Analysis of TCM (Travel Cost Method) and ITCM (Individual Travel Cost Method) calculations at the turtle conservation area of Pantai Pelangi

Yorra Anggara Putra[1]* Christina Dewi Febriani[2] A. Hadian Pratama Hamzah[3]

[1]*Master's Program in Environmental Studies, Universitas Terbuka, Indonesia
[2]Faculty of Agricultural Products Technology Program, Universitas Semarang, Indonesia
[3]Master's Program in Environmental Studies, Universitas Terbuka, Indonesia

*Correspondence: yorraanggaraputra@gmail.com

Abstract

Pantai pelangi Turtle Conservation is one of the frequently visited tourist destinations due to the beautiful views and nuances of the beach as well as the turtle breeding or conservation area. The olive ridley turtle or Lepidochelys is a type of turtle preserved on Pantai pelangi. In addition to the tourist destinations and attractions in Pantai pelangi, turtle conservation is also an attraction for people visiting Pantai pelangi. This may enable an analysis of the economic value of the Pantai pelangi Turtle Conservation Area using TCM or Trip Cost Method and Individual Trip Cost Method (ITCM). TCM method is a method that works to measure economic value, while ITCM focuses more on primary data obtained through surveys and these two things can be seen from the level of satisfaction and comfort of visitors through questionnaires given to visitors. or surveyed at Pantai pelangi Turtle Conservation Area.

1. Introduction

One of the notable places in Indonesia where sea turtles are found is Pantai pelangi, located in Padukuhan Grogol IX, Prangtritis Village, Kretek, Bantul, Yogyakarta. This area is well-known for its turtle conservation efforts. According to Ballamu (2022), sea turtles are reptiles characterized by their strong carapace and four flipper-like limbs, which help them in various activities such as feeding, swimming, and mating. Prihanta et al. (2016) mentioned that there are six species of sea turtles in Indonesia, namely Caretta caretta (Loggerhead turtle), Eretmochelys imbricata (Hawksbill turtle), Lepidochelys olivacea (Olive ridley turtle), Dermochelys coriacea (Leatherback turtle), Chelonia mydas (Green turtle), and Natator depressus (Flatback turtle). Sea turtles breathe using lungs, and they can die if they fail to reach the surface of the water. Yusra et al. (2022) reported that sea turtles are listed in Appendix I of the International Union for Conservation of Nature (IUCN) Red List and are protected globally.

Pantai pelangi is a nesting site for the Olive Ridley turtle (Lepidochelys olivacea). According to Nurhidayata et al. (2013), sea turtles typically lay their eggs during high tide when the mother turtle swims to the shore, crawls, digs a hole, lays eggs, covers the hole, and then returns to the ocean. The nesting habitat must be near sand and water for a higher hatching success rate. Harmino et al. (2021) added that land cover plays a critical role in the hatching duration and success rate of turtle eggs. The more sheltered the nesting site, the higher the likelihood of egg hatching and protection from diseases, predators, and climate changes. Saputro (2023) reported the financial performance of the Pantai pelangi turtle conservation project, showing a decline in the number of turtle arrivals and egg-laying activities over the years. For example, in 2019, the total revenue was Rp 36,492,000 from 960 visitors; in 2020, it decreased to Rp 30,202,000 with 805 visitors; and in 2022, it further dropped to Rp 14,341,000 with 507 visitors, including Rp 5,358,000 in August 2022. The decrease in visitors and revenue is likely attributed to the declining number of turtles arriving or nesting at Pantai pelangi, which also impacts the frequency of turtle release activities. Thus, it is vital to continue promoting turtle conservation at Pantai

pelangi, not only for its scenic views but also for the protection of turtle hatchlings and their release back into the ocean.

To estimate the economic value of Pantai pelangi using the Travel Cost Method (TCM), this method, as explained by Budiman et al. (2017), is widely used to measure the economic value provided by tourists and to analyze demand for outdoor recreational activities such as fishing, hiking, hunting, etc. Putri (2020) pointed out that TCM is a method for directly measuring use value, focusing on non-market environmental resources, by valuing the environmental resources associated with recreational activities. The advantage of using TCM is its relatively low cost and ability to produce demand curves that reflect actual visitor behavior through large sample surveys.

Budiman et al. (2017) emphasized that TCM helps assess the use value of resources and the environment through proxy measures, such as the travel expenses incurred to access environmental services. If travel costs are high, the number of visitors tends to decrease, and the marginal utility of improving the environment becomes negligible. Data collection for TCM is typically carried out through questionnaires given to visitors. Sugiyono (2017) stated that questionnaires are a useful method to gather personal information from respondents to address the research problem.

TCM can be applied through two methods: Zonal Travel Cost Method (ZTCM) and Individual Travel Cost Method (ITCM), as described by Arie et al. (2024). ZTCM uses secondary data and is applied to a group of visitors, while ITCM relies on primary data obtained via surveys and statistical techniques, ensuring more accurate results and better demand curve estimations. According to Putri (2020), ITCM provides more accurate data since it is based on individual-level responses. In ITCM, the hypothesis is that the number of visits to a tourist destination is significantly influenced by the total travel cost, which leads to a negatively sloped demand curve. Therefore, the estimation of the economic value of the Pantai pelangi turtle conservation site can be achieved by applying the TCM, considering the visitors' travel costs, the number of visitors, and the overall demand for conservation-related activities at the site.

2. Method
Research Location
The research location for this study is Pantai pelangi, located in Padukuhan Grogol IX, Prangtritis Village, Kretek, Bantul, Special Region of Yogyakarta, which is currently known for its turtle conservation efforts. The turtle conservation at Pantai pelangi is essential to promote, as it not only offers a beach destination with scenic views but also provides recreational activities and conservation efforts for hatchling turtles (tukik). These efforts include the release of Olive Ridley turtles (Lepidochelys olivacea) back into the sea at designated landing and release sites. The research will begin in the last week of April and continue through May. Data collection will be carried out four times during May. The report for the research practice will take approximately 1 to 1.5 months to complete.

Population and Sample
The population for this practice consists of visitors to the Turtle Conservation Area at Pantai Pelangi. The sample is taken using purposive sampling. According to Cooper and Schindler (2011), purposive sampling is a non-probability sampling method based on specific criteria. Sugiyono (2016) adds that one of the advantages of purposive sampling is that researchers can rely on their experience and expertise to select respondents. The estimated sample size or distribution of questionnaires targets 40 respondents.

Data Sources and Collection
The data collection source can be conducted through interviews with informants or conservators from the Turtle Conservation Area at Pantai Pelangi, which is indirectly obtained from the travel costs incurred by visitors (Waliambo et al., 2017). Additionally, another data collection method involves distributing questionnaires to visitors. Sugiyono (2017) explains that distributing questionnaires is one way to gather personal information from respondents to address research issues. The distribution of questionnaires to respondents, along with oral and written interviews, aims to assess the comfort level and satisfaction of visitors regarding the Turtle Conservation Tourism Destination at Pantai Pelangi.

Data Analysis

The data obtained is analyzed using the TCM (Travel Cost Method). This method is used to assess the goods used in tourism or the demand for visits or travel, including the total costs for accommodation, entrance fees, and other relevant expenses (Arie et al., 2024). The calculation of the total economic value can be formulated as follows:

TEV = (DUV+IUV+OV) + (BV+EV)

Explanation:
TEV = Total Economic Value
DUV = Direct Use Value
IUV = Indirect Use Value
OV = Option Value
BV = Bequest Value
EV = Existence Value

The calculation of visitors in one period uses the ITCM (Individual Travel Cost Method). ITCM is more focused on primary data obtained from surveys or questionnaires and statistics (Putri, 2020). The hypothesis of ITCM is that the visits to the tourist destination of the Pelangi Turtle Conservation Beach area are influenced by the travel costs. The demand function can be written as follows:

Vij = f (Cij, Tij, Qij, Sij, Mi)

Explanation:
Vij = The number of visits by individual i to tourist destination j
Cij = The travel cost incurred by individual i to visit tourist destination j
Tij = The duration of time spent by individual i at tourist destination j
Qij = The perception of individual i regarding the environmental quality of the visited destination
Sij = Characteristics of substitute tourist destinations that might exist in other locations
Mi = Income of individual i.

3. Results and Discussion

Results

Based on the data or facts collected during the practice, the results of the Parameters and the Number of Responses from Questionnaire Respondents are presented in Table 1 as follows.

Table 1

Parameters and Number of Responses from Respondents in the Questionnaire Completion

NO	Parameter Kuesioner	Jumlah dan Jawaban Responden								
		10	13	15	17	23	25	27	30	40
1	Jumlah Kunjungan	> 1x							1x	
2	Alat Transportasi			Mobil			Motor			
3	Lama Kunjungan	> 4 jam							2 s/d 4 jam	
4	Tingkat Kepuasan									Puas
5	Biaya yang Dikeluarkan									< Rp 100.000,-
6	Tertarik Menginap di *Cottage*									Tidak
7	Tingkat Kebersihan	Kurang Bersih							Bersih	
8	Jumlah Sampah									Sedikit
9	Kondisi Toilet	Kurang Bersih							Bersih	
10	Tingkat Kenyamanan									Nyaman
11	Kualitas Lingkungan									Cukup
12	Jumlah Tumbuhan			Cukup			Banyak			
13	Tingkat Keamanan									Aman
14	Kondisi Penyu	Kurang Baik							Baik	
15	Jumlah Penyu									10 s/d 20 ekor
16	Tingkat Kesukaan Makanan									Suka
17	Biaya Makan									< Rp 100.000,-
18	Tertarik *Merchandise*		Tidak				Ya			
19	Penawaran *Merchandise* Kaos				Tidak Setuju	Setuju				
20	Jumlah Pendapatan									< Rp 2.000.000

The results in Table 1 above show that from the completion of 20 questionnaire parameters by 40 respondents, the majority were students (30 respondents) with the last education being high school

and 10 respondents who were factory employees with a bachelor's degree. The results revealed that 30 respondents (75%) were first-time visitors to the Turtle Conservation Tourism at Pantai Pelangi, with a visit duration of 2 to 4 hours. They also stated that the location was relatively clean, evidenced by the comfort and good condition of the toilets, as well as the healthy condition of the turtles in the conservation area. On the other hand, 10 respondents (25%) had visited the Turtle Conservation Tourism site more than once, staying for more than 4 hours. These visitors mentioned that the location's cleanliness was below expectations, indicated by the poor condition of the toilets and the turtles' less-than-ideal condition. The mode of transport for most visitors was by motorbikes, with 25 respondents (62.5%) using motorbikes, while 15 respondents (37.5%) used cars to reach the conservation area. Regarding the greenery at the Turtle Conservation Tourism site, 25 respondents indicated that there were plenty of plants, while 15 others thought there were few plants. A significant 67.5% of visitors (27 respondents) expressed a strong interest in merchandise, while 32.5% (13 respondents) were not interested. When asked about the possibility of the conservation site offering t-shirts as merchandise, 57.5% (23 respondents) agreed, while 42.5% (17 respondents) disagreed. A total of 100% of respondents (40 people) expressed satisfaction with their visit to the Turtle Conservation Tourism site at Pantai Pelangi, with costs under IDR 100,000. None of the respondents chose to stay overnight at nearby cottages or hotels. Additionally, respondents reported seeing between 10 and 20 turtles during their visit, with minimal litter, and the overall environment being of satisfactory quality. Most visitors also felt safe and comfortable, reflected in the fact that they spent under IDR 100,000 on food and drinks and enjoyed the attractions at the site. Most respondents also reported having an income below IDR 2,000,000 (Widagdyo, 2017).

Additional practical information gathered from the Turtle Conservation site at Pantai Pelangi shows that the site attracts around 80 visitors from the last week of April to the last week of May. On weekends or during events, the number of visitors can reach 20 to 40, as many people tend to visit with family or friends during holidays (Sofyan et al., 2019). During weekdays, however, the number of visitors is much lower, ranging from 3 to 5 people per day. The direct cost for entry to the beach in Yogyakarta, including the Turtle Conservation area, is IDR 15,000, with parking fees of IDR 2,000 for motorcycles and IDR 5,000 for cars, and toilet fees of IDR 3,000. For indirect costs, activities such as turtle hatchling releases cost IDR 25,000, while mangrove or sea pandan planting activities cost IDR 13,000. Additionally, the conservationist, Mr. Daru, mentioned that the estimated budget for turtle conservation activities is between IDR 1,000,000 and IDR 3,000,000, and there is no specific charge for individuals to visit the Pantai Pelangi Turtle Conservation site or view the turtles.

Data Analysis

The results above show that 40 respondents expressed high levels of satisfaction, comfort, and safety while visiting the Turtle Conservation Tourism at Pantai Pelangi. This is evident from the relatively long visit durations (around 2 to 4 hours), with visitors using both cars and motorbikes. The clean tourist site, the abundance of turtles (10 to 20 turtles in good condition), minimal litter, and the clean toilets indicate a well-maintained environment. The quality of the environment is also enhanced by the presence of green plants, such as mangroves, which help prevent coastal erosion. The level of comfort and satisfaction is further reflected by the fact that many of the respondents were first-time visitors who expressed interest in the food, drinks, and merchandise offered, such as t-shirts. Visitors also reported spending less than IDR 100,000 to reach the destination and enjoy the offered services, including food and beverages. Additionally, the respondents who did not choose to stay at cottages and had incomes under IDR 2,000,000 were predominantly students, which supports the findings. This aligns with the studies by Winarno et al. (2021), who found that satisfaction, comfort, and safety are critical factors for tourists during their travels. Sumarni et al. (2013) also emphasize that tourism provides an opportunity for individuals to take a break from their daily routines. According to Sasmita et al. (2017), comfort, satisfaction, and even a sense of refreshment and joy can be gained when people step away from their daily life and engage in a travel experience. This is further supported by the concept of "wish fulfilment," where tourists can realize their desires to experience new things and interact socially. Visitors to the Turtle Conservation Tourism at Pantai Pelangi, therefore, benefit from minimal expenses, with a pleasant experience driven by the relatively low costs of travel, food, and drink. Marcelina et al. (2018) identified that the key factors attracting tourists to a destination are the natural beauty of the area, accessibility (i.e., the ability to reach the site by motorized vehicles), and cultural

attractions. This is evident at Pantai Pelangi, where the turtle release events, the mangrove planting initiatives, and the efforts to clean the beach area enhance the visitor experience. These activities highlight the importance of environmental conservation and the impact of community-based tourism. Additionally, the availability of merchandise like t-shirts further adds to the tourist experience, making it unique and memorable.

The data obtained from the Turtle Conservation Tourism at Pantai Pelangi can be analyzed using the Travel Cost Method (TCM) and Individual Travel Cost Method (ITCM). According to Arie et al. (2024), the TCM method can be used to assess the total accommodation costs, including entry fees to the conservation site. Putri (2020) states that TCM helps estimate the economic value of natural resources and the environment, offering insights into the financial impact of the Turtle Conservation Tourism. On the other hand, the ITCM focuses on primary data obtained from surveys, questionnaires, and statistics, particularly individual visits. By calculating the total economic value (TEV) using both methods, more comprehensive insights can be drawn about the economic impact of the Turtle Conservation Tourism at Pantai Pelangi. In the following section, we will provide the detailed calculation of TEV using the TCM and ITCM methods, as referred to in Appendix 2. The results will be summarized in Table 2 regarding ITCM calculations.

TEV = DUV+IUV+OV

TEV bila OV Rp 1.000.000,- = Rp 25.000 + Rp 38.000 + Rp 1.000.000 = Rp 1.063.000,-

TEV bila OV Rp 3.000.000,- = Rp 25.000 + Rp 38.000 + Rp 3.000.000 = Rp 3.063.000,-

Explanation:

TEV = Total Economic Value

DUV = Direct Use Value

IUV = Indirect Use Value

OV = Option Value

Table 2

*Total Economic Value Calculation using the ITCM Method*

NO	Jenis Pengeluaran	Biaya Pengeluaran (Rp)	Jumlah Responden Terlibat (Orang)	Total Biaya
1	Harga Tiket Masuk	Rp15.000	40	Rp600.000
2	Parkir Transportasi Mobil	Rp5.000	15	Rp75.000
3	Parkir Transportasi Motor	Rp2.000	25	Rp50.000
4	Biaya Toilet	Rp3.000	40	Rp120.000
5	Konsumsi	< Rp 100.000	40	Rp4.000.000
6	Pelepasan Tukik	Rp25.000	40	Rp1.000.000
7	Penanaman Bakau/Pandan Laut	Rp13.000	40	Rp520.000
8	Biaya Konservasi Penyu	Rp 1.000.000 s/d Rp 3.000.000	0	Rp0
Jumlah Total Biaya Keseluruhan				**Rp6.365.000**

The results above show that the total economic value (TEV) using the TCM method ranges from IDR 1,063,000 to IDR 3,063,000, and for the ITCM method, it is IDR 6,365,000. According to Saputro (2023), based on the financial reports of the Turtle Conservation of Pantai Pelangi over one year, for the years 2019, 2020, and 2022, the visits and expenditures were as follows: 960 visitors with an expenditure of IDR 36,492,000 in 2019, averaging IDR 3,041,000 per month; 805 visitors with an expenditure of IDR 30,202,000 in 2020, averaging IDR 2,516,833 per month; and 507 visitors with an expenditure of IDR 14,341,000 in 2022, averaging IDR 1,195,083 per month. These results show a curve between expenditure costs and the frequency or quantity of visitors, as shown in Figure 2 below. There is consistency between the number of visitors and the total economic value, including based on the financial reports of the Turtle Conservation of Pantai Pelangi, where in 2022 the average monthly expenditure was IDR 1,195,083, in 2020 it was IDR 2,516,833, and in 2019 it was IDR 3,041,000. This falls within the TEV range of the TCM analysis, which is between IDR 1,063,000 and IDR 3,063,000. The calculation using the ITCM method of IDR 6,365,000 also shows consistency with the financial audit report of August 2022, where Saputro (2023) revealed that the expenditure in August 2022 was IDR 5,358,000, which is lower than the ITCM value of IDR 6,365,000. The differences in the number or quantity of visits and total expenditure or TEV in each year or month could be influenced by qualitative factors, such as the number of turtles nesting at Pantai Pelangi, the success rate of hatching

turtle eggs, which is greatly affected by factors like the presence of land cover that can improve the hatching process by protecting the eggs from predators and extreme temperatures, as well as the intensity of mangrove planting or pandanus planting activities and the release of baby turtles (tukik).

Figure 2
Travel Cost Curve Estimation (Personal Documentation, 2023)
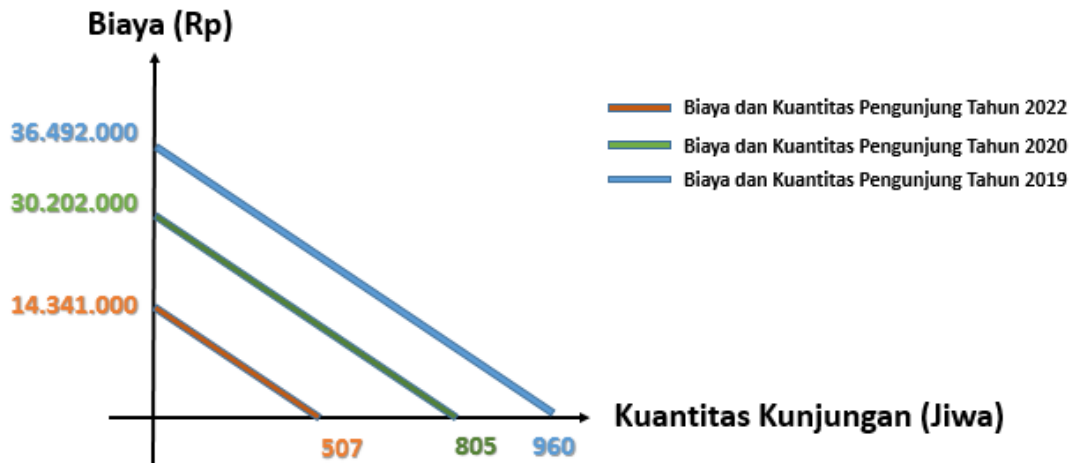
4. Conclusion

Based on the analysis conducted on the Turtle Conservation Area at Pantai Pelangi, Yogyakarta, the following conclusions can be drawn: The results from the questionnaire indicate that 40 respondents expressed satisfaction, comfort, and safety when visiting the Turtle Conservation Tourist Site at Pantai Pelangi. The total economic value obtained through the TCM analysis ranges from IDR 1,063,000 to IDR 3,063,000, while the ITCM method results in IDR 6,365,000. This study suggests that additional questions in the questionnaire should be included in future research to obtain more comprehensive results that better reflect the calculation of total economic value.

5. References

Arie, M. C., Mandel, J. R., & Waney, N. F. L. (2024). Pendekatan travel cost method dalam pengukuran nilai ekonomi kawasan agrowisata Tour Ma'asering di Desa Kumelembuai Kecamatan Tomohon Timur Kota Tomohon. *Jurnal Transdisiplin Pertanian (Budidaya Tanaman, Perkebunan, Kehutanan, Peternakan, Perikanan, Sosial, dan Ekonomi)*, *20*(2), 767–776.

Ballamu, F. (2022). *Mengenal penyu: Belajar dari Pulau Piai*. Daya Edukasi Papua.

Budiman, J. A., Sudarsono, B., & Sukmono, A. (2017). Analisis nilai ekonomi kawasan menggunakan travel cost method (TCM) & contingent valuation method (CVM) untuk pembuatan peta zonasi nilai ekonomi kawasan dengan SIG. *Jurnal Geodesi Undip*, *6*(2), 81–89.

Cooper, D. R., & Schindler, P. S. (2011). *Business research methods*. McGraw-Hill International Edition.

Hamino, T. Z. A. E., Parawangsa, I. N. Y., Sari, L. A., & Arsad, S. (2021). Efektivitas pengelolaan konservasi penyu di Turtle Conservation and Education Center Serangan, Denpasar Bali. *Journal of Marine and Coastal Science*, *10*(1), 18–34.

Marcelina, D., Febryano, I. G., Setiawan, A., & Yuwono, S. B. (2018). Persepsi wisatawan terhadap fasilitas wisata di pusat latihan gajah Taman Nasional Way Kambas. *Jurnal Belantara*, *1*(2), 45–53.

Nurhidayata, B. S., Nurdin, J., & Indra, J. Z. (2013). Penetasan telur penyu lekang (*Lepidochelys olivacea* Eschscholtz, 1892) pada lokasi berbeda di kawasan konservasi penyu Kota Pariaman. *Jurnal Biologi*. Universitas Andalas.

Prihanta, W., Syariffudin, A., & Zainuri, A. M. (2016). Upaya konservasi dan pengelolaan habitat penyu laut melalui pengembangan ekowisata berbasis masyarakat. *Semnas Pro UMM*, 68–80.

Putri, E. I. K. (2020). *Valuasi lingkungan*. Penerbitan Universitas Terbuka.

Saputro, D. A. (2023a). *Laporan keuangan konservasi penyu Pantai Pelangi.* Aksi Konservasi dan 4K Yogyakarta.

Saputro, D. A. (2023b). *Audit keuangan Pantai Pelangi tahun 2022.* Aksi Konservasi dan 4K Yogyakarta.

Sasmita, E., Darsiharjo, & Rahmafitria, F. (2017). Analisis daya dukung wisata sebagai upaya mendukung fungsi konservasi dan wisata di Kebun Raya Cibodas, Kabupaten Cianjur. *Jurnal Manajemen Resort dan Leisure*, *11*(2), 1–14.

Sofyan, A., Hidayat, W., Winarno, G. D., & Harianto, S. P. (2019). Analisis daya dukung fisik, riil, dan efektif ekowisata di Pulau Pisang, Kabupaten Pesisir Barat. *Jurnal Sylvia Lestari*, *2*(7), 225–234.

Sumarni, Zulkarnain, & Sugiyanta, I. G. (2013). Faktor-faktor pendorong dan penarik wisatawan berkunjung ke objek wisata Gunung Dempo Kota Pagar Alam. *Jurnal Penelitian Geografi*, *1*(2), 1–12.

Sumarto, H. S. (2003). *Inovasi, partisipasi dan good governance.* Yayasan Obor Indonesia.

Sugiyono. (2016). *Metode penelitian kuantitatif.* Alfabeta.

Sugiyono. (2017). *Metode penelitian kuantitatif, kualitatif, dan R&D.* Alfabeta.

Waliambo, R., Wulandari, C., & Rusita, R. (2017). Studi daya dukung ekowisata air terjun Wiyono di Taman Hutan Raya Wan Abdul Rachman Provinsi Lampung. *Jurnal Sylvia Lestari*, *5*(1), 47–60.

Widagdyo, K. G. (2017). Pemasaran daya tarik ekowisata dan minat berkunjung wisatawan. *Esensi: Jurnal Bisnis dan Manajemen*, *7*(2), 261–276.

Winarno, G. D., Widiastuti, E. L., Setiawan, A., & Dewi, B. S. (2021). Polarisasi persepsi stakeholder terhadap pengembangan ekowisata Lampung Mangrove Center Desa Maragasari Kecamatan Labuhan Maringgai Lampung Timur. *Jurnal Hutan Tropis*, *9*(3).

Yusra, A. A., Fisesa, A. A., Fachrizal, A., & Susanto, H. (2022). *Penyu dan Paloh: Perjalanan konservasi di ekor Borneo.* Yayasan WWF Indonesia