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Physical Carrying Capacity of the Semama Island Wildlife Sanctuary

(Daya Dukung Kawasan Suaka Margasatwa Pulau Semama)

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ABSTRACT

The Semama Island Wildlife Sanctuary (SIWS) was part of the Derawan National Tourism Strategic Areas (NTSA) with great potential. As a conservation area, tourism should consider the carrying capacity at SIWS for its optimal development. Therefore, this study aimed to estimate the carrying capacity of the SIWS area using the Physical Carrying Capacity approach. Literature studies, field observations, and interviews were conducted in October 2021 to collect data. The results showed that the pyhsical carrying capacity of the SIWS was 506 people per day, consisting of 45 mangrove tours, 401 snorkeling, and 60 birdwatching activities, indicating the maximum number of visitors the SIWS could accommodate. This information is essential as a consideration for future tourism development.

INTISARI

Suaka Margasatwa Pulau Semama merupakan kawasan konservasi yang termasuk dalam wilayah Kawasan Strategis Pariwisata Nasional (KSPN) Derawan dan memiliki potensi wisata yang dapat dikembangkan guna menunjang KSPN Derawan. Sebagai salah satu kawasan konservasi, maka pengembangan wisata di SM Semama harus memperhatikan aspek daya dukung kawasan. Tujuan penelitian ini adalah menghitung daya dukung kawasan SM Pulau Semama dengan menggunakan pendekatan Daya Dukung Kawasan (DDK). Penelitian dilakukan pada Oktober 2021 melalui studi literatur, observasi lapang dan wawancara. Berdasarkan hasil perhitungan, nilai DDK SM Semama adalah 506 orang/hari dengan rincian wisata mangrove 45 orang/hari, snorkeling 401 orang/hari, dan birdwatching 60 orang/hari. Data tersebut merupakan jumlah maksimal pengunjung yang dapat ditampung oleh Kawasan SM Semama. Informasi ini dapat digunakan sebagai bahan pertimbangan dalam pembangunan pariwisata di Kawasan SM Semama di masa yang akan datang.

Introduction

Wildlife Sanctuary (WS) is a nature reserve area with great diversity and unique wildlife species, and the management can develop the habitats for their survival (Law No. 5 of 1990). As a form of conservation area management, WS should prioritize area protection. However, this area can also be a tourist destination, particularly for special interest tourism. Article 17, paragraph 2 highlights the activities included in the WS Area for special interest tourism.

Semama Island Wildlife Sanctuary (SIWS), Berau Regency, has become one of the WSs that has the potential for a tourist destination, mainly due to its large market share. Tourism development in the SIWS has excellent prospects because its location is in the Derawan Islands National Tourism Strategic Area (NTSA), where the number of tourists has continued to increase every year after it received the Regent's approval. In 2017, the number of visitors to Derawan Island was 207,780. This number increased by 59.65% from the number of visitors in 2009, 3,426 (Ministry of Tourism 2018). The introduction of the Derawan Islands NTSA and the relocation of the capital city (IKN) to East Kalimantan will contribute to the increasing number of visitors to the Island. Besides, the growing population and other regional developments will also increase the demand for various tourist destinations, including the SIWS.

The SIWS area needs an integrated tourism development plan with great attention to area preservation as one of the main bases. Failure to consider environmental aspects, in this case, the carrying capacity, will adversely impact the area (Kamperman 2000; Saveriades 2000; Clivaz et al. 2004; Suleva 2007; Bowers 2016). Furthermore, Clivaz et al. (2004) stated that a decrease in biophysical quality, including disturbance to biodiversity, might occur when the number of tourists is uncontrolled. As a small island, the Semama WS area is vulnerable to change due to low biodiversity but higher endemic species, limited geographical size and resources, and a relatively isolated area (Directorate of Marine National Park and Conservation 2004). Moreover, environmental damage due to tourism development will affect the area's conditions.

The sustainable development principle must be applied to anticipate adverse impacts from tourism at SIWS, such as determining the regional carrying capacity (DDK) in a tourist destination. The tourism approach emphasizes the responsible use of economic, socio-cultural, and environmental resources for tourism development (Kunasekaran et al. 2017; Hieu and Rasovska 2017). Based on the Minister of Tourism Regulation No. 9/2021 mandated the calculation of the carrying capacity in sustainable tourism development. Wearing and Neil (2009) suggested that the carrying capacity concept becomes the basis of area protection and sustainable tourism development.

Furthermore, the carrying capacity concept in tourism development will limit the number of visitors, thereby preventing disturbance to both the physical environment and society, including tourist satisfaction (Clivaz et al. 2004; Richardson and Fluker 2004; Soemarwoto 2008; Sari et al. 2015). Hutabarat et al. (2009) explained the carrying capacity implementation in resource utilization to support marine tourism activities. Ketjulan (2010) also suggested that marine tourism is not mass tourism because it is vulnerable and has limited space for visitors.

The SIWS needs to calculate its physical carrying capacity as a newly developing area to determine the maximum number of tourists the region can accommodate, maximize the benefits, and minimize adverse impacts (Sasmita et al. 2014). Dirawan (2006) revealed that the physical carrying capacity is related to the environment's ability and depends on the

resources and systems to assimilate impacts. The area's physical capacity determines its tolerance capacity to accommodate tourists' activities flexibly and fulfill their satisfaction when carrying out activities. Carrying capacity is also the maximum intensity by balancing the long-term utility of natural resources (Ketjulan 2010). Therefore, the DDK calculations can be used as primary data to minimize unintended adverse impacts. This research aims to calculate the DDK in SIWS, Berau Regency, East Kalimantan Province.

Material and Method

Data collection was conducted at SIWS in October 2021, including tourist attractions, site area used for each activity, visit rotation, and operational time through field observation and interviews. A literature study was crucial to the research (Sugiyono 2018) to obtain information on the carrying capacity of tourism in the area. The literature includes books, journals, results, documents, and other reliable sources, such as the Semama WS Block Plan, Long Term Development, Area Damage, the Derawan National Tourism Strategic Area, and the Berau Regency Market and Business Model.

Observation is a research method to observe the subject directly (Krisyantono 2009). In this research, observation of the actual conditions of tourist attraction and SIWS environment intended to:

1. Determine the coordinates of each potential tourist attraction and the size of its area
2. Verify the suitability of secondary data with the actual conditions
3. Dig deeper into information on various aspects of tourism development, which included the availability of facilities and infrastructure, accessibility, and management conditions.

This research conducted in-depth interviews with the head and forest ecosystem managers of the East Kalimantan Natural Resources Conservation Center. The interviews used a semi-structured method to explore the tourism development plan in Semama WS. The key questions included tourism potential in the Semama WS Area, the number of visits, tourism development plans, facility development plans, the available area for tourism activities, permitted limits in conservation areas, specifically WS, and limiting factors in tourism development.

The carrying capacity analysis used the DDK approach based on the physical aspects. DDK was the maximum number of visitors that could be physically accommodated in an area at a particular time without causing disturbance to nature and humans. The DDK calculations used the Yulianda (2007) formula as follows:

$$DDK = K \times \frac{Lp}{Lt} \times \frac{Wt}{Wp}$$

Remarks:

DDK : PhysicalCarrying Capacity

K : Maximum ecological potential of visitors per unit area

Lp : Size of the area for utilization

Lt : Size of the area for specific tourist categories

Wt : Area operating hours

Wp : Time spent by visitors on tourism activities

Table 1. Time and space requirements for marine tourism activities

No	Activity	Time (Hour)	Visitors	Space requirement
1	Snorkeling*	3	1	500 m^2
2	Mangrove Tourism*	2	2	50 m^2
3	Birdwatching**	2	1	67 m^2

Source: *) Yulianda (2007), **) Douglas (1982)

Results and Discussion

Based on the Minister of Agriculture of Indonesia Decree No. 604/Kpts/Um/8/82 on August 19, 1982, the area of SIWS was 200 ha. Its morphology was a coastal plain with a flat topography, a slope of 5°-10°, a beach width of 8.5-10 meters, and an average shallow sea depth of 1.5 meters at medium tide. Moreover, it had a utilization block covering an area of ± 14,361 ha, consisting of coastal forests covering an area of ± 0.59 ha and mangrove forests of ± 13.78 ha (Figure 1).

SIWS was isolated from the tour packages in the Derawan Islands because it had no tourism activities yet. However, the managers planned to develop tourism potentials, such as mangrove forests, various kinds of underwater beauty, and rare birds such as the *linggisan* bird (seagull). Tourism development in SIWS should pay great attention to the number of visitors and the size of the area. Table 2 shows that the DDK of SIWS was 506 people per day.

Mangrove Tracking

Mangroves could grow in tidal areas with muddy, loamy, sandy, seawater-logged soil types and alternate saline and freshwater flow over time, becoming the main characteristic. Common types of mangrove vegetation included Rhizophora, Avicennia, Acanthus, Cerbera, Bruguiera, Ceriops, and Sonneratia.

The mangrove ecosystem consists of several zonings, such as Avicennia, Rhizophora, Brugueria, and Nipa (Cahyanto & Kuraesin 2013). With the characteristics of each mangrove vegetation, the

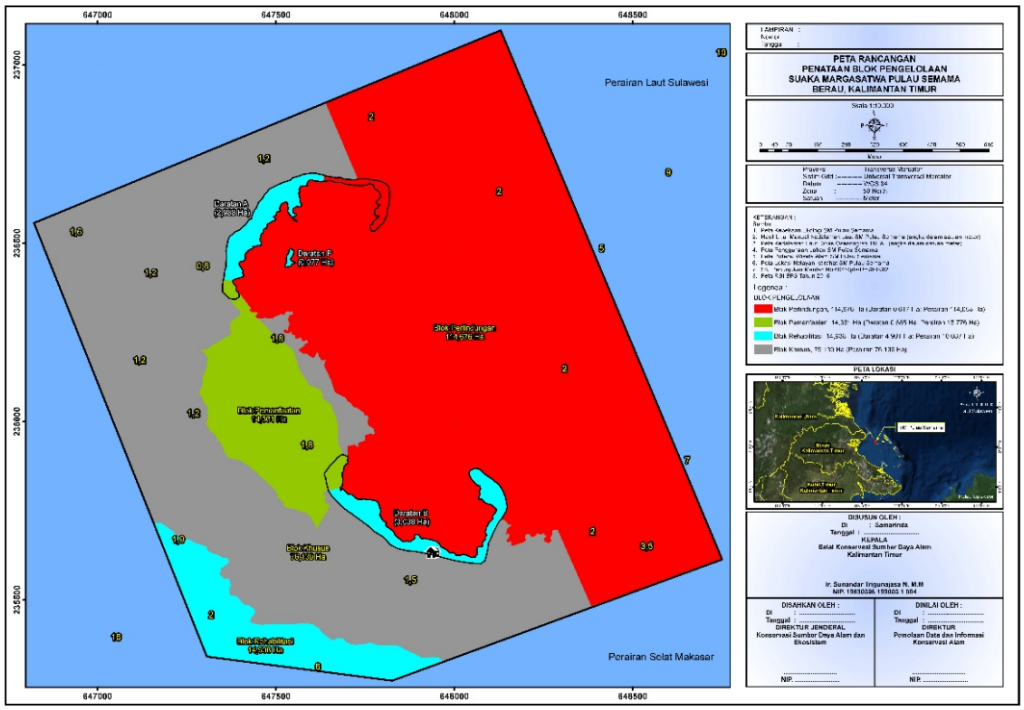

Figure 1. Management block of SIWS
Source: East Kalimantan Natural Resources Conservation Agency (2014)

Table 2. The Physical Carrying Capacity (DDK) of the SIWS Area

No	Activity	Area (ha)	Average visit (hour)*	Operational*	Rotation	Space requirement	DDK (people per days)
1	Mangrove	0.075	2	6	3	50 m^{2**}	45
2	Birdwatching	0.20	2	4	2	67 m^{2***}	60
3	Snorkeling	10.04	3	6	2	500 m^{2**}	401
Total							506

Source: *) Interviews results with management, **) Yulianda (2007), ***) Douglas (1982)

Figure 2. Mangrove ecosystem in the SIWS

entire area became shelters and breeding grounds for various marine biotas such as mollusks, fish, crabs, shrimp, and birds. Ecotourism development could become one of the utilization forms of the mangrove ecosystem to provide economic benefits for managers and the surrounding community without causing damage, as suggested by Muhaerin (2008).

The uniqueness of the mangrove ecosystem made it a tourist attraction due to the diversity of fruit shapes, flowering systems, and root systems. According to Bahar (2004), tourism potential in the mangrove ecosystem included the typical root forms of *Rhizophora* sp. with stilt roots, *Bruguiera* sp. with knee roots, *Sonneratia* sp. and *Avicennia* sp. with peg roots, and *Heritiera* sp. with plank roots. The mangrove ecosystem also consisted of zoning, which generally differed from the coast to the interior, fauna diversity (water birds, reptiles, mammals, primates, and aquatic animals), and the utilization of mangrove resources by the communities. With these, the mangrove forest ecosystem could host various tourist activities such as fishing, sailing, photography, swimming, wildlife attractions, observing plant species, hiking, and education.

The utilization blocks of the SIWS consisted of mangrove forests lying on the water and land areas (Figure 2). The designation of the utilization blocks considered their location, condition, and natural potential for the benefit of limited nature tourism and other uses (Figure 3). The water areas had attractive natural tourism with natural mangrove forest scenery and bird migration observation points. While the land areas, there were mangrove forests with no coastal coconut trees. SIWS have seven types mangrove (Table 3).

The managers planned to build a mangrove track in this ecosystem using wood with a length of 500 m and a width of 1.5 m. The track's primary function was to serve as a patrol route and route for special interest tourism. The Physical Carrying Capacity of mangrove tracking activities in the SIWS Area was 45 people per day.

Underwater Beauty

The SIWS had a fascinating underwater beauty with various species of seagrass beds, specifically *Cyamodocea rotundata* and *Halophila ovalis*. Other types included *Enhalus acroides, Thalassa hemprichii,* and *Syringodium isoetifolium*. The SIWS was also a habitat for green turtles (*Chelonia mydas*) and dolphins (*Ziphiicae/Dolphinidae*) (Ministry of Maritime Affairs and Fisheries 2015), and tiny seahorse fish 'Pygmy seahorse' (East Kalimantan Governor Regulation No 60 of 2019).

Snorkeling was one of the potential tourism activities in SIWS. Almost all of the islands in the

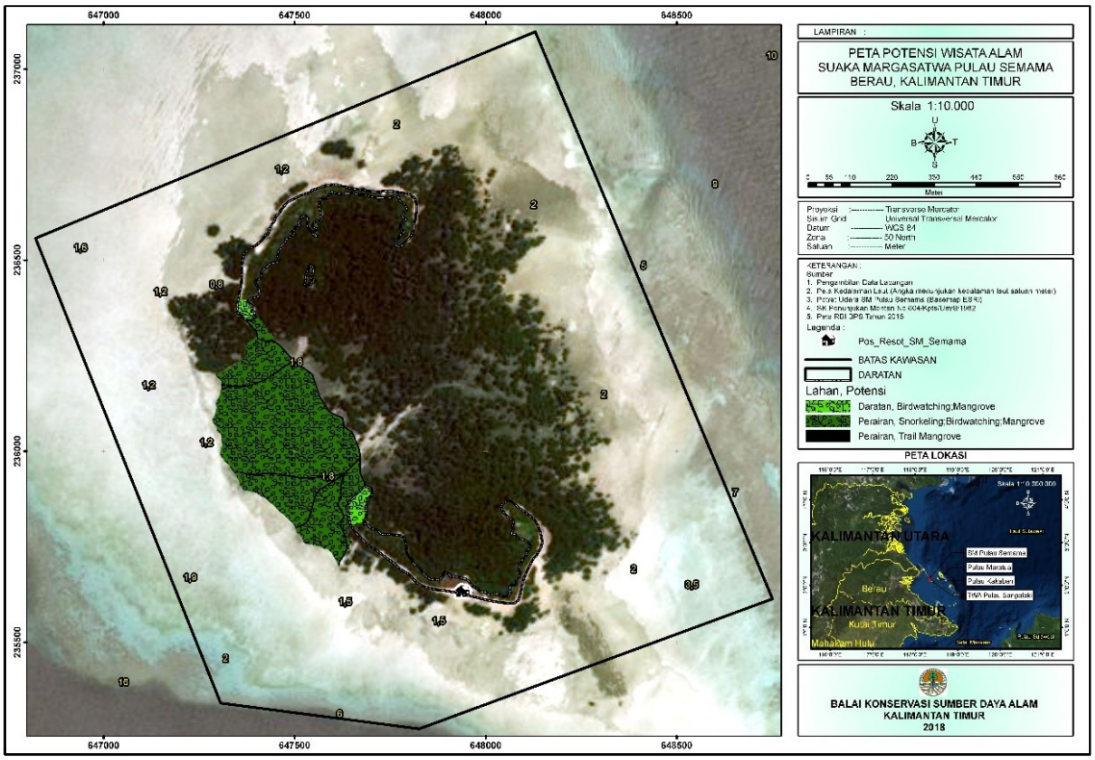

Figure 3. Mangrove distribution in the SIWS
Source: East Kalimantan Natural Resources Conservation (2014)

Table 3. Types and distribution of mangrove in the SIWS

No	Type of Species	Family	Distribution
1	*Lumnitzera racemosa*	Combretaceae	North Island
2	*Bruguiera gymnoriza*	Rhizoporaceae	Dominant center of the island
3	*Metopium* sp	Anacardiaceae	North island
4	*Sonneratia alba*	Sonneratiaceae	Dominant island edge
5	*Rhizopora stylosa*	Rhizoporaceae	Dominant center of the island
6	*Rhizopora mucronata*	Rhizoporaceae	Dominant center of the island
7	*Aegiceras floridum*	Myrsinaceae	South island

Source: East Kalimantan Natural Resources Conservation (2011).

Derawan Region have snorkeling sites. For example, Maratua Island has 50 snorkeling sites. The SIWS has a 10.4 ha of water area that could host the snorkeling activity from 08.00 a.m. – 04.00 p.m. WITA with six hours of effective utilization time because this area was affected by high tides. Based on these conditions, the physical carrying capacity of the Semama WS Area was 401 people per day.

The carrying capacity of SIWS was relatively lower than other islands. The carrying capacity of Anambas Archipelago Marine Tourism Park was 1,227 people per day with an area of 306.692 km (Ilham et al. 2018), while the Sabesi Island was 2,489 people per day with an area of 62.23 ha (Johan 2016), as well as Liukang Loe Island with a coral area of 24.65 ha and 983 people per day (Rajab et al. 2013). It was crucial to calculate the carrying capacity because human activities such as snorkeling affected the decline in coral reef quality (Schleyer & Tomalin 2000; Sahetapy 2010).

Bird Diversity

Birdwatching, especially the Cikalang or Frigatebird migrant bird, became a potential tourism activity in the SIWS area. MacKinnon et al. (2010) suggested that unique or endemic wildlife could attract visitors. Birdwatching could become a tourist attraction in the SIWS. Glowingski (2008) defined birdwatching as observing, identifying, and

photographing birds for recreational purposes. It became an ecotourism activity closely related to ecosystem protection because its locations were in the habitat of various bird species (Kurnia 2013). In the last two decades, birdwatching has become popular and rapidly grown as a fun recreational activity (BTBN (2010). In 2011, the USA hosted 47 million people of birdwatchers, of which 41 million were birdwatching around their homes and 18 million away from their homes (Carver 2013).

Birdwatching could become a medium to raise tourists' awareness about the importance of bird conservation in nature (Son et al. 2011). A professionally managed birdwatching activity would provide financial benefits and contribute to bird conservation efforts through habitat management (Cahyana 2007). It also provided economic benefits (Sekercioglu 2002) from the tourist visits and contributed to the conservation of various bird species (Widyasari 2013). For example, the annual economic value of birdwatching in Costa Rica reached $9 million (Maldonado et al. 2018) and $200 million in South Africa (Nicolaides 2014).

The SIWS area had 16 bird species from 11 families (Table 4 and Figure 4). Shorebirds dominated them, with the source of food in this area being aquatic biota. Seven families and birds used mangrove forest vegetation as food sources, such as nectar from mangrove flowers, and five families ate insects.

Table 4 indicated that seven species had high conservation status. Two species were listed in CITES Appendix II and protected (Government Regulation No. 5 of 1990 in conjunction with Government Regulation No. 7 of 1999). Five species were protected (Law No. 5 of 1990 in conjunction with Government Regulation No. 7 of 1999). All species fell in the Least Concern (LC) based on the IUCN criteria.

Copper-throated sunbird (*Nectarinia calcostetha*) and Collared Kingfisher (*Halcyon chloris*) were bird species protected by the Indonesian government but were not included in the CITES appendix and had the Least Concern status according to IUCN. The Collared Kingfisher and Copper-throated sunbird had the most frequency of encounters, with scores of 108 and 78, respectively. Meanwhile, the Mountain leaf warbler (*Phylloscopus trivirgatus*) and White-bellied sea eagle (*Haliaeetus leucogaster*) had a minor frequency of encounters (Figure 5).

The Semama Island in the Derawan Archipelago was a unique stopover for migratory birds, including the Great Frigatebird (*Fregata minor*). Meanwhile, Indonesia became one of nine bird migration flight

Table 4. List of bird species on SIWS

No	Species	Scientific name	Family	IUCN	CITES	Regulation (PP 7 Year 1999)	Rank in TSc
1	Copper-Throated Sunbird	Nectarinia calcostetha	Nectariniidae	LC		√	2
2	Collared Kingfisher	Halcyon chloris	Alcedinidae	LC		√	1
3	Great Frigatebird	Fregata minor	Fregatidae	LC			12
4	Small Frigatebird	Fregata ariel	Fregatidae	LC			4
5	Mountain Leaf Warbler	Phylloscopus trivirgatus	Phylloscopidae	LC			15
6	Common Iora	Aegithina tiphia	Chloropseidae	LC			5
7	Brahminy Kite	Haliastur indus	Acciptidae	LC	II	√	9
8	White-Bellied Sea Eagle	Haliaeetus leucogaster	Acciptidae	LC	II	√	14
9	Pacific Reef Heron	Egretta sacra	Ardeidae	LC		√	6
10	Eurasian Whimbrel	Numenius phaeopus	Scolopacidae	LC		√	7
11	Pied Imperial Pigeon	Ducula bicolor	Columbidae	LC			13
12	Ceyx Rufidorsa	Cyx rufidorsa	Alcedinidae	LC		√	10
13	Grey-tailed Tattler	Triga brevipes	Scholopacidae	LC			11
14	Glossy Swiftlet	Collocalia esculenta	Apodidae	LC			8
15	Black-nest Swiftlet	Collocalia maxima	Apopidae	LC			3
16	Dusky Megapode	Megapodius freycinet	Megapodiae	LC		√	16

Source: East Kalimantan Natural Resources Conservation (2011)
Note: IUCN (The International Union for Conservation of Nature), CITES (The Convention on International Trade in Endangered Species of Wild Fauna and Flora), LC (Least Concern), TSc (Timed Species Counts)

Figure 4. Birds in SIWS

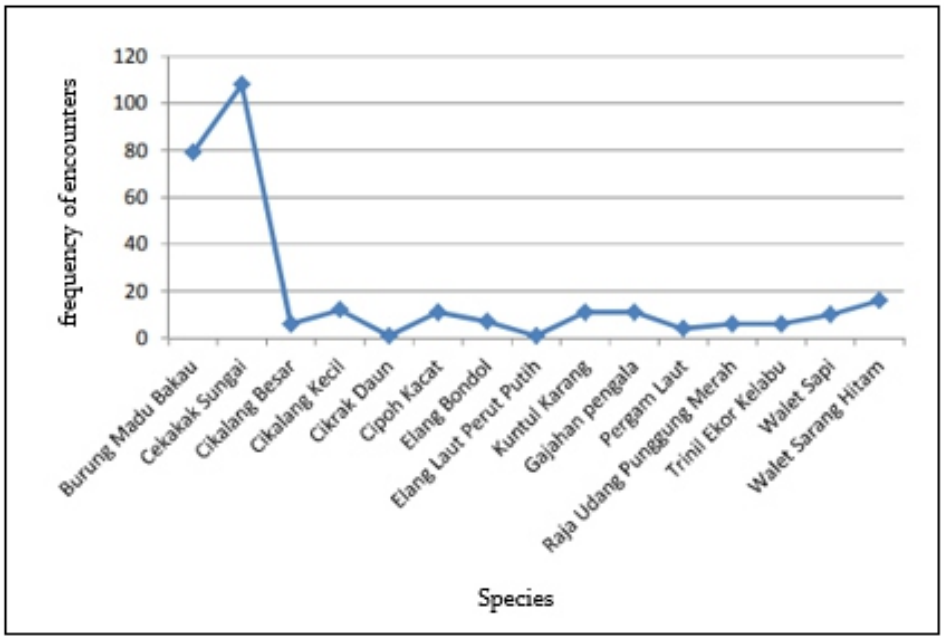

Figure 5. Frequency of bird encounters on SIWS;
Source: East Kalimantan Natural Resources Conservation (2011)

paths worldwide, namely the East Asia-Australia flight path (Bamford *et al.* 2018). The migratory birds stopped over in Indonesia between November-March annually (Howes et al. 2003).

The SIWS became the habitat for migratory birds because it hosted unique mangrove forests not found in other areas in the Derawan archipelago. The migratory birds stopped in mangrove assemblages located north of the Island and are far beyond the designated boundaries in SK.6026/MENLHK-PKTL/KUH/PLA.2/11/2017. These mangrove forests indirectly provide macrozoobenthos and other food sources for shorebirds (Burger et al. 1997; Davis & Smith 1998; Green et al. 2015; Howes et al. 2003; Jumilawaty 2012).

Tourism development in the SIWS should maintain its function as a habitat for these migratory birds, although the existing habitats were beyond the designated boundaries. Tourism development must adhere to the precautionary principle, preserve the habitats of migratory birds, and prevent the adverse impacts of the facilities and infrastructure developments on the birds' habitats.

The total area of the bird habitat in SIWS was 3.49 ha, of which 0.2 ha was suitable for birdwatching without disturbing the birds. Yulianda (2007)

suggested that each tourist required 10 m^2 to conduct birdwatching activities. Therefore, the PCC for birdwatching activity in the SIWS Area was 60 people per day.

Implications of Application of Carrying Capacity in Tourism Development at SIWS

The SIWS had excellent tourism potential due to its unique mangrove ecosystem in the Derawan archipelago. This uniqueness could add to the tour packages in the Derawan archipelago. However, the management should limit the number of tourist visits to maintain its primary function as a conservation area and to minimize disturbances. Therefore, implementing the area carrying capacity in SIWS became crucial and required coordination with other stakeholders to ensure optimum execution. Dissemination and coordination with travel agents were essential because most tourists bought tour packages and services from travel agents.

When SIWS could implement the DDK concept properly, SIWS could become a role model for sustainable tourism development in conservation areas, particularly in areas designated for a wildlife sanctuary. Implementing the DDK concept could also minimize the adverse impacts of tourism developments (Sasmita et al. 2014, Sari et al. 2015). However, implementing the carrying capacity concept should combine with other management tools such as environmental impact assessments, land use policies, tourism strategies, and development plans. In other words, it required collaboration with other tourism stakeholders in Berau Regency. To ensure the implementation of the DDK concept, the SIWS managers could design coordination and communication mechanisms between stakeholders, increase the role and capacity of tour guides, boat owners, and snorkeling and diving instructors, and enhance the online booking mechanism. The SIWS promotion should consider the primary function of the area as a conservation area. Therefore, it should emphasize conservation, customize the visit time to the wildlife behavior, and enforce applicable regulations.

Conclusion

The Semama WS area has great potential to support tourism development in the Derawan Archipelago National Tourism Strategic Area, with activities including snorkeling, mangrove tracking, and observing animals (birds). The physical carrying capacity of the SIWS was 506 people per day, consisting of 45 people for mangrove tourism, 401 for snorkeling, and 60 for birdwatching. These numbers indicated the ceiling capacity of the SIWS to prevent disturbances and minimize risks of tourism development.

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References

Bahar A. 2004. Kajian kesesuaian dan daya dukung ekosistem mangrove untuk pengembangan ekowisata di Gugus Pulau Tanakeke Kabupaten Takalar, Sulawesi Selatan [tesis]. Bogor (ID): Institut Pertanian Bogor.

Bamford M, Watkins D, Bancroft W, Tischler G, Wahl J. 2008. Migratory shorebirds of the East Asian-Australasian flyway: population estimates and internationally important sites. Canberra (AU): Wetlands International-Oceania.

Bowers J. 2016. Developing sustainable tourism through ecomuseology: a case study in the Rupununi region of Guyana. Journal of Sustainable Tourism. 24(5):1-25

[BTNB] Balai Taman Nasional Baluran. 2010. Pemetaan Jalur Interpretasi Wisata Pengamatan Burung di Resort Bama, SPTNW I Bekol. Laporan kegiatan pengendali ekosistem hutan. Baluran (ID): Departemen Kehutanan, Dirjen Perlindungan Hutan dan Konservasi Alam

Burger J, Niles L, Clark KE. 1997. Importance of beach, mudflat and marsh habitats to migrant shorebirds on Delaware *Bay. Biol Cons*. 79:283-292.

Cahyana AN. 2007. Fotografi burung sebagai tantangan dan kesempatan dalam *birdwatching*. Di dalam: Kelompok Pemerhati Burung Perenjak, editor. *Prosiding Seminar Nasional Burung Indonesia*, Bogor 2 Juni 2007. Bogor (ID): Kelompok Pemerhati Burung Perenjak. hlm 45-46.

Cahyanto T, Kuraesin R. 2013. Struktur vegetasi mangrove di Pantai Muara Marunda Kota Administrasi Jakarta Utara Provinsi DKI Jakarta. Jurnal ISTEK. 7(2): 73-88.

Carver E. 2013. Birding in the United States: A Demographic and Economic Analysis Addendum to the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Arlington VA. https://www.fws.gov/southeast/pdf/report/birding-in-the-united-states-ademographic-and-economic-analysis.pdf.

Clivaz C, Hausser Y, Michelet J. 2004. Working Papers of the Finnish Forest Research Institute 2. http://www.metla.fi/julkaisut/workingpapers/2004/mwp002.htm.

Davis CA, Smith LM. 1998. Behavior of migrant shorebirds in Playas of The Southern High Plains Texas. *Condor* 100:266-276.

Dirawan GD. 2006. Strategi Pengembangan Ekowisata pada Suaka Margasatwa. [Disertasi]. Bogor: Institut Pertanian Bogor.

Direktorat Konservasi dan Taman Nasional Laut, 2004. *Pedoman Umum Pengembangan Wisata Bahari Berbasis Masyarakat di Kawasan Konservasi Laut*. Departemen Kehutanan Republik Indonesia

Douglass, R.W. 1982. *Forest Recreation*. New York (US): Pergamon Press.

Glowinski. 2008. Bird-watching, ecotourism, and economic developement: A review of the evidence. Applied Research in Economic Development 5:65-77.

Green JMH, Sripanomyom S, Giam X, Wilcove DS. 2015. The ecology and economics of shorebird conservation in a tropical human-modified landscape. *J Appl Ecol*. 52(6):1483-1491.

Hieu VM, Rašovská I. 2017. Developing Cultural Tourism Upon Stakeholders' Perceptions Toward Sustainable tourism Development in Phu Quoc Island, Vietnam. Research and Science Today. 2(14):71-86.

Hutabarat AA, Yulianda F, Fahrudin A, Harteti S, Kusharjani. 2009.*Pengelolaan Pesisir dan Laut SecaraTerpadu*. Bogor: Pusdiklat Kehutanan-Departemen Kehutanan RI-SECEM-Korea International Cooperation Agency.

Ilham Y, Siregar YI, Efizon D. 2018. Analisis Kesesuaian dan Daya Dukung Wisata Bahari di Pulau Mangkian Taman Wisata Perairan Kepulauan Anambas. Berkala Perikanan Terubuku. 46(2): 1-10. Doi: http://dx.doi.org/10.31258/terubuk.46.2.1-10.

Johan Y. 2016. Analisis Kesesuaian dan Daya Dukung Ekowisata Bahari Pulau Sebesi, Provinsi Lampung. Depik. 5(2): 41-47. Doi: http://dx.doi.org/10.13170/depik.5.2.4165.

Howes J, Bakewell D, Noor YR. 2003. Panduan Studi Burung Pantai. Bogor (ID): Wetland Internasional-Indonesia Programme. hlm 13-17.

Jumilawaty E. 2012. Kesesuaian Habitat dan Distribusi Burung Air di Percut Sei Tuan Sumatera Utara [disertasi]. Bogor (ID): Institut Pertanian Bogor.

Kamperman A. 2000. Temporal aspects of theme park choice behavior. Modeling variety seeking, seasonality and diversification to support theme park planning [disertasi]. Eindhoven (NL): Faculteit Bouwkunde, Capaciteitsgroep Stedebouw, Technische Universiteit Eindhoven.

Ketjulan R. 2010. Analisis Kesesuaian dan Daya Dukung Ekowisata Bahari Pulau Hari Kecamatan Laonti Kabupaten Konawe Selatan Provinsi Sulawesi Tenggara. Bogor (ID): Sekolah Pascasarjana IPB.

[KKP] Kementerian Kelautan dan Perikanan. 2015. Pedoman Pendataan dan Survei Populasi Pari Manta (*Manta alfredi* dan *Manta birostris*). Jakarta: Direktorat Konservasi Kawasan Dan Jenis Ikan Ditjen Kelautan, Pesisir, dan Pulau-Pulau Kecil Kementerian Kelautan dan Perikanan .

Kementerian Pariwisata 2018. Studi Penyusunan Rencana Operasional Pengembangan 3A di KSPN Derawan Sangalaki dan Sekitarnya Provinsi Kalimantan Timur. Jakarta: Kementerian Pariwisata.

Ketjulan R. 2010. Analisis Kesesuaian dan Daya Dukung Ekowisata Bahari Pulau Hari Kecamatan Laonti Kabupaten Konawe Selatan Provinsi Sulawesi *Tenggara*. Bogor: Sekolah Pascasarjana IPB.

Kriyantono R. 2009. *Teknik Praktis Riset Komunikasi*. Malang: Prenada Media Group.

Kunasekaran P, Gill SS, Ramachandran, S, Shuib A, Baum T, Afandi SHM. 2017. Measuring Sustainable Indigenous Tourism Indicators: A Case of Mah Meri Ethnic Group in Carey Island, Malaysia. Journal of Sustainability. 9(7):1256. doi:10.3390/su9071256.

Kurnia I. 2003. Studi Keanekaragaman Jenis Burung untuk Pengembangan Wisata Birdwatching di Kampus IPB Darmaga. Skripsi. Institut Pertanian Bogor. Bogor. 73 hlm.

MacKinnon J, Phillips K, van Balen B. 2010. Burung-burung di Sumatera, Jawa, Bali dan Kalimantan. Terjemahan dari Fieldguide to the Birds of Borneo, Sumatra, Java dan Bali. Bogor (ID): Burung Indonesia.

Maldonado JH, Moreno-Sánchez R del P, Espinoza S, Bruner A, Garzón N, Myers J. 2018. Peace is much more than doves: The economic benefits of bird-based tourism as a result of the peace treaty in Colombia. World Dev. 106:78–86. doi: 10.1016/j.worlddev.2018.01.015.

Muhaerin M. 2008. Kajian sumberdaya ekosistem mangrove untuk pengelolaan ekowisata di Estuari Perancak, Jembrana, Bali. [Tesis]. Departemen Manajemen Sumberdaya Perairan Fakultas Perikanan Dan Ilmu Kelautan Institut Pertanian Bogor.

Nicolaides A. 2014. Stakeholders, purposes and responsibilities: Avitourism in South Africa. African J Hosp Tour Leis. 3(32).

Rajab MA, Fahruddin A, Setyobudiandi I. 2013. Daya dukung perairan Pulau Liukang Loe untuk aktivitas ekowisata bahari. Depik. 2(3): 114-125. Doi: https://doi.org/10.13170/depik.2.3.854.

Richardson JI, Fluker M. 2004. Understanding and Managing Tourism. Australia: Person Education Australia, NSW Australia.

Sasmita E, Darsihatjo, Rahmafitria F. 2014. Analisis Daya Dukung Wisata Sebagai Upaya Mendukung Fungsi Konservasi Dan Wisata Di Kebun Raya Cibodas Kabupaten Cianjur. Jurnal Manajemen Resort dan Leisure. 11(2): 71-84. Doi: https://doi.org/10.17509/jurel.v11i2.2960.

Scheleyer M, Tomalin B. 2000. Damage on South Africa Cotal Reefs and an Assessment of Their Sustainable

Diving Capacity Using Fisheries Approach. Bulletin of Marine Science Miami. 67 (3): 1025-1042 .

Sahetapy D, 2010. Sebaran Spesies Karang Batu dan Kondisi Terumbu Karang di Perairan Pesisir dan PPK Provinsi Maluku. Prosiding Konferensi Nasional (KONAS) VII Pengelolaan Sumberdaya Pesisir dan Laut

Saveriades A. 2000. Establishing the social tourism carrying capacity for the tourist resorts of the east coast of the Republic of Cyprus. Tourism Management, Vol. 21, pp. 147-156.

Sekercioglu CH. 2002. Impacts of birdwatching on human and avian communities. Environ Conserv. 29(3):282–289. doi:10.1017/S0376892902000206.

Soemarwoto O. 2008. Ekologi, Lingkungan Hidup dan Pembangunan. Jakarta: Djambatan.

Son Nguyen LH, Dung Le T, Van Nguyen T. 2011. Developing bird watching ecotourism combined with education and natural conservation. Hanoi National University of Education 136 Xuan Thuy, Hanoi, Vietnam

Sugiyono. 2018. Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta.

Suleva DT. 2007. Management strategies of theme park in the experience economy context. A focus on action Aqua Park's customers' behavior and management policy [disertasi]. Bournemount: European Tourism Management. Bournemouth University, United Kingdom.

Wearing S, Neil J. 2009. Ecotourism; Impact, Potentials and Possibilities. Second Edition. Sydney (AU) : University of Technology, School of Leisure, Sport and Tourism.

Widyasari KL, Hakim, Yanuwiadi B. 2013. Kajian jenis - jenis burung di Desa Ngadas sebagai dasar perencanaan jalur pengamatan burung (birdwatching). Journal of Indonesian Tourism and Development Studies. 3(I): 108-109

Yulianda F. 2007. Ekowisata Bahari sebagai alternatif pemanfaatan sumberdaya pesisir berbasis konservasi. Seminar Sains; 2007 Feb 21 ; Bogor, Indonesia. Bogor (ID): Fakultas Perikanan dan Ilmu Kelautan