Important value aspect of mangrove community at coastal area of Pangkalpinang City, Bangka Island

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Abstract. Mangrove is one of high-level plants because it has structure roots, branches and leaves. Mangrove commonly was found in the delta or brakishwater, but has ecological benefit as well as economic value. Mangrove found in the intertidal zone and high tide level. This research was aimed to analysis important value aspect of species mangroves at coastal area of Pangkalpinang City. This study uses a purposive sampling method. Data was collected using the line and plot transect method (LTP) and hemisphere photography agreed upon for mangrove monitoring in the COREMAP-CTI. The results showed that Mangrove composition found in 5 stations as many as 22 species mangroves which were classified into 10 family Rhizophoraceae, Sonneratiaceae, Avicenniaceae, Meliaceae, Combretaceae, Rubiaceae, Euphorbiaceae, Myrcinaceae, Arecaceae, Malvaceae, Pteridaceae. The type of vegetation that has the highest INP value at the capling level is Rhizophora apiculata BI. of 266.65%, and The type of vegetation that has the highest INP value at the sapling level is Rhizophora apiculata BI. of 202.85%. Dominance species found in 5 station is Rhizophora apiculata BI and Sonneratia alba.

1. Introduction
Geographically, Pangkal Pinang City has a territorial boundary, in the northern part bordering Bangka Regency, in the South bordering Central Bangka Regency, in the East bordering the South China Sea, in the West Side bordering West Bangka Regency. Pangkalpinang City is the central province of the Bangka Belitung Islands which has an area of 89.4 km2 with a coastline of 36 km2. Some beaches in the City of Pangkalpinang are overgrown with mangrove vegetation and coastal forest vegetation which tends to vary. The beach border is a protected area that must not be carried out by development that damages the environment of the beach’s function [1]. The coastal border has two forest formations, namely mangrove forest and beach forest [2]. Mangrove forest and beach forest are coastal green line that have ecological and economic function [3]. Ecological functions include protecting the coastal from ocean waves, and forming land [4], prevent sea water intrusion, maintain stable beach conditions and prevent abrasion [5], as a habitat for flora and fauna, as a place to lay eggs (spawning ground) for various types of sea turtles [6], feeding ground, and
micro climate regulator [7]. Among other economic functions as fuel, building materials, textile dyes, foodstuffs, and medicines [5], as a producer of raw materials for the cosmetics industry and as biodiesel derived from coastal borders [6].

The potential of a coastal border vegetation area in the City of Pangkalpinang provides high economic value for the local community. These resources are utilized by the community to meet the needs of shelter such as cutting down mangrove trees to be used as firewood and building materials. Along with the increasing community need for shelter, the expansion of residential areas has also increased. The high level of human activities such as the felling of trees on certain types of mangroves continuously and the conversion of mangrove lands in the coastal area is thought to cause the degradation of the coastline area in the Pangkalpinang City. In addition, the role of the Pangkalpinang region as the capital of the province makes this region the center of the development of the Bangka Belitung Islands Province, both the development sector, the tourism sector, the industrial sector, trade, ports (docks), and warehousing as well as other leading sectors, the consequences are not directly the composition of mangrove vegetation will also experience a decrease both in terms of quantity and function in the ecosystem and can affect the existence and importance of mangrove communities in the Pangkal Pinang City Coastal area.

Various efforts to preserve coastal vegetation, especially mangroves, have been carried out by the local government, ranging from seeding and planting mangroves at several points, to utilizing the mangrove area as a coastal tourism area. The efforts made do not yet have information related to the collection of types of vegetation found in the coastal border area of Pangkalpinang City, while mangrove vegetation is thought to continue to experience pressure that could threaten its existence and function in the Pangkal Pinang Coastal Sempadan Beach area. Therefore, it is necessary to conduct research related to the collection of species and aspects of the importance of mangrove vegetation in the Sempadan Beach area of Pangkalpinang City to support efforts to conserve mangrove vegetation in protected forest areas.

2. Methodology
This study uses a survey method. As for the technique of data collection done by purposive sampling using a systematic random sampling design. The stages carried out in this study are as follows:

2.1 Time and Place.
This research was conducted in August 2019 - September 2019. The research location was divided into 5 observation stations, including station I located at Perepat Mati Beach, station II located at Tanjung Bunga Beach, station III located at Serata Pasir Padi, station IV located in the Kuala area Jembatan Emas, station V is located in the Lintas Timur Selindung area. The research location can be seen in Figure 1 below:
2.2 Tool and Materials
Tools and materials used in this study, namely the Global Positioning System (GPS), cameras, label paper, roll meters, permanent markers, iron plates, permanent plots, ties wires, colorful phlox paint, geological compasses, raffia ropes, scissors or knife, label paper, plastic bag (porous plastic sample) as well as newsprint, multi-parameter analysis (pH indicator, soil pH tester, thermometer, salinometer), observation datasheets using waterproof paper, work stationery (ATK), books identification of mangroves, 70% alcohol and 4% formalin as well as some chemicals needed for analysis in the Laboratory.

2.3 Method
Data was collected using the line transect method and hemisphere photography that has been agreed for the implementation of mangrove monitoring in the COREMAP-CTI area and refers to [8], and Minister of the Environment Decree No. 201 of 2004 [9]. The line transect method is made and in each zone, a plot of 10 x 10 m² is made along the line transect to measure the diameter of the tree at breast height (DBH) which has a minimum stem circumference of 16 cm, for each tree that has been measured DBH will be marked with 3 cm thick phlox paint. Mangrove species that grow in the plot are recorded regarding Tomlinson [10], and Noor et al. [11], and the trunk circumference and number of trees in each plot were calculated. Substrate sampling was carried out by plugging core samplers on a watershed basis. The substrate sample in the core sample is taken as much as ± 500 g, then put into sample paper to be analyzed for the substrate in the laboratory.

Mangrove sampling is carried out at each station by placing a quadratic transect on the transect line drawn from the sea towards the land/perpendicular to the line along the mangrove zonation in the low tide area (minimum representation of 30-100 m), but if the mangrove condition grows thinly along the coastline, mangrove sampling can be done by extending LTP (Line Transect Plot) parallel to the coastline along 30 meters from right to left or vice versa, with a total plot area of 3 plots [12]. A sampling of cover data and density of mangrove vegetation is carried out in a 10 m x 10 m quadrat transect for each stage of growth, both seedlings, saplings, and trees, and then recorded the frequency, amount, and size of the waste and tree felling in a permanent plot and will be measured by several representatives height of mangrove trees using the protractor application on the Android phone.

Mangrove cover data retrieval is done using a photographic method that refers to research Jenning et al. which was modified [13]. The photographic method was carried out in four quadrants in each research plot. In each quadrant, a photo was taken towards the sky. Photos were analyzed using Image...
J software using pixel comparison analysis, where sky pixels will be compared with mangrove vegetation pixels.

2.4 Data Analysis

2.4.1 Density of Species (Di)
Species density (Di) is the number of individual species i in a unit area. Species density is calculated based on the formula as follows, [14]:

\[ Di = \frac{ni}{A} \]  

where: Di = density of Species I; ni = the total number of individual of species i; A = total sampling area (total sample plot area)

2.4.2 Relative Density of Species (RDi)
The relative density of species (RDi) is the ratio between the number of individuals of species i (ni) and the total stand of all species (\(\sum n\)), ([14]

\[ RDi = \left( \frac{ni}{\sum n} \right) \times 100\% \]  

where: RDi = relative density of species; ni = the total number of individual of species I; \(\sum n\) = density of all types species.

2.4.3 Species Frequency (Fi)
Species frequency (Fi), is a chance of finding an species i for all sample plots compared to the total number of sample plots created, [14]

\[ Fi = \frac{pi}{\sum p} \]  

where: Fi= species frequency; Pi = number of sample plots where species i was found; \(\sum p\) = the total number of sample plots created

2.4.4 Relative Frequency of Species (RFi)
Relative frequency of species is a comparison between frequency species i (Fi) and the number of frequencies for all types (\(\sum F\)), ([14]

\[ RFi = \left( \frac{Fi}{\sum F} \right) \times 100\% \]  

dimana: RFi = relative frequency of species; Fi = species frequency I; \(\sum F\) = the number of frequencies for all types

2.4.5 Species coverage (Ci)
Species cover (Ci) is an area of species i in a unit area (Dharmawan & Pramudji (2014), Ishida (2004):

\[ Ci = \frac{\sum Hemispherical\_Fotography}{A} \]  

\[ Ci = \frac{\sum BA}{A} \] (Brower et al. 1998):

dimana: Ci = species coverage; BA = Basal Area (\(\pi\text{dbh}^2/4\)); HF = Hemispherical Fotography (sky pixel / canopy vegetation pixel); A = Total area of sampling

2.4.6 Relative Coverage (RCi)
The relative closure of species or species dominance (Ci) is the ratio between the area of type-i closure area and the total area of coverage area for all species or the ratio between the total number of species of i (Ci) and the total number of the dominance of all individuals (\(\sum C\)), [14]

\[
RC_i = \left(\frac{C_i}{\sum C}\right) \times 100\%
\]

(7)

dimana : \(RC_i = \) Relative coverage , \(\sum C = \) the total number of the dominance of all individuals

2.4.7 Indeks Nilai Penting (INP)
Important Value Index is the sum of Relative Density (Di), Relative Frequency (RFi), and Relative Domination (RCi) values. The formula is \(INP = RDi + RFi + RCi\). The importance of a type ranges from 0 - 300. This important value provides an overview of the role of a mangrove type in an ecosystem.

3. Result and Discussion
3.1 Description of the research station
Based on the results of research conducted at 5 research sites, it was found that Station I, located at Perepat Mati Beach (Air Itam District), had freshwater input that had a sloping type of beach, where the coastline was overgrown with coastal forests in the forefront formation and followed by mangrove vegetation, with coordinates -02°08'13.5" S dan 106°10'28" E. This station, has a relatively stable substrate condition and is surrounded by white sand. The next research location is Station II, which is located at Tanjung Bunga Beach, Bukit Intan District with coordinate locations -02°07'56.9" S dan 106°10'51.2" E. Station II has a steep beach elevation, many found mangrove tree felling spots for various purposes. Besides that this station is close to the TI Apung (Tin Mining Floating) location. The base substrate around the waters of Tanjung Bunga is composed of sand, coral fragments and tends to be dominated by sandy mud.

Station III is located at estuary Serata Pasir Padi, Pangkal Balam District, with coordinates -02°05'55.6" S dan 106°09'48.2" E, the location is right west of Pasir Padi Beach and also found estuary and brackish water input. The beach topography at station III tends to be gentle, and sandbanks are found which are thought to be the impact of sedimentation due to mining activities at sea. The substrate bottom is dominated by muddy sand. Marine life can be found on this beach, including macroalgae, seagrasses, snails, and shellfish. Station IV is located in the Coastline of Kuala Jembatan Emas, Selindung Baru sub district, Gabek District, with coordinates -02°05'34.3" S dan 106°09'35.3" E. This station has a sloping beach topography as well as Stations I and III, and is located adjacent to the maritime ship dock / express port and cargo ship. The bottom substrate of the water at this station is muddy sand with white sand along the coast. The water conditions at this station tend to be unstable because they are located near the location of dredgers that are still operating. Marine life can be found on this beach, including macroalgae, seagrasses, snails, and shellfish.

The final location of this study is Station V, which is located in Pesisir Lintas Timur, Kelurahan Selindung Lama, Gabek District, with coordinates of -02°05'34.3" S dan 106°09'35.3" E. The location of the station is located across the eastern causeway near the bridge and a large river shelter. Station V’s basic substrate, which is muddy sand.

3.2 Inventory of Spesies Mangrove at The Coastal Pangkalpinang City.
Based on identification result, was found 22 mangrove species from 10 family at the location study, include Rhizophoraceae (R. apiculata, R. mucronata, R. stylosa, R. lamarckii, C. tagal, C. decandra, B. gymnorrhiza, B. cylindrica, B. sexangula, B. parviflora), Sonneratiaceae (S. Alba, S. Ovata, S. caseolaris), Avicenniaceae (A.lannata), Meliaceae (X. granatum), Combretaceae (L.littorea), Rubiaceae (S. hydrophyllaceae), Euphorbiaceae (E. Agallocha), Myrcinaceae (A. corniculatum) dan Arecaceae (N. fruticans), Beside of, there are several asosiation mangrove species which also found, include Malvaceae (H. tiliaeus), dan Pteridaceae (A. aureum). Dominance mangrove spesies of documentation at reasearch location served for Figure 2.
3.3 Important Value Index of Mangroves

Important value index The INP value also shows the important role of vegetation in a community (Fachrul 2007) [15]. Data from INP calculation can be seen in Figure 3 and Figure 4.

In general, Pangkalpinang City Coastal Areas in several research stations have health conditions of mangrove communities with relatively good and varied/poor (good) - good (good) categories with a range of cover percentage and lowest mangrove stand density - highest in sequential tree growth stages between 20.76 ± 2.56% (1133.3 ± 484 ind / ha), then followed by a value of 23.62 ± 2.92% (733.33 ± 533 ind / ha) to 54.30 ± 5.50% (1466.7 ± 145 ind / ha). The Pasir Padi Coastal Region (PKPM03) has the highest percentage of cover and mangrove stand density among other stations with the most dominating type, namely R. apiculata with an INP of 176.23%, and the mangrove type that has the lowest INP at station 3, namely C. decandra by 12.44%. According to Tomlinson 1986; usman (2013) [16], a group of plants that grows predominantly in mangrove forests is a type of mangrove from the family Rhizophoraceae which consists mainly of commercial wood species such as Rhizophora mucronata, Rhizophora apiculata, Rhizophora stylosa.
Figure 4. Important Value Index For Capling (Vegetation size > dbh 16 cm)

Station 2 (PKPM02), which is located on Tanjung Bunga Beach, is one of the areas that was once carried out by mangrove rehabilitation by the Pangkalpinang City Government and related SKPD in the Bangka Belitung Islands Province Region, even to this day Tiapung activities continue to operate. Station 2 is dominated by the rocky sand substrate on the leading zonation of mangrove (plot 1), while the zonation behind it (plot 2 and plot 3) tends to have Sandy and muddy sand substrate. The PKPM02 region is a region with quite strong currents, therefore, this area has a dense substrate and is not muddy so it is low in organic. The number of stand densities for tree growth stage at Station 2 (PKPM02) is 1233 ± 433 ind / ha (with good criteria with a rare level of mangrove density, this is evident from the percentage of mangrove tree cover at station 2 which tends to be lower, namely 31.99 ± 3.09% (<50%), this indicates that the mangrove vegetation community that grows in the coastal area of Tanjung Bunga is classified as young age and its condition has improved and successfully regenerated after mangrove rehabilitation in the region. The most dominant type in this region is S. alba with an INP of 177.13%, while the lowest INP of the type R. apiculata of 122.87%.

From 5 observation stations that were carried out mangrove sampling, there were only two stations located and adjacent to the river mouth, namely station 3 (PKPM03) and station 5 (PKPM05) which had a wide green mangrove forest line and grew thick and fertile with substrate vary from sandy substrate / PL (lump sand), LP (sandy mud) to muddy substrates. The substrate is dominated by lumps whereas in areas farther from the river have sandy substrates. This causes the diversity of mangrove species to be quite high at both stations, where ± 10 species of mangroves were found consisting of major and minor mangroves forming perfect formation/zoning. The condition of the mangrove community at the station was also the best among the three other stations.

Station 4 (PKPM04) which is located in the Kuala Jembatan Emas area, is the only research station in the northern coastal area of Pangkalpinang City which is adjacent to the Pangkal Balam port jetty where mooring fishing boats, expeditions, and maritime express vessels as well as ship sails. This location is also close to the location of the Suction Boat. PKPM04 has a sandy substrate with fairly dynamic water conditions plus in the land area, there has been a conversion of mangrove land to an industrial area. This is thought to cause coastal abrasion at this spot and is even thought to have caused siltation (formation of scorch in the Serata Sand Rice Region (PKPM03) which are located close to each other due to the high dynamics of the Pangkalpinang City Coastal Station. Station 4 has a total stand of 1366.7 tree stands ± 1120 ind / ha with the percentage of mangrove cover for the stage of tree growth of 37.82 ± 4.80, based on the Decree of the Minister of Environment No. 201 of 2004, the status of mangrove health conditions at station 4 is included in the quite good category with a rare mangrove density, this is caused by the large S. alba mangrove species that experience death and grow rarely and take up space ranging from 50-100 m from the shoreline, while the zonation behind it grows with dense
Rhizophoraceae genus, especially from R. apiculata species with the largest INP of 95.89%, and also found the R type Lamarckii but who owns INP minimum is the type of R. mucronata that is equal to

Unlike the case with Station 5 (PKPM05) which is located in the Eastern Cross Coastal area, the value of tree stand density tends to be greater (1133.3 ± 484 ind / ha) compared to Station 1, but the% cover (mangrove cover) tends to be smaller compared to Station 1 ie of 20.76 ± 2.56%, this means that the condition of the mangrove community at station 5 is classified as good / moderate (≥ 1000 - <1500) only the mangrove vegetation community that grows in the area is classified as young mangrove. The most dominating type of mangrove at station 5 is X. granatum with an INP of 118.2% and the lowest INP of type B. sexangula which is equal to 12.10%. Noor (2012) [11] states that type X. granatum is a minor mangrove plant that generally grows in the direction of land, away from tidal inundation fluctuations. This type of mangrove is thought to be more able to survive and also able to adapt to mangrove areas that are damaged due to mangrove land conversion. At station 5, also found several species of mangrove association Acrosticum aureum, but not included in the plot calculation. Not only that there is one type of true mangrove minor component found at station 1 and station 5, namely S. hydrophyllace in low amounts, according to Noor et al. (2012) [11]; Mardi (2017) [17], the S. hydrophyllaceae mangrove species is a globally rare and endemic species in Indonesia and therefore needs to be preserved.

4. Conclusion

Based on the results of research in 5 research stations, it can be concluded that mangrove vegetation in the coastal border area in the Pangkal Pinang City Coastal area found 22 species of mangrove from 10 families both true mangrove and associations. The most dominant mangrove species and have a high INP at each research station in the study area are Rhizophora apiculata and Sonneratia alba. While the mangrove species that has the highest INP at the juvenile level is Rhizophora apiculata found at station II, which is 202.84%.

References

[1] Aditya 2017 Status Hak Milik Atas Tanah di Kawasan Sempadan Pantai Kelurahan Tanjung Ketapang ditinjau dari Undang-Undang Nomor 5 Tahun 1960 tentang Peraturan Dasar Pokok-Pokok Agraria (Bangka: Universitas Bangka Belitung)
[2] Tuheteru FD and Mahfudz 2012 Ekologi, Manfaat dan Rehabilitasi Hutan Pantai di Indonesia (Manado: Balai Penelitian Kehutanan Manado).
[3] Alwidakdo A, Azham Z and Kamarubayana L 2014 Studi Pertumbuhan Mangrove pada Kegiatan Rehabilitasi Hutan Mangrove di Desa Tanjung Limau Kecamatan Muara Badak Kabupaten Kutai Kartanegara. Jurnal Agrifor. 13 pp 11-18
[4] Kuraesin R and Cahyanto T 2013 Struktur Vegetasi Mangrove di Pantai Muara Marunda Kota Administrasi Jakarta Utara Provinsi Dki Jakarta [Diakses pada 24 Juli 2020]. http://journal.uinsgd.ac.id/index.php/istek/article/view/252
[5] Syauqi AL and Purwani KI 2017 Inventarisasi Vegetasi Mangrove di Kampus Institut Teknologi Sepuluh Nopember Jurnal Sains dan Seni Pomits 6 pp 2337-3520
[6] Burhan 2014 Penilaian Kondisi Ekologi Vegetasi Pantai (Pes-Caprae & Barringtonia) pada Daerah Sempadan Pantai di Desa Mattiro Tasi Kabupaten Pinrang (Makassar: Universitas Hasanuddin)
[7] Baderan DWK 2016 Keanekaragaman Jenis Tumbuhan Mangrove di Kawasan Pesisir Tabulon Selatan, Kabupaten Bualamo, Provinsi Gorontalo. Prosiding Seminar Nasional Lahan Basah Lembaga Penelitian dan Pengabdian Kepada Masyarakat Universitas Lambung Mangkurat 1 pp 41-44
[8] Bengen DG 1999 Pedoman Teknis Pengenalan dan Pengelolaan Ekosistem Mangrove, Pusat Kajian Sumberdaya Pesisir dan Lautan (Bogor: Institut Pertanian Bogor)
[9] KEPMEN LH NO. 201. Keputusan Menteri Negara Lingkungan Hidup Nomor 201 Tahun 2004. Keputusan Menteri Negara Lingkungan Hidup Nomor 201 Tahun 2004 tentang Kriteria Baku dan Pedoman Penentuan Kerusakan Mangrove

[10] Kitamura S, Anar C, Chaniago A, and Baba S 2003 Buku Panduan Mangrove di Indonesia (Denpasar, Bali: PassKress Communications)

[11] Noor YR, Khazali M, and Suryadiputra INN 2012 Panduan Pengenalan Mangrove di Indonesia (Bogor: Ditjen. PHKA)

[12] Akhrianti I 2019 Struktur Komunitas Vegetasi Mangrove di Pesisir Utara Pulau Mendanau dan Pulau Batu Dinding, Kecamatan Selat Nasik Kabupaten Belitung Jurnal Akuatik Sumberdaya Perairan 13 1

[13] Hartoko A 2012 Image Processing and Algorithm for Mangrove Using Quickbird. Marine Geomatic Center. Semarang: Jurnal of Management of Aquatic resources 1 pp 57-66

[14] Akhrianti I, Bengen DG, and Setyobudiandi I 2014 Distribusi Spasial dan Preferensi Habitat Bivalvia di Pesisir Perairan Kecamatan Simpang Pesak Kabupaten Belitung Timur Jurnal Ilmu dan Teknologi Kelautan Tropis 6 pp 171-185

[15] Fachrul FM 2007 Metode Sampling Bioekologi (Jakarta: Bumi Aksara)

[16] Usman L, Syamsuddi, and Hamzah SN 2013 Analisis Vegetasi Mangrove di Pulau Dudepo Kecamatan Anggrek Kabupaten Gorontalo Utara. Jurnal Ilmiah Perikanan dan Kelautan 1 pp 11-17

[17] Mardi, Amri K and Saru A 2017 Konektivitas Struktur Vegetasi Mangrove dengan Keasaman dan Bahan Organik Total pada Sedimen di Kecamatan Wonomulyo Kabupaten Polewali Mandar. Spermonde 3 pp 1-6

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