

Locating the unique biodiversity of Balikpapan Bay as an ecotourism attraction in East Kalimantan, Indonesia

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Locating the unique biodiversity of Balikpapan Bay as an ecotourism attraction in East Kalimantan, Indonesia

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³Faculty of Forestry, Universitas Mulawarman. Jl. Penajam, Gunung Kelua, Samarinda Ulu, Samarinda 75123, East Kalimantan, Indonesia. Tel./fax.: +62-541-735089, **email: yruslim@gmail.com

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10 **tract.** Willard K, Aipassa MI, Sardjono MA, Rujehan, Ruslim Y, Kristiningrum R. 2022. Locating the unique biodiversity of Balikpapan Bay as an ecotourism attraction in East Kalimantan, Indonesia. *Biodiversitas* 23: 2342-2357. Balikpapan Bay is rich in biodiversity and natural beauty that present unique opportunities for the developing ecotourism industry in East Kalimantan, Indonesia. This study aimed to identify biodiversity hotspots with potential as ecotourism attractions. Four field surveys by boat, each survey taking between 10 to 22 hours duration, tracked the river and tidal flow through the Bay, recording highlights of biodiversity at 19 defined observation points. The study results recorded observations on five species listed in the IUCN protected species classification, namely: Lesser Adjutant Stork (*Leptoptilos javanicus*) - classified as a Vulnerable species; Proboscis Monkey (*Nasalis larvatus*), Irrawaddy Dolphin (*Orcaella brevirostris*) and Green Turtle (*Chelonia mydas*) - classified as Endangered species; and the Hawksbill Turtle (*Eretmochelys imbricata*) - classified as Critically Endangered. In addition, details were recorded of a unique variant of the mangrove species *Rhizophora apiculata*, with leaves that have a vibrant yellow color instead of the usual green. Combined with great views, including at night when there are enchanting displays of Fireflies (*Lampyridae*) on several riverbanks, the biodiversity of the waterways results in Balikpapan Bay having great potential as an ecotourism destination. Therefore, this study provides useful input to relevant agencies charged with responsibility for conserving and managing the natural resources of the Bay for the benefit of communities who stand to gain economically from developing this ecotourism potential.

Keywords: Balikpapan Bay, biodiversity, ecotourism, endangered species, tourist attraction

INTRODUCTION

The uncontrolled growth of the tourism industry raises various environmental problems that question the sustainability framework of conventional tourism (Malik et al. 2019; Adetola et al. 2021). This gives rise to a discourse on ecotourism as a sustainable tourism solution (Arsad et al. 2021). Ecotourism can minimize the environmental impact that tourism produces (Blanco-Cerradelo et al. 2018). In addition, ecotourism is becoming increasingly used as a framework for tourism in the world. It is estimated that ecotourism currently makes up about 20% of total international trips and is growing at around 5% per year (Abdullah et al. 2018). Following the world trend in ecotourism development, one driver of economic development in Indonesia is ecotourism (Sofiyanti et al. 2021). Ecotourism, as an advanced concept of tourism, applies sustainable tourism development to support environmental conservation efforts (nature and culture) (Haryati et al. 2016; Hera and Khazinatul 2021).

Ecotourism plays a role in conserving marine biodiversity, which cannot be separated from its natural resources (Huffard et al. 2012). Nchor et al. (2018) noted that tropical forests, wildlife species, and community

14 cultural heritage are great assets in ecotourism. Indonesia is known as the center of the world's Coral Triangle. Indonesia is very high in marine biodiversity; 18% of the world's coral reefs consisting of 500 species in 70 genera, are found in Indonesian waters. Other marine biodiversity found in Indonesia is 2500 fish species, 2500 mollusk species, 1500 shrimp species, and various other marine biotas (Huffard et al. 2012). Within Indonesia's 17,502 islands, there are about 85,700 km² of coral reefs, representing 14% of the world's coral reefs. Thus, well in excess of 3500 marine species live in Indonesian seas, especially in its coral reefs (Bakti et al. 2021).

The Indonesian natural environment, with its wealth of biological, cultural, geological, and meteorological diversity, is the main attraction that characterizes ecotourism destinations (Rhama 2019). Kalimantan, the Indonesian territory of the island of Borneo, is a destination in such attractions. As part of Sundaland, Borneo has 5% of the world's endemic plants and 2.6% of vertebrates. Although it does not seem large this value indicates that the Sundaland area is the second most populous area in the world in terms of endemic plants and the fifth in terms of world endemic vertebrates (Myers et al. 2000). Borneo has orangutans and proboscis monkeys, two endangered and

endemic species of megafauna on the island. Orangutans, in particular, are of important significance because like chimpanzees in Africa, they exhibit high intelligence and behavior, much closer to humans than do other species of the world's megafauna. Many places in Borneo are used to conserve these animals; 72% of the remaining jungle in Kalimantan, and Sumatra in general, has been granted conservation status (Myers et al. 2000). However, despite having large concentrations of endemic and small-ranged species, only fifty percent of the initial forest area remains intact (Gaveau et al. 2016). Continued large-scale deforestation caused by commercial logging, plantation development, and subsequent expansion of smallholder and industrial plantation for oil palm, pulpwood, rubber and other commodities presents a challenge for the long-term conservation of forest vertebrates on Borneo (Abood et al. 2015; Gaveau et al. 2017). This acts synergistically with threats from indiscriminate hunting and from the wildlife trade (Collar 2015; Harris et al. 2017). Currently, Borneo is the world's largest oil palm producing region with 8.3 Mha of industrial plantations (Gaveau et al. 2016), and the demand for palm oil is projected to continue to increase (Malins 2017).

Also of crucial importance is the fact that Kalimantan contains 45 sub-tribes with unique, irreplaceable indigenous cultures (Dengen et al. 2018). They are major stakeholders in the future of ecotourism in Kalimantan. Several ecotourism destinations in Kalimantan offer unique experiences to the would-be tourist: Sebangau has a black water ecosystem; Tanjung Puting has orangutans; Danau Sentarum has a lake panorama; and Tarakan has proboscis monkeys. Other potential ecotourism destinations in Kalimantan currently do not have defined characteristics that differentiate and recommend them in the way that already owned and branded destinations do. Therefore, these alternative ecotourism destinations need to immediately build distinctive brands to increase their competitiveness in the global ecotourism environment (Rhama 2019). Making this point strongly, King (2016) concluded that if Malaysia, Brunei, and Kalimantan are compared, then Malaysia (Sarawak and Sabah) has ambitions and have resources, Brunei does not have resources but has ambitions, while Kalimantan has resources but lacks ambitions (Santodomingo et al. 2015).

The Balikpapan Bay, located in East Kalimantan, is an area with ecosystems rich in high-value biodiversity (Lahjie et al. 2019; Sayektiningsih et al. 2019; Kreb et al. 2020). It also has beautiful natural scenery accentuated by the diversity of its protected fauna (MCL 2016). The Bay is divided into two administrative regions: namely, the city of Balikpapan and the Penajam Paser Utara Regency, which results in the Bay being in a very strategic position (Karim et al. 2019). As a result, the Bay has a crucial role as an avenue of transportation for people in these two areas. The various potential value of the Bay has enhanced the level of activity at this location. The most current one is the plan for the Indonesian New Capital City, "Nusantara" (IKN Nusantara), in the district of Penajam Paser Utara.

Therefore, we considered it is necessary to conduct a study to provide information about the location of unique species and points of natural beauty as potential ecotourism attractions in Balikpapan Bay. We expect that the results of this study will give insight to the local government and stakeholders regarding the potential of Balikpapan Bay as an ecotourism destination.

MATERIALS AND METHODS

Study area

The study was conducted by doing survey at 19 observation points with a total of four survey occasions (Figure 1). The research location was in the vicinity of Balikpapan Bay. The survey started at a small pier in a creek of Somber River (1) then headed to the observation points that included: Nelayan Berdasi Fishing Village (2); Somber River (3); Tanjung Batu (4); Djenebora Fishermen Village (5); Pantai Lango Fishermen Village (6); Tempadung River Estuary (7); Balang Island Bridge - Long Span (8); Balang Island Bridge - Short Span (9); Maridan Village (10); Benawa Island 1 (11); Benawa Island 2 (12); Pemaluan River (13); Sabut River (14); Jawang Island (Mada Beach) (15); Mentawir Ecotourism Mangrove Village (16); Great Maloi River (17); Sambo River (18); Small Maloi River (19) and Tipis Cape (20).

Data collection procedures

Data were collected using a Boat Survey method by tracking along the Bay and the river flowing into it (Atmoko et al. 2014, 2021; Lahjie et al. 2019; Mediawati et al. 2021a; Mediawati et al. 2021b). The direct field observations included 10-19 observation points. The data were collected from a total of four survey occasions. At the time of data collection, GPS was used to determine the coordinates of locations where species were observed and studied. Smartphones and notebooks were used to record the research results. In addition, two cameras were used, namely Canon Eos 7D and Nikon Coolpix P1000 equipped with Tamron SP 150-600mm f/5-6.3 DI VC USD G2 lenses and Velbon tripods. The survey trips for data collection used a wooden boat with a double engine of each 24 horsepower (HP), complete with security equipment. The 'tides' application program was used (Putera et al. 2021). The data collection procedure began with 10 locations as observation points in the 1st survey trip. The observation points for data collection increased in the following surveys due to information collected from fishers and people living along the Bay who recommended several other potential points for investigation. Observations were carried out mostly between morning and evening, with the exception of the 4th survey, when researchers spent a night on the Sambo River. Observations were conducted in such a way as to minimize disturbance to the animals being observed.

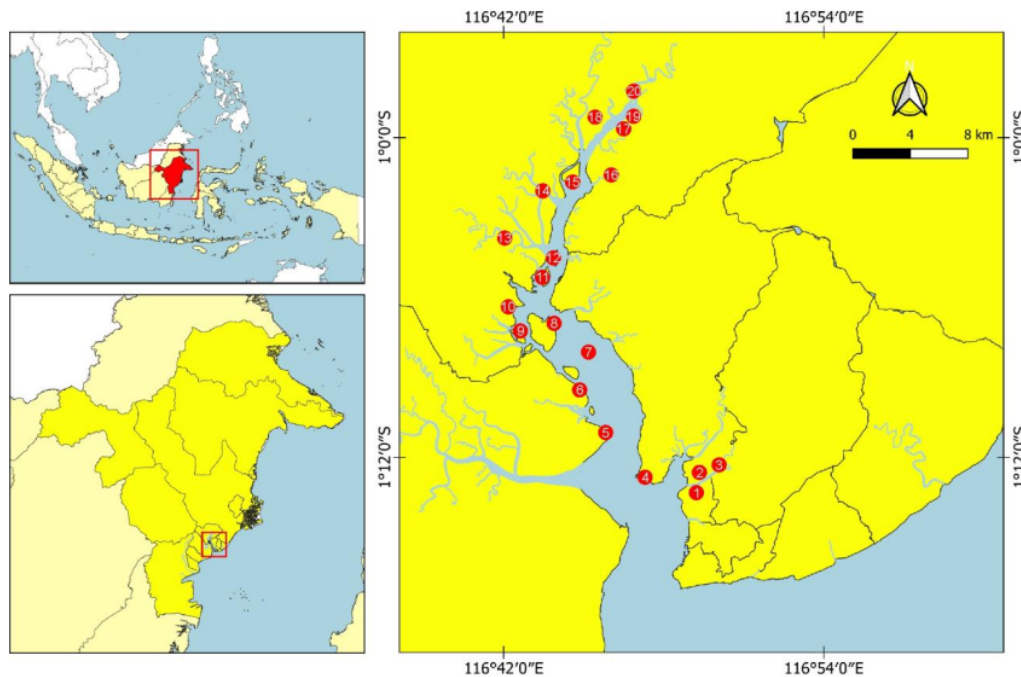


Figure 1. Map of Balikpapan Bay, East Kalimantan, Indonesia and the study areas

RESULTS AND DISCUSSION

Overview of the species diversity in Balikpapan Bay

Balikpapan Bay is located between the city of Balikpapan and North Penajam Paser Regency (PPU). The Bay area has primary and secondary mangrove forest, which is in diminishing condition due to the construction of housing and the development of industrial area (Malik et al. 2019). According to Lahjie et al. (2019), Balikpapan Bay is a strategic port in the province of East Kalimantan, which has rapidly gained prominence domestically as one of the leading ports of Indonesia. Balikpapan City is now the primary trade and industry center for mining, fishing, plantation and forestry in East Kalimantan. Consequently, development in Balikpapan Bay has caused significant ecosystem destruction. Approximately 47.6% of the mangrove ecosystem has been lost, and mangrove forests have decreased by around 12.5% in the last 15 years. Specifically, mangrove forests decreased from 19,428 ha in 2002 to 17,000 ha in 2017 (Lahjie et al. 2019). The validation of Indonesian new constitution, Undang-undang RI Nomor 3 tahun 2022 about the new capital of Indonesia (IKN) is, confirms the plan of relocating the Indonesian Capital City from Jakarta to the district of Penajam Paser Utara. This new plan of IKN would make Balikpapan Bay as the water access to the new capital city. This would add additional weight to the ecosystem of Balikpapan Bay. Therefore, a balance concept of development and conserving ecosystem is necessary to minimize large-scale

habitat destruction that has impacted some species on the endangered species lists.

Zarghi and Imani (2014) stated that ecotourism could be defined as a form of tourism that is responsible for preserving unspoiled areas, providing economic benefits, and maintaining the socio-cultural integrity of local communities. Ecotourism is a form of travel to natural areas for many tourists who have insight and sensitivity regarding the natural environment (Polónia et al. 2015). The International Ecotourism Society defines ecotourism as "responsible travel to natural areas that conserves the environment, supports the well-being of local communities and involves interpretation and education." Therefore, the success of a tourist attraction depends on the ability of tourism planners and managers to actualize the potential value of biodiversity as a tourist attraction (Hakim 2017; Karim et al. 2019; Aipassa et al. 2022).

The uniqueness of a tourist area is an attraction for visitors (Basalamah and Hariri 2020; Nala et al. 2021; Cahaya et al. 2021), especially related to ecotourism. According to the Law of the Republic of Indonesia Number 10 of 2009 on Tourism and Mayasari (2017), tourist attractions are those things that have uniqueness, beauty, and value in the form of various natural, cultural, and historical sites that become the object or purpose of the tourist's visit. Furthermore, Mayasari (2017) stated that there are six elements of tourist attraction, namely: authenticity and natural beauty, diversity, scarcity, uniqueness, wholeness, and usefulness. In addition,

Siahaya et al. (2021) stated that the tourism development strategy should aim to develop ecotourism by promoting ecotourism attractiveness, developing tourism education, and promoting diversity of flora, fauna, culture, and customs.

Ecotourism to achieve sustainable tourism has contributed 20% of international travel and has a growth rate of around 5% per year. Ecotourism destinations are generally characterized by a natural environment with abundant biological, cultural, geological, and meteorological diversity as the main attractions in Kalimantan (Rhama 2019). Studies at the local level suggest various obstacles faced in the development of ecotourism in Kalimantan (Purwanto et al. 2014). The identified problems include unclear status of the area and its management; insufficient planning documentation; no comprehensive data on area potential; unavailability of management; limited human resources such as management personnel; no partnerships in managing the area; limited funds and budgets; fires and forest encroachment; rock mining and hunting; community dependence on natural resources in the area; potential conflict over space use; wastes; and vandalism. Yuniarti et al. (2018) identified some additional issues relating to ecotourism, including the attractiveness of tourist facilities; accessibility; the condition of the community surrounding the area; management and services; accommodation; supporting facilities and infrastructure; the availability of clean water supply; and security. Wardah (2014) identified additional problems, including the importance of sustainable funding; support of local governments in developing the region; green business networks; and capacity building of human resources (Prasetyo et al. 2020).

Kalimantan, especially the Balikpapan Bay area of East Kalimantan, has ecotourism destinations that are not well known among locations on the global ecotourism map. Therefore, it is necessary to identify the unique biodiversity in the area as a potential ecotourism attraction. Šamšulová (2016) added policy development and human resources as two important factors that must be considered in order to improve ecotourism destinations in the case of Balikpapan Bay, East Kalimantan, (Putri et al. 2021). Currently, there are deficiencies in these two factors and so the preparedness of the Balikpapan Bay area to become an ecotourism destination remains questionable. According to Erwin (2013), ecotourism has three dimensions, namely: Conservation - i.e., tourism activities that help local nature conservation efforts with as little negative impacts as possible; Education - i.e., of tourists who desire to gain knowledge about the uniqueness of biology, ecosystems, and social activities in the area visited; and Social - i.e., the kind of tourism activities in which the local community has the opportunity to participate. Tourism objects and natural tourist attractions are high-value economic resources and, at the same time, are of medium value for the purposes of education and nature conservation. The development of natural tourist attraction objects is also closely related to increasing the productivity of forest resources that are of

vital concern to the government, community, and private party stakeholders.

Natural ecosystems in the Balikpapan Bay area offer many opportunities for development as tourist attractions. The Bay provides a unique natural panorama that includes tropical rain forest, mangrove forest, freshwater swamp forest, sandy beaches, and beautiful estuaries, all of which can be found within the area between the hinterland and coastline of the Bay (Mediawati et al. 2021a; Mediawati et al. 2021b). Kristiningrum et al. (2019) stated that in Mentawir Village, which is one of the villages included in the Balikpapan Bay area, there is a mangrove forest with 12 mangrove species. The forest is home to 16 types of mammals, 40 species of birds, one species of reptiles, and three species of amphibians (Kristiningrum et al. 2020). According to Lhota (2010), the mangrove forest in Balikpapan Bay has nearly 300 species of birds. Just within Kariangau Industrial Zone extending from the Centre of Balikpapan city to the coast in Western Balikpapan, Putera et al. (2018) claimed that 34 species of birds are recorded, of which two species are categorized as vulnerable (VU) by IUCN, namely: the Short-toed Coucal (*Centropus rectunguis*) and the Lesser Adjutant (*Leptoptilos javanicus*).

Based on our research involving four survey trips with up to 19 data collection points, we managed to spot several species in Balikpapan Bay, namely Irrawaddy Dolphins (Figure 4), Green Turtles, Hawksbill Turtles, Proboscis Monkeys (Figure 2), Lesser Adjutant locally called Bangau Tongtong (Figure 5), Fireflies and Golden Mangroves/Bakau lemit (Figure 3). These results confirmed the reports of Stark et al. (2012); MCL (2016); Toulec et al. (2020), who state that Balikpapan Bay has a diversity of protected wildlife species such as Proboscis Monkeys (*Nasalis larvatus*), Irrawaddy Dolphins (*Orcaella brevirostris*), Dugongs (*Dugong dugon*), Green turtle (*Chelonia mydas*), and other exotic fauna. This statement is in line with the research conducted by Kristiningrum et al. (2020), who found Proboscis Monkeys and various bird species in the Balikpapan Bay Area, especially in the Mentawir Village. Therefore, it appears that the mangrove forest habitat plays a very important role in conserving the local fauna of the Bay. According to Richards and Friess (2016), mangrove loss in Balikpapan Bay is slower than the loss nationwide or even in Southeast Asia. The loss of mangrove between 2000 and 2017 in Balikpapan Bay was 0.40% yr⁻¹, in Indonesia 1.72% yr⁻¹, and overall in Southeast Asia 2.12% yr⁻¹. Therefore, there remains significant opportunity for sustainable economic development that values and conserves the ecosystem in Balikpapan Bay.

Species spotted in Balikpapan Bay that are included in the IUCN Red List, are: the Hawksbill turtle, which belongs to the Critically Endangered category (Rodríguez 2010); the Irrawaddy Dolphin (Minton et al. 2017), the Proboscis Monkey (Boonratana et al. 2021; Mediawati et al. 2021), and the Green Turtle (Lhota 2010) all classified in the Endangered category; and the Lesser Adjutant classified in the Vulnerable category (Lhota 2010; BirdLife International 2017; Putera et al. 2021). For the fireflies, the

threat level cannot be ascertained because they are not verified yet. Based on data from IUCN, there are 126 species in the Lampyridae family, of which one species is in the Critically Endangered category, six species are in the Endangered category, and five species are in the Vulnerable category (Boonratana et al. 2021). Therefore, it is necessary to conduct further research to determine the species of fireflies in Balikpapan Bay and to assess their rarity. Regardless of their rarity, fireflies are potential ecotourism attractions because they provide quite amazing scenery on several riverbanks in the Balikpapan Bay area, especially on nights when there is no or very little moonlight. Firefly tourism is quite interesting to be developed. One of the firefly tours managed by a local community is the Firefly Watch in Iwahig Mangrove Forest in Puerto Princesa in the Philippines. In 2010, this tour managed to bring in 7032 visitors (Jayagoda 2016). In other areas, the combination of fireflies and Proboscis Monkeys has become an integrated ecotourism attraction. For instance, in several wetland areas in Sabah Malaysia, such as the Kota Kinabalu Wetland Centre, Kudat Mangrove Forest, and Klias Peninsular Wetland Reserve, fireflies and Proboscis Monkeys are primary attractions in these ecotourist destinations (Tahapary et al. 2020). Therefore, within Balikpapan Bay, the existence of the Proboscis Monkey, needs to be conserved as a potential ecotourism attraction. The current development of multiple industries within the Proboscis Monkey habitat of Balikpapan Bay, including chip mills, cement manufacturing, energy (power plants), paint production and shipping constructions, has caused significant habitat loss for Proboscis Monkey (Tarigan et al. 2017). However, Toulec et al. (2020) claimed that several palm oil bulking stations, refineries and biodiesel plants are the single most prominent cause of the loss of Proboscis Monkey habitat in Balikpapan Bay (35.6%). Toulec et al. (2022) claimed that the Proboscis Monkey is under strong anthropogenic pressure in his most recent research. A large population was predicted to decline due to the ongoing habitat loss and degradation, notably because of the forest fire.

Another important species found in Balikpapan Bay is the Irrawaddy dolphin (*Orcaella brevirostris*). It is an endangered marine and freshwater cetacean in South and Southeast Asia. Its population is distributed from coastal India and Bangladesh in the northeast through Myanmar, Thailand, Malaysia, Cambodia, Vietnam, the Philippines, and Indonesia (Minton et al. 2017). The species faces numerous anthropogenic threats, including gillnet entanglement, habitat degradation, pollution, noise, and boat disturbance (Minton et al. 2017; Kreb et al. 2020). This anthropogenic threat is also very likely to happen within Balikpapan Bay. This is because Balikpapan Bay is home to the largest oil industry in Indonesia (Tarigan et al.

2017). Most sea transportation uses ships to transport industrial materials and products. Industrial expansion along the coast of Balikpapan Bay has also increased since 2017 (Kreb et al. 2020). The development of the oil industry can cause habitat loss for biodiversity along the coast. In addition, the beach area as a fish nursery has decreased from 17,620 hectares in 1995 to 16,706 hectares in 2006 (Anwar et al. 2021).

Besides the existence of its protected fauna, the beauty of the natural scenery in the Balikpapan Bay area adds considerable value to its potential as an ecotourism destination. Breathtakingly beautiful sunset scenery is found at several points in the Bay when sundown is observed between the islands filled with forests of mangroves, some of which are still primary types of mangroves (Figures 6 and 7). Research conducted by Oktawati and Sulistianto (2015) found four types of mangrove species in the Kariangau District, while Anwar et al. (2021) identified 20 mangrove species in Balikpapan Bay. Kristiningrum et al. (2019) found that among twelve mangrove species in the area, the species *Rhizophora apiculata* was dominant compared to the other mangrove species. Based on observation, among the types of mangroves in the Balikpapan Bay area, this is a unique species that the local community refers to as "Mangrove Lemit" (Figure 7). The leaves of *Rhizophora apiculata* have a golden yellow hue; therefore, some people call it the Golden Mangrove (Figure 3). For the local community, this uniqueness is associated with cultural and spiritual beliefs. These beliefs are signaled culturally by the adoption of a yellow flag and by announcement in Paser Tribe customary law that the location is considered to be a "Religious Area". In interviews with local indigenous people (Suku Paser), the Manager of the Pro Natura Foundation Mitra Management of the Sungai Wain Protection Forest explained that in the folkloric wisdom of the local community, the yellow flag is regarded as a symbol of the existence of metaphysical power.

Planning for the surveys to observe the uniqueness of biodiversity in the Balikpapan Bay area was based on information obtained from several sources, including secondary data from several previous researchers, fishing people, and residents around the Bay. During the progress of the surveys, communication with local communities and fishermen provided additional information regarding areas and locations of potential value to be included in the list of observation sites. As a result, the number of observation points increased with every additional survey. In the first survey, there were only 10 observation points but by the time of the 4th survey the number of observation points increased to 17. This can be seen in the results of the surveys detailed in Tables 1 to 4 and the maps of the survey routes and observations shown in Figures 8 to 11.



Figure 2. A. Proboscis Monkey (*Nasalis larvatus*) at Nelayan Berdasi Fishing Village, East Kalimantan, Indonesia 2021 with inset of a female Proboscis Monkey. B. Morphology of a Proboscis Monkey (WWF 2020)



Figure 3. A. Golden mangrove, locally called Bakau Lemit, which actually is a unique variety of the species *Rhizophora apiculata* at Sabut River, East Kalimantan, Indonesia 2021. B. Morphology of normal *Rhizophora apiculata* leaves based on Flora Fauna Web (2019)

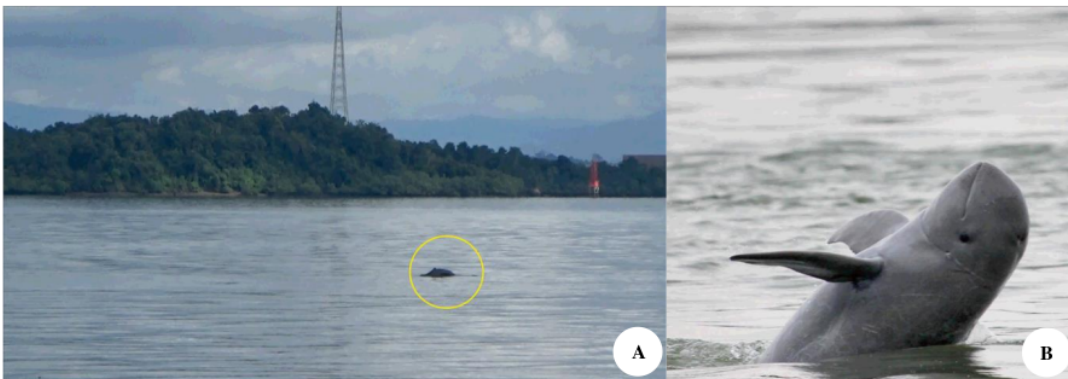
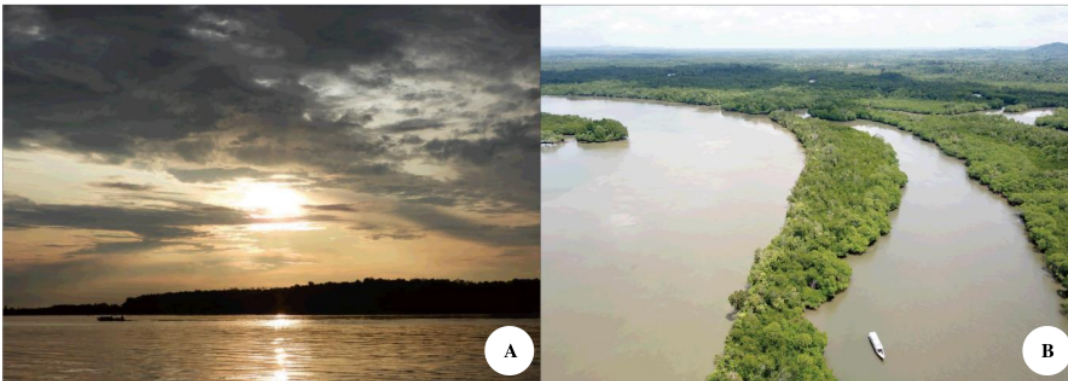


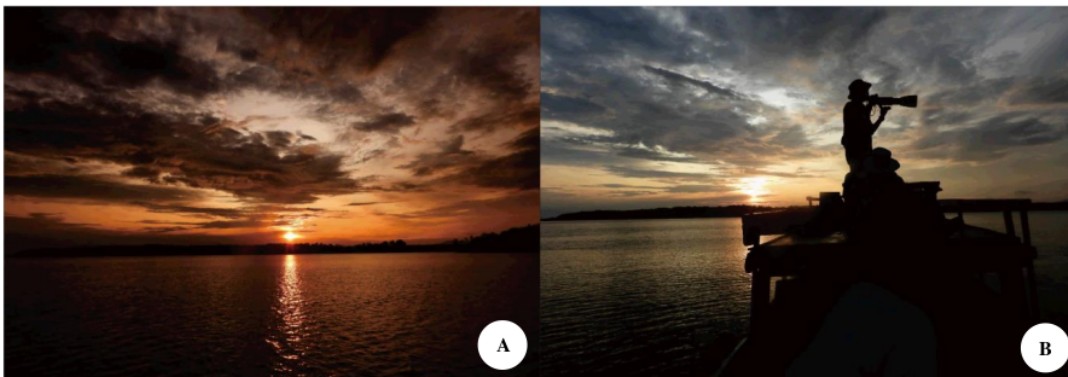
Figure 4. A. Irrawaddy Dolphin (*Orcaella brevirostris*) spotted at Tempadung River estuary, East Kalimantan, Indonesia 2021. B. *Orcaella brevirostris* morphology based on (WWF 2022)



Figure 5. A. Lesser Adjutant (*Leptoptilos javanicus*) spotted at Jawang island, East Kalimantan, Indonesia 2021. B *Leptoptilos javanicus* morphology based on (WWF 2021).



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Figure 6. A, B. Beautiful scenery at several points in Balikpapan Bay, East Kalimantan, Indonesia



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Figure 7. A, B. Breathtaking sunset at several points in Balikpapan Bay, East Kalimantan, Indonesia

Survey 1

The 1st survey, conducted on Sunday, April 25, 2021, started at 06:50 and ended at 15:30 WITA, meaning that the duration of data collection was 9 hours 20 minutes. The weather condition at that time was sunny and a bit windy. Although at the beginning, the tide was still relatively high, the outward flowing current was quite heavy. The direction of the survey boat was against the current; therefore, it took some time to reach the observation destinations. There were 10 observation points in this first survey, starting from Jalan Baru (a creek in the Somber River) then continuing to Tanjung Batu - Djenebora Fisherman's Village - Lango Beach Fisherman's Village - Tempadung River Estuary - Balang Island Bridge (long span) - Benawa Island 1 - Benawa Island 2 - Sabut River - Nelayan Berdasi Fishing Village (Kariangau) - Somber River - and ending back at the Somber River on Jalan Baru. The route of the 1st survey showing the 10 observation points can be seen in Figure 8.

The detailed activities of the 1st survey can be seen in Table 1. Across the observation points of the survey, five types of natural attractions were spotted, namely: Irrawaddy Dolphins; Proboscis Monkeys; Golden Mangroves (called Mangrove Lemit by the locals); small fish on the surface of the water around the pier; and beautiful natural scenery.

The Irrawaddy Dolphin (*Orcaella brevirostris*) was spotted at several locations. The 1st spotting was at the estuary of Tempadung River; then, the 2nd was spotted near the bridge of Balang Island. At both locations, only one adult individual was spotted. Later on, two adult Irrawaddy Dolphins were sited while on the way from Balang Island bridge to the 1st Benawa Island. When approaching closer to the 1st Benawa Island another Irrawaddy Dolphin was spotted. Then, a group of approximately 4 individuals was spotted, one individual of which seemed to be still juvenile. Finally, at one small river estuary near Benawa Island, approximately 10 dolphins in various sizes came in three groups.

Proboscis Monkeys (*Nasalis larvatus*) were found in one group of approximately 10 to 12 individuals in Kampong Nelayan Berdasi fishing villages in the Kariangau district. No other groups were observed in the mangrove area because the day was still bright. During bright days, monkeys are usually still deep in the forest of Wain River Protected Forest where they look for food before returning to the mangrove close to sunset time.

In addition to dolphins and proboscis monkeys, two groups of Golden Mangrove (i.e., the unique "Lemit Mangrove" yellow-leaved variety of *Rhizophora apiculata*) were found in the estuary of the Sabut River. One of them had more vegetation than the others. As was explained earlier, yellow flags and notices from the Paser tribe community are placed within those Golden Mangrove areas.

Also, during the 1st survey, crowds of various small fish observed around several traditional fishing piers presented a unique attraction. Around the piers of the Lango Beach Fisherman Village area, the fish were visible on the shallow water surface. These schools of small fish tended to approach us when we put our feet or hands into the water.

This suggests that the placement of a see-through waterfront table at breakfast time in this location would offer tourists an enjoyable experience of the diversity of small fish in the natural environment as an initial highlight to an Ecotourism journey. For ecotourists, the beautiful natural panoramas around Benawa Island 1 and Benawa Island 2 (Figure 6) would also be a major drawcard. In addition, it was realized that the possibility of observing the Lesser Adjutant stork species in the area would be another attraction for tourists.

The Lesser Adjutant, *Leptoptilos javanicus* (known locally as Ba⁶au Tongtong in the Balikpapan Bay Area), is classified as an Endangered species in the IUCN Red List. So, in planning for the 2nd survey, additional locations were added to the list of observation points in the hope of sitting behavior of this attractive bird species.

Survey 2

The 2nd survey was conducted on Wednesday, May 26th, 2021. It took a longer time than the 1st survey, i.e., more than 13 hours, starting at 07:40 am and finishing at 7:17 pm WITA. There were two reasons for this. Firstly, the trip covered a longer distance to reach an additional destination in anticipation of observing Lesser Adjutant. Second, additional information was collected on the beautiful sunsets to be observed at several points around the Bay at the end of the day. The weather conditions at the time of the 2nd survey were sunny with quite strong winds. The tide was high with quite heavy currents. At the time of departure departing, the water height was at its maximum and was just starting to recede sharply. This season was conducted during high tide season, so this extended the duration of the survey significantly compared to the first survey. The survey included 11 observation sites (Figure 9), starting from Jalan Baru (a creek in Somber river), then proceeding along the following route: Tanjung Batu - Djenebora Fisherman Village - Pantai Lango Fisherman Village - Tempadung River Estuary - Balang Island Bridge (long span) - Benawa Island 1 - Benawa Island 2 - Sabut River Estuary - Mada Beach at Jawang Island (locally known as Belanda Island) - Nelayan Berdasi Fishing Village (Kariangau) - Somber River - and finally ending at Jalan Baru.

Table 2 records the details of observations made across the 11 points of the 2nd survey. The same five types of natural attractions that were observed as in the first survey were also observed in this survey, namely: Irrawaddy Dolphins; Proboscis Monkeys; Golden Mangroves; schools of small fish on the surface of the water around the piers of Pantai Lango Fisherman Village; and beautiful scenery around Benawa Island. However, some of the locations and the number of individuals of the Irrawaddy Dolphin (*Orcaella brevirostris*) found were different from what was observed in the first survey. Dolphins were spotted in the estuary of the Tempadung River in 2 pods of approximately 7 individuals each, which was more than was found at the same locations in the first survey. However, that was the only observation point where Irrawaddy Dolphins were spotted during the second survey.

Four groups of Proboscis Monkeys (*Nasalis larvatus*) were spotted at the Somber River, three groups of those were a usual group which led by one big nose male Proboscis Monkey as the "Dominant Male" while the other group consisted only young male proboscis monkeys, called as an all-male group (AMG) (Atmoko et al. 2014). An additional two other groups of Proboscis Monkey were

spotted at Nelayan Berdasi Fishing Village. However, the Proboscis Monkeys at the Nelayan Berdasi Fishing Village did not stay long, only passing the area briefly.

In addition to dolphins and proboscis monkeys, the attraction of schools of small fish was again observed at the pier, Golden Mangrove groves were again observed, as was the spectacular scenery of the area.



Figure 8. Route of the 1st survey 25 April 2021

Table 1. Ecotourism attractions spotted in the 1st survey of Balikpapan Bay, East Kalimantan, Indonesia (25 April 2021)

Ecotourism attraction	The location has been spotted	Number of individuals spotted	Note
15 Irrawaddy Dolphin (<i>Orcaella brevirostris</i>)	Tempadung River Estuary	24 1 individual	Adult
	Near Balang Island Bridge	1 Individual	Adult
	Some distance to Benawa Island 1	2 Individuals	Adult
	Near Benawa Island 1	1 Individual	Adult
	At the Benawa Island 1	4 individual (1 group)	With juvenile
	Estuary of a small river near to Benawa Island 1	10 individual (3 groups)	With juvenile
Proboscis Monkey (<i>Nasalis larvatus</i>)	Nelayan Berdasi Fishing Village	1 Group (est. 10 individual)	Proboscis Monkey only passing by
Golden Mangrove/Bakau Lemit (<i>Rhizophora apiculata</i>)	Sabut River Estuary	2 Groups	One group has a larger area than another
School of small fish in the water surface	Pier of Pantai Lango fisherman Village	Not countable	The school of fish was clearly visible from the surface, and the school tended to come forward approaching visitors
Natural Scenery	Surrounding Benawa Island 1 and 2		



Figure 9. Route of the 2nd survey, 26 May 2021

Table 2. Ecotourism attractions spotted in the 2nd survey of Balikpapan Bay (26 May 2021)

Ecotourism attraction	The location has been spotted	Number of Individual	Note
Irrawaddy Dolphin (<i>Orcaella brevirostris</i>)	Tempadung River Estuary	2 Groups (app. 7 individuals)	The only location that spotted on 2 nd survey
Proboscis Monkey (<i>Nasalis larvatus</i>)	Somber River Nelayan Berdasi Fishing Village	4 Groups 2 Groups	Monkey just returning from the forest. The monkeys are just passing by
Golden Mangrove / Bakau Lemit (<i>Rhizophora apiculata</i>)	Sabut River Estuary	2 Groups	Similar condition no significant change
School of small fish in the water surface	Pier of Pantai Lango Fisherman Village	Not Countable	Similar condition as 1 st survey
Lesser Adjutant (<i>Leptoptilos javanicus</i>)	Mada Beach at Jawang Island	5-6 individuals	Lesser Adjutant was feeding on the beach
Natural Scenery	Around Benawa Island 1 and 2		
Beautiful Sunset	Seen from surrounding Benawa Island 1 and 2		

Besides these five attractions, in this 2nd survey, observations were made of the Lesser Adjutant (*Leptoptilos javanicus*). From 5 to 6 individuals of Lesser Adjutant were seen feeding at Mada beach in Jawang Island, which the local people call Belanda Island. Also, during the 2nd survey, more information of was gathered about other protected fauna as potential ecotourism attractions, namely about the possibility of Green Turtle (*Chelonia mydas*) and

Hawksbill Turtle (*Eretmochelys imbricata*) at Sambu River. Since both of these turtles are in the category of Protected species in the IUCN red list, with the Green Turtle is classified as Endangered, and the Hawksbill turtle is classified even higher as Critically Endangered. As a result of this information, we decided to add Sambu River to the list of observation points for the 3rd survey.

Survey 3

The 3rd survey was conducted on Saturday, October 23rd, 2021, and covered 13 observation points. However, the duration for the survey was about the same as for the 2nd survey (i.e., about 13 hours) because an additional 24-horsepower engine was applied to the boat. The survey started at 08:15 am and finished at 7:15 pm WITA. The weather conditions at that time were sunny and a bit windy. The current against the direction of the boat was again quite heavy. The tide was high with water height just past the peak and beginning to recede sharply. The survey consisted of 13 observations sites, slightly different in pattern from the previous survey with the route taking in a different part of the bridge, the short span of Balang Island Bridge on the return trip. Therefore, the Village of Maridan was added as an observation point. To save time, since the 3rd survey did not focus on the kinds of biodiversity already observed in the 1st and 2nd survey, and so the Djenebora Fisherman Village was skipped as an observation site. Therefore, the route for 3rd survey was as follow: again starting from Jalan Baru (a creek in Somber river) and then progressing to the following destinations Tanjung Batu - Pantai Lango Fisherman Village - Tempadung River Estuary - Balang Island Bridge (long span) - Benawa Island 1 - Benawa Island 2 - Sabut River Estuary - Mada Beach at Jawang Island (locally known as Belanda Island) - Sambo River - Maridan Village - Balang Island Bridge (short span/Rainbow Bridge) - Nelayan Berdasi Fishing Village (Kariangau) - Somber River - then returning to Jalan Baru (Somber River). The route is mapped in Figure 10.

All seven potential attractions for Balikpapan Bay Ecotourism observed in the first two surveys were confirmed in the 3rd survey (Table 3). However, for the Irrawaddy Dolphin and Proboscis Monkey, there were some differences both in locations and numbers. Within 15 minutes of the start, the first Irrawaddy Dolphin was spotted at the first point of observation, Tanjung Batu. In contrast, in the 1st and 2nd surveys, there were no Irrawaddy Dolphins spotted in that area. It was a single adult Irrawaddy Dolphin at Tanjung Batu, relatively larger than dolphins sited in the previous surveys. In this 3rd survey, at the Tempadung Estuary, no Irrawaddy Dolphins were spotted, possibly because about six fisherman boats were in the process of casting nets for fishing at the time when our observations were being conducted. But under the Balang Island Bridge (the long span side of the bridge), a little bit on from the Tempadung Estuary, a pod of four to five Irrawaddy Dolphins was spotted. One of these dolphins, possibly a juvenile, was much smaller in size than the rest.

Proboscis Monkeys were again spotted in similar places and with similar types of groups as in the first two surveys. Most likely, they were the same Proboscis Monkeys as spotted in the 2nd survey. At the Somber River, three groups were spotted; two of those groups were the normal groups with one dominant male, while the other group was an all-male group (AMG).

The Lesser Adjutant was again spotted at Mada beach on Jawang Island. However, they were only three individuals seen. They were possibly others further inland

because those three individuals were also very far inland and were not easy to spot.

On the return part of the trip, the route was different than in the previous two surveys. The team found that the view around the Pelangi Bridge (Balang Island bridge short span) was quite beautiful. This added another site to the to the list of potential ecotourism attractions.

However, despite the effort made, this 3rd survey was not successful in spotting turtles, neither the Green Turtle nor the Hawksbill Turtle. Although a fisher boat that passed by during the search informed us that two turtles had been spotted nearby, our team was not able to spot any turtle. The team received information that turtles were more usually spotted further upstream in the Bay. Additionally, information was provided that fireflies are more usually to be observed at several upstream riverbanks, namely Pemaluan River, Maloi Besar River, Maloi Kecil River, and at the delta of Mentawir Estuary. Therefore, the 4th survey was planned to venture further on, to the most upstream part of the Bay, the Tanjung Tipis.

Survey 4

The 4th survey was planned to reach more observation points up to Tipis Peninsula at the end of Balikpapan Bay (Tanjung Tipis). The trip was planned to take two days overnight in the Balikpapan Bay area in order to verify the existence of hawksbill and green turtles. In addition, by spending a night in the Bay, the team planned to prove the existence of fireflies on several riverbanks within the Bay area. The 4th survey was conducted on Wednesday and Thursday, on November 3rd and 4th, 2021, with 19 (nineteen) observation points (Figure 11). The 4th survey began at 15:30 WITA on November 3, 2021, and concluded at 16:30 on Thursday. The trip lasted a total of 25 hours. Weather conditions were cloudy and windy. It was a medium-level tide with water just beginning to recede at the time of departure. As one of the targets was to verify the existence of Fireflies, the trip was conducted while the moon was very small (only 1%) based on the Tide application program. Thus, dark conditions were expected to provide a more contrasting view for observing the presence of fireflies. The routes for the first and second days of the 4th survey are depicted in different colors in the route map shown in Figure 11.

On the first day, there were 12 observation points starting from the same starting point as in three previous surveys (i.e., Tanjung Batu) and then progressed on to - Djenebora Fisherman Village - Tempadung River Estuary - Pantai Lango Fisherman Village - Balang Island Bridge (long span) - Benawa Island 1 - Benawa Island 2 - Sabut River Estuary - Pemaluan River - Maloi Kecil River - Maloi Besar River - with an overnight stay at Sambo River. The next day's trip included 7 points of observations; was starting from Sambo River - then on to Tanjung Tipis (Tipis Cape) - Mentawir Mangrove Ecotourism Village - Jawang Island/Mada Beach - Maridan - Balang Island bridge (Short span/Rainbow Bridge) - Nelayan Berdasi Fishing Village (Kariangau) - Somber River - finally, returning to Baru Street (a creek on the Somber River).

During the 4th survey, the ecotourism attractions spotted in the previous survey were spotted again. For Irrawaddy Dolphins, Proboscis Monkeys, and Tongtong Storks, there

were some changes in location and number of individuals spotted.



Figure 10. Route of the 3rd survey, 23 October 2021

Table 3. Ecotourism attractions spotted in the 3rd survey of Balikpapan Bay (23 October 2021)

Ecotourism attraction	The location has been spotted	Number of individual	Note
Proboscis Monkey (<i>Nasalis larvatus</i>)	Somber River Nelayan Berdasi Fishing Village	3 Groups 2 Groups	2 Normal group; 1 AMG Normal group
Irrawaddy Dolphin (<i>Orcaella brevirostris</i>)	Tanjung Batu Balang Island (long span)	1 Individual 4 - 5 Individuals	Adult 1 is juvenile
Golden Mangrove / Bakau Lemit (<i>Rhizophora apiculata</i>)	Sabut River Estuary	2 Group	Similar condition, no significant change
School of small fish in the water surface	At Pier of Pantai Lango Village Fisherman	Not spotted	Water is very low and not clear
Lesser Adjutant (<i>Leptoptilos javanicus</i>)	Mada Beach at Jawang Island	3 Individuals	A similar location
Natural scenery	Balang Island Bridge (short span)		Local called Pelangi Bridge (Rainbow Bridge)
Hawksbill Turtle (<i>Eretmochelys imbricata</i>)	Sambo River		Not spotted
Green Turtle (<i>Chelonia mydas</i>)	Sambo River		Not spotted

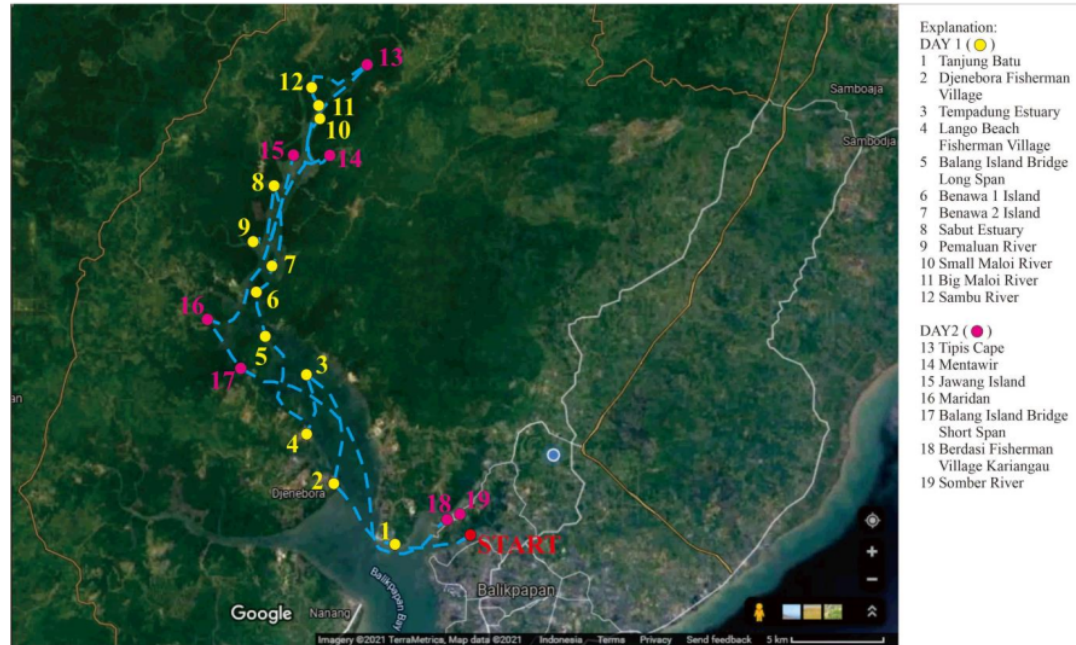


Figure 11. Route of the 4th survey, 3 and 4 November 2021

Table 4. Ecotourism attractions spotted in the 4th survey of Balikpapan Bay (3 and 4 November 2021)

Ecotourism attraction	The location has been spotted	Number of individual	Note
Proboscis Monkey (<i>Nasalis larvatus</i>)	Somber Creek (Near Jalan Baru) Somber River Nelayan Berdasi Fishing Village	1 Group 3 Groups 2 Groups	Normal group 2 Normal groups; 1 AMG All normal groups. One group were crossing the creek
Irrawaddy Dolphin (<i>Orcaella brevirostris</i>)	Mentawai River Estuary	2 - 3 Individuals	Adult
Small fish on the water surface	Same location	Uncountable	Spotted
Golden Mangrove / Bakau Lemit (<i>Rhizophora apiculata</i>)	The Estuary of Sabut River	2 Groups	Similar Condition, No significant change
Lesser Adjutant (<i>Leptoptilos javanicus</i>)	Mada Beach / Jawang Island Mentawai River Estuary	4 Individuals 10-11 individuals	
Hawksbill Turtle (<i>Eretmochelys imbricata</i>) / Green Turtle (<i>Chelonia mydas</i>)	Peninsula Tipis	4 - 5 Individuals	Still unclear which species as it shows in a very short time
Fireflies (<i>Lampyridae</i>)	Maloi Kecil River Maloi Besar River Pemaluan River	Not countable Not countable Not countable	Spotted at both sides of the riverbanks. Starting to arrive around 20.00 WITA then later the number arise

The survey had a great start. The team spotted the first group of Proboscis Monkeys in a mangrove even before leaving the Creek of Somber River near Baru Street. The group was a normal group of about 10 members with a

dominant male. The Proboscis Monkeys were spotted again on the return journey on the second day of the 4th survey. They were spotted at Somber River in three groups: two groups were the normal group with a dominant male, and

one was an AMG. Two groups of Proboscis monkeys were also spotted in the Nelayan Berdasi Fisherman Village. One of these two groups gave the team a breath-taking moment as they were crossing a small creek. The dominant male led the group by jumping from the mangrove tree into the water and then swimming to the other side of the mangrove.

The Irrawaddy Dolphins were spotted in two areas. On the first day of the 4th survey, the team spotted about three adult individuals of Irrawaddy Dolphin on the way between Benawa Island 1 and Benawa Island 2. On the second day, the team spotted four to five Irrawaddy Dolphins much further upstream of the Bay, between Sabut River Estuary and Jawang Island.

Lesser Adjutants (*Leptoptilos javanicus*) were spotted in two areas. The first area was the same as in the previous survey; i.e., at Mada Beach on Jawang Island, where there were four individuals. The second area was the Delta of Mentawir River Estuary. In this second area, the Lesser Adjutants spotted were approximately 11 to 12 in number. The Lesser Adjutants at the Delta site were feeding. Since the water was very low, many parts of the Delta were protruding above the water level.

The 4th survey was not only successful in confirming the result of the previous survey but also successful in proving the existence of the turtles and the fireflies. About four individual turtles were spotted in the area around the narrow cape close to the end of the Bay, which the local people know as Cape Tipis (Tanjung Tipis). Turtles were also spotted at the Sambo River, swimming and just slightly above the water surface. Thus, taking the image of the turtle using the camera was not successful. Since the wind in that area was quite strong, the team was not successful in releasing the drone to take photos. Based on their look and size, it was assumed that most of these turtles belonged to the Green Turtle species (*Chelonia mydas*), while one of them appeared to be a Hawksbill turtle (*Eretmochelys imbricata*). However, observations of the turtles were sub-optimal because they were only seen occasionally in the water and did not emerge on land. Therefore, the team had difficulty in confirming the exact species of the turtles. Further research will be required to verify the species of the turtles.

The team managed to locate the presence of fireflies along several riverbanks. At the Pemaluan Riverbanks, the fireflies were spotted in Nypa palm vegetation (*Nypa fruticans*). In contrast, at the Maloi Kecil River and the Maloi Besar River, the fireflies were spotted in symbiosis with mangroves of the species *Rhizophora apiculata* and plants from the species *Scyphiphora hydrophyllacea*. The fireflies began to arrive around 20.00 WITA, but became more crowded later in the night. At around midnight, the views along those riverbanks during the firefly watch were enchanting. They were like natural Christmas trees scattered along the riverbanks. However, the team was unable to take pictures of those fireflies due to the limited ability of the camera to take their photos in very dark conditions. Moreover, the boat was not completely steady, having slight movements due to the current.

Results from the four survey occasions indicated that the Proboscis Monkey would be Balikpapan Bay's most accessible Ecotourism attraction for tourists to enjoy in comfort. The locations of the Proboscis Monkey's spots are relatively close to the city and easier to reach than the other attractions. In each survey, the team was always able to spot the monkeys and they were always within similar locations. The Lesser Adjutant was also consistently spotted within an identified locality in each survey. However, the further distance from the city to the Lesser Adjutant location would necessitate at least two to three hours of travel by a normal passenger wooden boat. The Irrawaddy Dolphin was also successfully spotted in each survey, but the location of the observed dolphin pods varied among the four survey trips. Therefore, more patience and effort would be required by tourists in order to spot the dolphins. The fireflies were spotted within the same well-defined area, but the locations were quite far from the city. Besides, to enjoy the fireflies requires a night trip, cruising along the river banks through the mangrove forest about 4 hours from the city. This would create another challenge for the tourist. Finally, more effort would be required if tourists wished to observe the turtles. The turtles are difficult to spot and the locations are far from the city in the most upstream section of the Bay. To watch the turtles, tourists would most likely have to stay overnight in one of the villages within the Bay.

In conclusion, based on four systematic field surveys by boat of 19 observation points, seven biodiversity attractions were identified within Balikpapan Bay. These attractions were Proboscis Monkeys, Irrawaddy Dolphins, Golden Mangroves, diverse schools of small fish close to shore, Lesser Adjutant Storks, Green Turtles, Hawksbill Turtles, and Fireflies. In addition, the beautiful scenery at various points around the Bay, especially at sunset, were identified as of potential value to ecologically-minded tourists seeking not only to enjoy the Bay's natural beauty but also to contribute to its conservation. The government plan of relocating Indonesia capital city nearby the Bay has stimulated the promotion of Balikpapan Bay as a tourist attraction to potential visitors. This offers ecotourism opportunities to be developed in the Bay for the benefit of local communities aspiring to conserve and profit from the natural beauty and resources of the East Kalimantan littoral environment. A sustainable Ecotourism concept that empowers the community and ensures the balance between utilization and regeneration capacity of resources should be applied.

The results of this investigation recommend that further research be undertaken to identify the particular species of fireflies and turtles observed in these surveys. This is necessary to scientifically document their relative diversity, abundance and fragility. Research is also necessary to locate additional spots of unique biodiversity within still unexplored habitats of Balikpapan Bay.

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