrisna IK. 2021. Pengaruh Perubahan Iklim Terhadap Hasil Produksi Ikan di Kabupaten Badung. *E-Jurnal EP Unud*. 10(9): 3613-3643

