

Mapping of Village-Based Economic Leading Potentials Geographic Information System in the Tomini Bay Area

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Abstrak: Kawasan teluk tomini memiliki beragam kekayaan alam yang sangat potensial untuk di kembangkan mulai dari perkebunan, perikanan, pariwisata, pertambangan. Kurangnya akses data dan informasi terkait dengan potensi unggulan desa di kawasan teluk tomini menyebabkan sulitnya investor mendapatkan akses informasi tersebut. Terbatasnya aksesibilitas terhadap informasi ini juga mengakibatkan Pemerintah daerah dan *stakeholder* terkait sering kali mengalami kesulitan dalam mencari data dan informasi terkait dengan potensi unggulan desa di kawasan teluk tomini. Tujuan penelitian ini adalah mengidentifikasi dan merancang aplikasi pemetaan potensi unggulan ekonomi desa di kawasan teluk tomini. Target yang ingin dicapai penelitian ini yaitu adanya sebuah aplikasi pemetaan yang dapat membantu pengguna dalam mencari dan melihat sebaran potensi unggulan desa berbasis visualisasi wilayah geografis secara lebih cepat dan akurat. Metode yang digunakan adalah pendekatan kualitatif yang terdiri dari 4 tahap yaitu tahap persiapan, pengambilan data, pengolahan data dan visualisasi data.

Kata kunci: pemetaan wilayah, sistem informasi geografis, teluk tomini

Abstract: *The Tomini Bay area has a variety of natural resources that have the potential to be developed, ranging from plantations, fisheries, tourism, and mining. Lack of access to data and information related to the leading potential of villages in the Tomini Bay area makes it difficult for investors to access that information. The limited accessibility to this information inflicts the local government and related stakeholders hard in finding data and information related to the potential of leading villages in the Tomini Bay area. The purpose of this research is to identify and design an application for mapping the leading economic potential of villages in the Tomini Bay area. The target to be achieved in this research is the existence of a mapping application that can assist users in finding and seeing the distribution of potential villages based on geographic area visualization more quickly and accurately. The method used is an approach consisting of 4 stages: the preparation stage, data collection, data processing, and data visualization.*

Keywords: regional mapping, geographic information system, Tomini bay

I. Introduction

Tomini Bay is the largest bay on the equator, with an area of $\pm 59,500$ km² or ± 6 million hectares, with enormous potential natural resources. Tomini Bay to the east is bordered by the Maluku Sea, while the Sulawesi Sea borders the northeastern part. According to the classification of biodiversity areas, this area is in the Wallacea zone, which historically was a separate area from the continents of Asia and Australia (Miru & Darman, 2018). Additionally, the geographical boundaries: Geographical boundaries: in the north, it is bordered by Buol Regency, Tolitoli Regency, Gorontalo Province, and North Sulawesi; while to the south, it is bordered by Poso, Touna, and Luwuk Regencies; and to the west, it is bordered by Parimo, Palu City and Donggala Regency and to the east by the Sulawesi Sea and the Atlantic Ocean (Hamad, 2008).

The declaration meeting held at the "Green Investment Meeting," which was attended by regional heads from 17 regencies in the Tomini Bay region and three provinces, Central Sulawesi, North Sulawesi, and Gorontalo, determined that there would be investment development in various regional leading sectors which include fisheries, agriculture, transportation, marine ecotourism and port development that are connected and integrated between regions in the Tomini Bay area.

Several regencies in the Tomini Bay area possess leading resources, such as Parimo Regency, which is currently developing the potential of the tourism industry, such as hospitality and culinary services, to boost the

local's economy (Hazliansyah, 2017). As for the Province of Gorontalo, it has several leading sectors, including the agricultural and plantation sectors in Dulupi district, Mananggu, in Boalemo Regency, Boliyohuto District, Asparaga, Telaga Biru, Tolanguhula in Gorontalo Regency, Anggrek Sumalata District, Gentuma Raya, Tolinggula in North Gorontalo Regency, Taludi District, Lemito, Popayato in Pohuwato Regency, Suwawa District, Bulango, Kabila Bone, etc. in Bone Bolango Regency (Bappeda, 2021).

Gorontalo Province has support areas in the Districts of Kwandang, Sumalata, Wonggarasi, Randangan, Suwawa, Kabila, Bongomeme, Mootilango, Wonosari, Paguyaman, etc., for the sector of fresh water and pond fisheries as well as marine fisheries. Meanwhile, several tourism hotspots can be developed in Torosiaje tourism in Popayato, Libuo Paguat beach, Boliohutuo beach, Saronde Island, Lombongo, Olele, Otanaha Fort, etc. (Bappeda, 2021).

Geographic Information System functions to store, obtain, analyze, manipulate, and display all forms of information efficiently in geographic form. Geographic Information Systems can aid in solving problems related to mapping an area. The research findings by Arismunandar (2017) reveal that Geographic Information Systems can help solve monitoring and decision-making problems in the distribution and sale of pharmacy products. This is supported by research conducted by Noraida, Khair, and Raharja (2014), who created a geographic information system for diarrhea in toddlers, and also research by Tamrin, Zyen, and Dina (2019), who designed an android application based on Geographic Information System (GIS) to make it easier for users to find information on the location of the furniture industry in Jepara.

As previously mentioned, the Tomini Bay area possesses an extensive area. This area has a variety of natural wealth that has the potential to be developed, such as plantations, fisheries, tourism, mining, etc. Investors find it challenging to obtain information regarding the leading potential of the communities in the Tomini Bay region due to a lack of data and information in this area. The limited accessibility to this information has also impacted local governments and related stakeholders in finding data and information related to the leading potential of villages in the Tomini Bay area.

Based on the study rationale, this proposed research is supposed to assist university strategic planning in realizing its goal of empowering coastal areas to achieve Leading and Competitive UNG through developing a Geographic Information System for regional mapping potential in the Tomini Bay area.

II. Method

This study employs a qualitative approach with survey research techniques, interviews, field notes, and documentation. Primary data was gathered by conducting surveys at study areas, recording events, and documenting objects. In addition, secondary data was obtained by observation and interviews with several related parties, including the Department of Tourism and Culture of the Province of Gorontalo, managers of tourist objects, and reference studies.

On the other hand, the observations result and findings in the field were analyzed using a qualitative descriptive method with the help of ArcGIS software by visualizing spatial data and descriptions. Thus, a comprehensive picture is obtained through graphic-attribute data and descriptions of each village's leading potential.

The research process is divided into four stages:

a. Preparatory Stage

The preparatory stage includes identifying problems with the study's object and reviewing literature related to the scope of the study. The problem identification was obtained from a study of news and articles regarding Tomini Bay village's leading potential. This stage's study output is the identification of problems in creating a map of the village's leading potential. At the same time, the achievement indicator is the identification of problems in mapping the village's leading potential. Further, Mr. Salahudin Olii coordinates all activities from preparation to implementation of research activities.

b. Data Retrieval Process

This stage is in the form of spatial and non-spatial data, including GPS coordinates for village locations, photos of village locations, and other non-spatial data obtained through observation and interviews with pertinent agencies or communities. This study's output is the collection of spatial and non-spatial data in the form of regional or village coordinate points with their leading potential. The indicators include gathering coordinate data, photos of leading village products, etc. Mukhlisulfatih Latief and two students participated in this study were in charge of this stage.

c. Data Processing

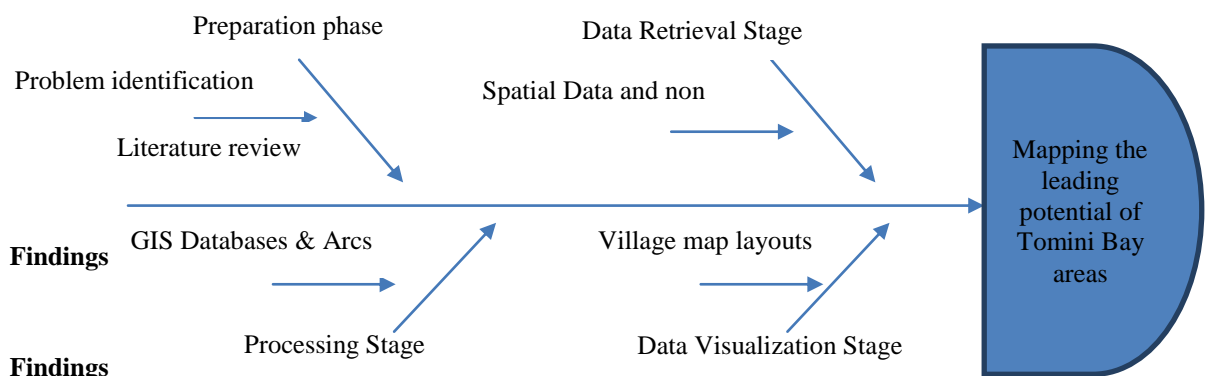
This process is carried out by inputting village location coordinate data into the ArcGIS 10.5 software, followed by the creation of a database that will be equipped with non-spatial data such as name, type, village potential, etc. The study's output is the input of coordinate data to the mapping system database and the indicator. Those responsible for this research are Salahudin Olii and Mukhlisulfatih Latief, whose duty is to process and analyze data to create geographic information systems with a prospective database design for the Tomini Bay area.

d. Data visualization process

After gathering the coordination of each location and database, the map layout process is carried out by displaying each area / village location point on the map to show the position of the area / village location. Thus, the community and the local government / investors can easily identify locations with leading potential in the Tomini Bay Area.

The output of this research is a digital map layout in the form of visualization. This mapping system can search based on the potential or leading products of villages in the Tomini Bay area. This activity is coordinated explicitly by Mukhlisulfatih Latief and two student members who are in charge of testing, repairing, and evaluating the system.

Figure 1 provides a brief explanation of the research stages.



According to data on the potential of Natural Resources and the Development Potential of the Maritime and

Figure 1. Research flowchart

Marine Sector Along the Sea of Tomini Bay, the focus of the research object for this village’s economic leading potential is the development of tourism and aquaculture areas. Based on the Spatial Pattern data of Gorontalo Province RTRW for 2010-2030, the distribution of spatial allotment in an area includes the space for the protection function and the space for the cultivation function, which has several areas such as:

- a. The mangrove ecosystem area, which is a protected area and offers an attraction to be utilized as a mangrove tourism area which, is dispersed in several areas, including:
 - Langede mangrove area, North Gorontalo Regency;
 - Bulili mangrove area, Pohuwato Regency;
 - Marisa mangrove area, Pohuwato Regency;
 - Paguat mangrove area, Pohuwato Regency; and
 - Popayato mangrove area, Pohuwato Regency
- b. Fisheries Area
The research object in the fishery area is aquaculture (fish resources) which is spread across all of Gorontalo Province’s regencies and cities.
- c. Tourism Area
 - Tourism Area on land;
 - Seascape Natural Tourism Area;
 - Coastal/coastal natural tourism areas and small islands;
 - Underwater natural tourism area;
 - Water sports tourism area; and
 - Cultural Tourism Area.

The following is a spatial pattern distribution map in Gorontalo Province.

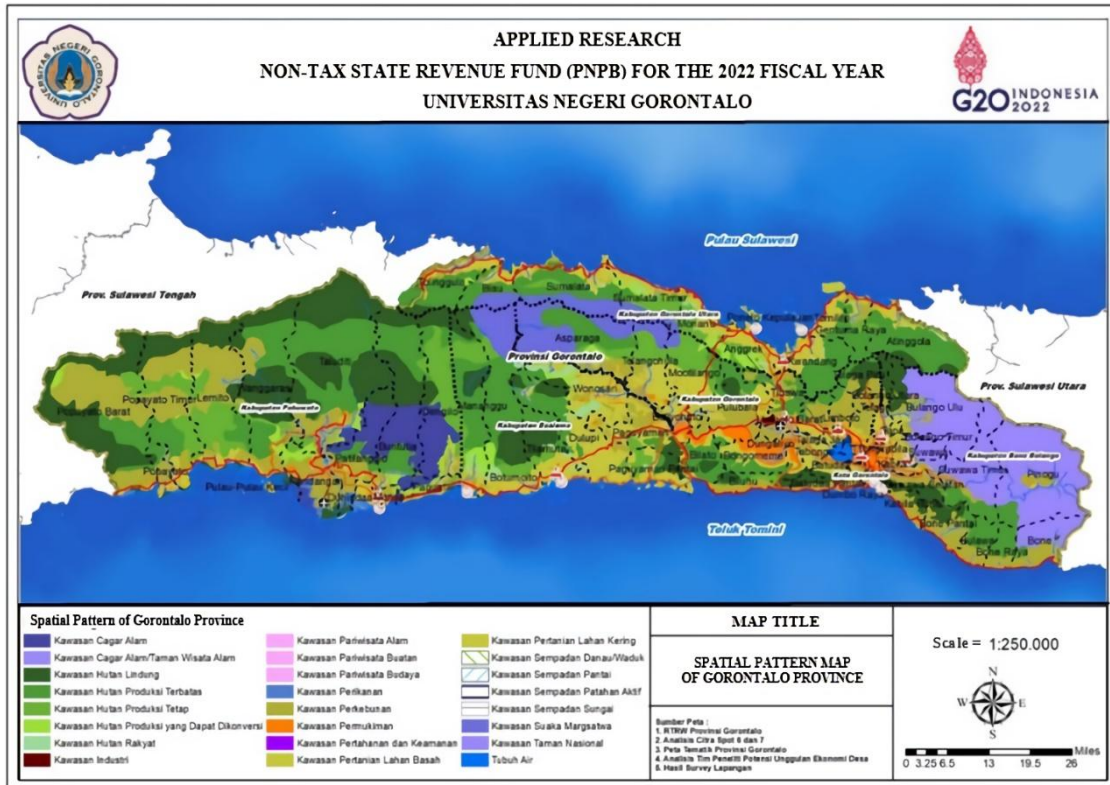


Figure 2. Spatial pattern distribution map of Gorontalo Province

The following is a modeling of Village potential research results based on RZWP3K Gorontalo Province data.

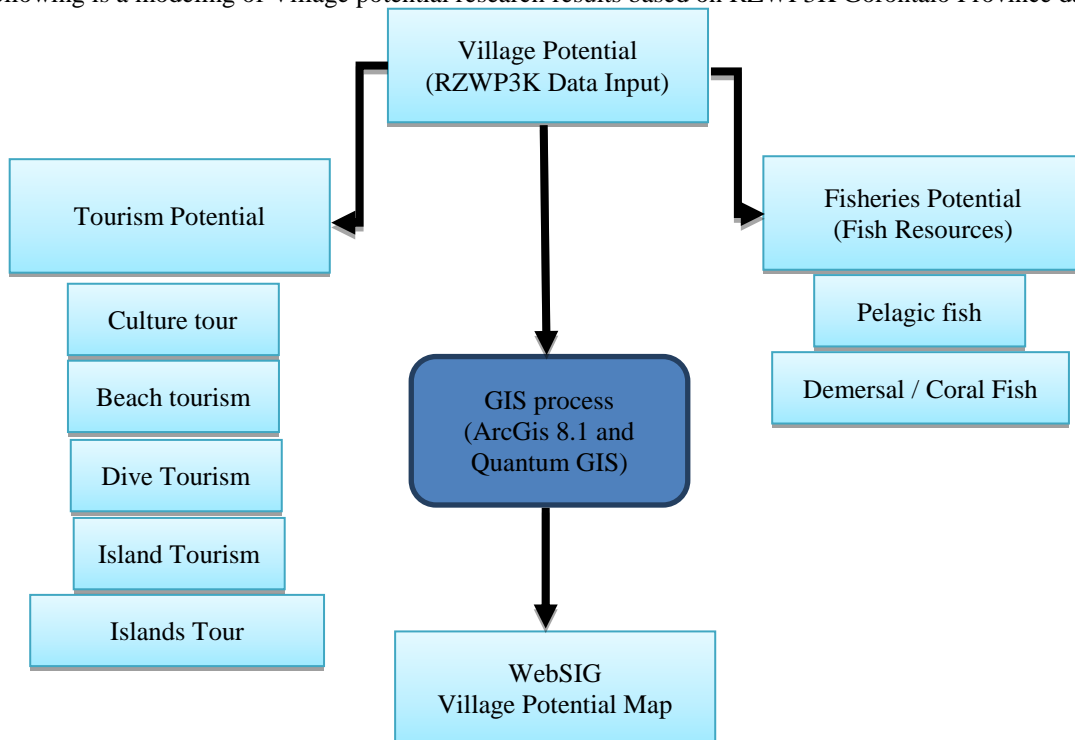


Figure 3. Village Potential Research Model

d. GIS of Tourism Potential in Tomini Bay Sea Waters

The Tomini Bay Sea’s tourism potential seeks to realize a diversity of tourism businesses in the form of services and natural tourist attractions along with the development of co-benefits, specifically tourism that benefits businesses (economic sustainability), provides benefits for environmental and cultural sustainability (sustainability of the natural and cultural environment) and ensures the equitable welfare of local communities (social sustainability).

The realization of a tourism industry structure with a strong value chain and tourism products that are highly competitive and develop as an economic area based on the characteristics of tourist destinations. Increased labor intake, growth, and development of local enterprises; improved the skill capacity of tourism industry centers and business managers up to the rural level.

The distribution of tourism potential in Tomini Bay’s waters based on GIS is shown in the table below.

Table 1. Distribution of Tourism in Gorontalo Province

Tour Type	District	Regency	Amount
Culture tour	- Tilamuta - Popayato	- Boalemo - Pohuwato	3
Island Tourism	- Marisa - Lemito - Tilamuta - Ponelo Islands - Tomilito - Gentuma Raya - Sumalata	- GorontaloRegency - North Gorontalo - Boalemo - Pohuwato	12
Dive Tourism	- Bone Raya - Bone - Bulawa - Bone Pantai	- Bone Bolango	5
Beach tourism	Spread over several districts	- Bone Bolango - GorontaloRegency - North Gorontalo - Boalemo - Pohuwato	32
Islands Tour	Tilamuta	- Boalemo	4

III. Discussion

The study result by the Maritime Affairs and Fisheries Service of the Province of Gorontalo, which is included in the Zoning Plan document for Coastal Areas and Small Islands or RZWP3K, are then analyzed through the ArcGIS and quantum gis applications that result in a GIS Web map of Village Potential for Tourism and Fisheries.

The observations results of reef fish in Gorontalo waters in the form of a combination of major fish, indicator, and target fish showed that the average abundance of reef fish at each observation station was 353 ind/350m². The abundance of major fish based on tribe shows an unbalanced composition, which is dominated by the Pomacentridae tribe, with 3,579 individuals out of a total of 5,047 individuals. A similar analysis of indicator fish abundance by tribe reveals the dominance of several tribes, with the *Plotosidae* (500 individuals) and the lowest is the *Kyphosidae* tribe.

Based on specific observations of target reef fish, the total counted at all stations was 1,630 individuals. The number was dominated by the coral fish of the Caesionidae family of 1,475 individuals, while the other tribes were relatively few, such as Lutjanidae, only 62 individuals, Siganidae only 4 individuals, and even Haemulidae only 20 individuals, and Serranidae tribe with only 19 individuals. The stark contrasts between various tribes that exist are evidence of the ecosystem’s instability.

Moreover, based on particular observations of the target reef fish, the total counted at all stations was 339 individuals. The number includes 36 species of target reef fish, consisting of 5 species from the Acanthuridae

tribe, 11 species from the Scaridae tribe, 5 species from the Siganidae tribe, 2 species from the Haemulidae tribe, 1 species from the Lethrinidae tribe, 3 species from the Lutjanidae tribe and 9 species of the tribe Serranidae. This indicates that the highest number of the species discovered is the target fish species *Serranidae* or grouper fish, while the least is the target fish *Lethrinidae* or lance fish, which only one species, namely *Lethrinus* harak.

WebGIS data processing utilizes the Quantum GIS application, which is analyzed using shapefile (shp) primary data obtained from the Gorontalo Province map's digitization results. The following is a distribution of fisheries and tourism potential maps.

1. WebGIS Map of Tourism Potential Distribution in Gorontalo Province

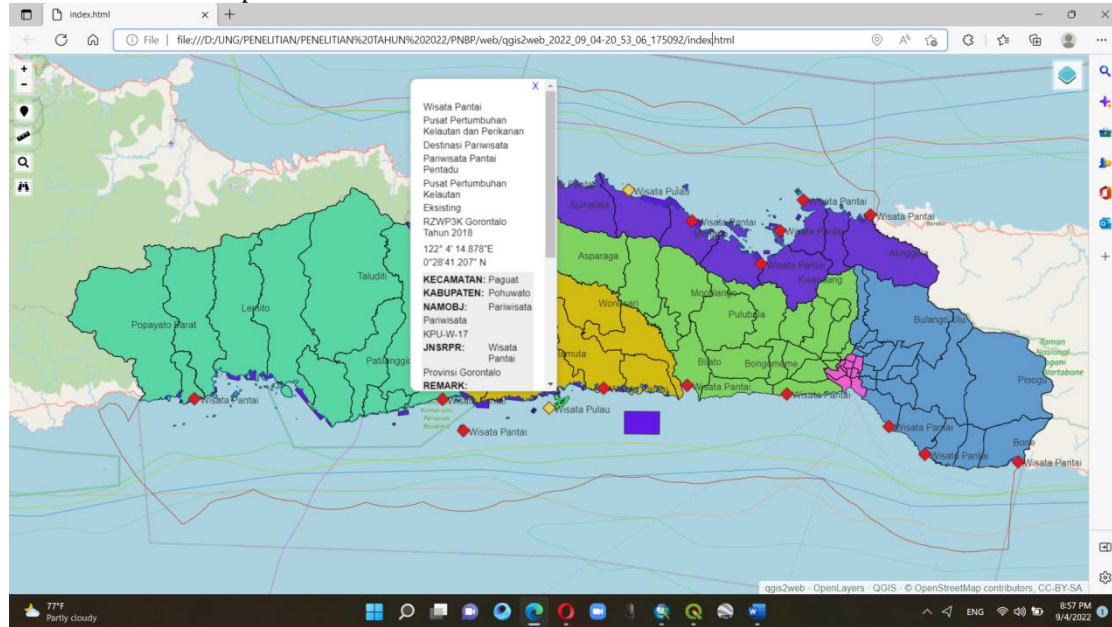


Figure 4. WebSIG Tourism Potential

2. WebSIG Map of Potential Distribution of Aquaculture in Gorontalo Province

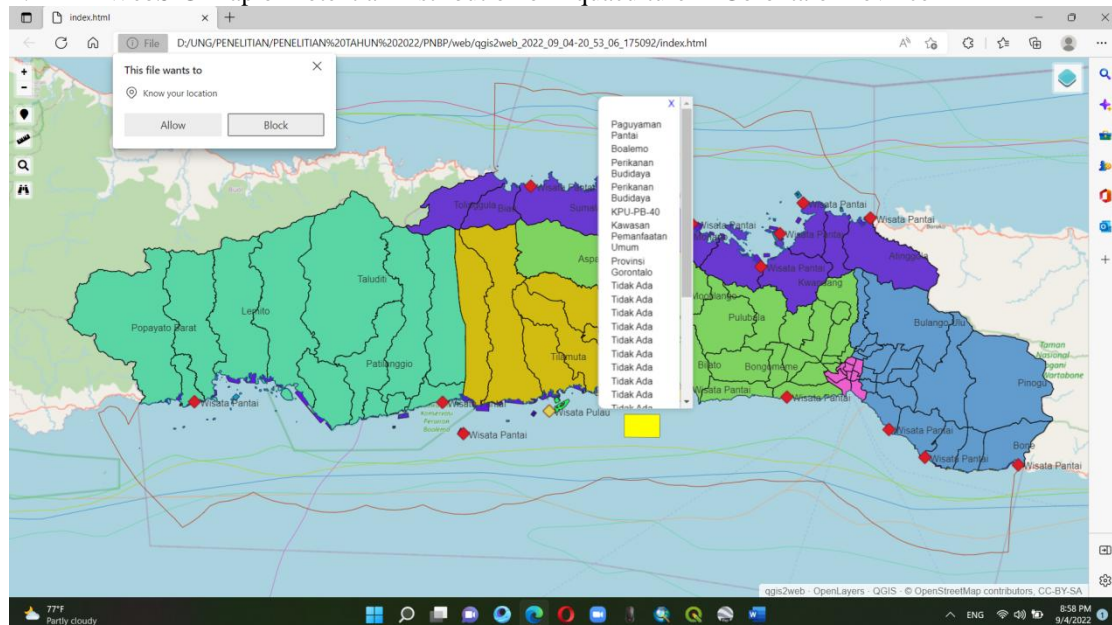


Figure 5. WebSIG Aquaculture Potential

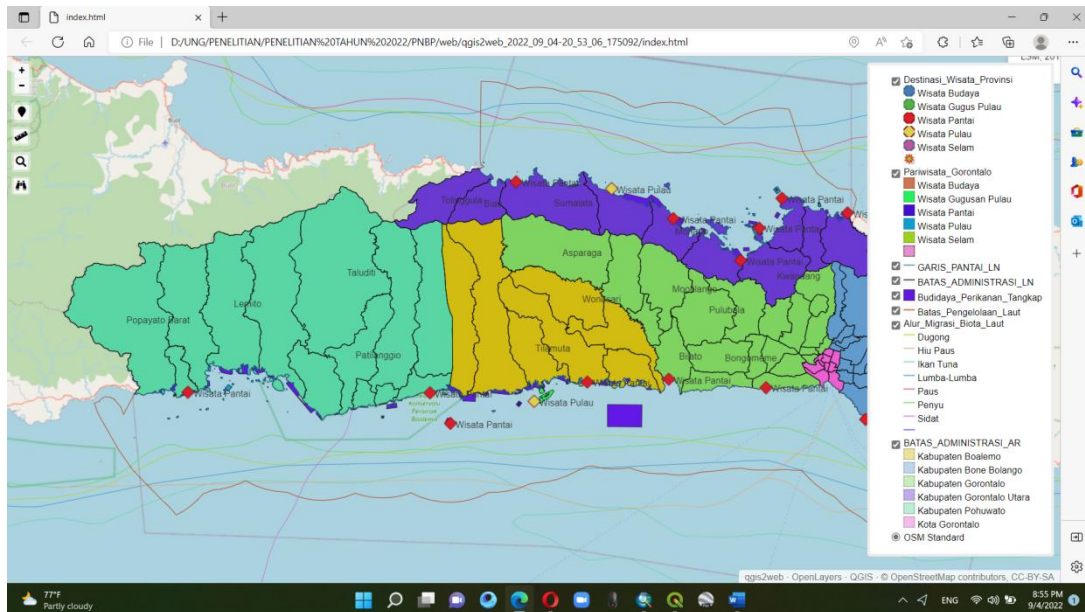


Figure 6. WebSIG Potential of Tourism and Fishery Villages

IV. Conclusion

In the RZWP3K Document, Tourism Potential along the Tomini Bay Sea aims to realize a diversity of tourism businesses in the form of natural tourism services and attractions with the development of co-benefits implementation, specifically tourism that benefits businesses (economic sustainability), provides benefits for sustainability environment and culture (sustainability of natural and cultural environment), and ensures the equitable welfare of local communities (social sustainability). There are five types of tourism, viz. cultural tourism, island tourism, beach tourism, island cluster tourism, and diving tourism.

Furthermore, the potential for fish resources in Tomini Bay (WPP 715) in the waters of Gorontalo Province's WPP zone is 631,703 tons per year. In Gorontalo Province, fishing still plays a significant strategic role in developing marine resources. This is evident from the production contribution of the capture fisheries, which totaled 115,873 tons, or 53.62% of the overall fishery production, that reached 216,118 tons in 2016. The aquaculture production was large at 100,245 tons, in which the fish cultivation was 38,2995 tons, and the grass sea was 61,950 tons. There are 2 types of Aquaculture Fish, namely Pelagic Fish and Demersal/Coral Fish.

The Fisheries data and tourist data are managed using the ArcGIS and Quantum GIS applications, respectively. The WebSIG application program is then updated with the process results.

References

- [1]. Agus, & Ridwan, M. (2019). Pemetaan Objek Wisata Alam Kabupaten Kepulauan Selayar Berbasis Sistem Informasi Geografis [Mapping Natural Tourism Objects in Selayar Islands Regency Based on Geographic]. *Pusaka*, 1(1), 45–50.
- [2]. Akmal, F., Ramdani, F., & Pinandito, A. (2018). Sistem Informasi Pengelolaan Perkebunan Kelapa Sawit Berbasis Web GIS [GIS Web-Based Palm Oil Plantation Management Information System]. *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, 2(5).
- [3]. Arismunandar, R. (2017). Sistem Informasi Geografis Sebagai Alat Monitoring Terhadap Apotek Kerja Sama PT Bayer Indonesia [Geographic Information System as a Monitoring Tool for Collaborative Pharmacies with PT Bayer Indonesia]. *Teknosi*, 03(01), 187–198.
- [4]. Bappeda. (2021). *Arah Kebijakan Pembangunan Kabupaten / Kota [Development Policy Directions of District/City]*. Retrieved from https://bappeda.gorontaloprov.go.id/institution/file_share/BAB-V_182_571.pdf
- [5]. Hamad, H. (2008). Kondisi hidrodinamika dan oceanografi teluk tomini propinsi sulawesi tengah [Hydrodynamic and oceanographic conditions of Tomini Bay, Central Sulawesi Province]. *Mektek*, 10(1).
- [6]. Hazliansyah. (2017). Teluk Tomini Objek Wisata Unggulan Parigi Moutong [Tomini Bay is the Main Tourism Object of Parigi Moutong]. Retrieved March 8, 2021, from

- <https://republika.co.id/berita/ojbbm5280/teluk-tomini-objek-wisata-unggulan-parigi-moutong>
- [7]. Imtihan, K., & Fahmi, H. (2020). Analisis Dan Perancangan Sistem Informasi Daerah Rawan Kecelakaan Dengan Menggunakan Geographic Information Systems [Analysis and Design of Accident-Prone Area Information Systems Using Geographic Information Systems]. *MISI*, 3(1), 16–23.
- [8]. Miru, S., & Darman. (2018). Model rantai pasok perikanan tangkap di kawasan teluk tomini 1[A capture fisheries supply chain model in the Tomini Bay area 1]).
- [9]. Muzakir, S. (2016). Strategy of Developing Tomini Bay for Economic Growth of Coastal Community in Central Sulawesi. *Jejak*, 9(1), 96–110.
- [10]. Noraida, Khair, A., & Raharja, M. (2014). Sistem informasi geografis diare pada balita di wilayah kerja puskesmas banjarbaru [Geographic information system for diarrhea in toddlers in the working area of the Banjarbaru Health Center]. *Kesehatan Lingkungan*, 11(1), 151–157.
- [11]. Tamrin, T., Zyen, A. K., & Dina, M. H. (2019). Perancangan Geographic Information System Berbasis Android Untuk Potensi Mebel Di Kecamatan Tahunan Kabupaten Jepara [Android-based Geographic Information System Design for Furniture Potential in Tahunan District, Jepara Regency]. *Walisongo Journal of Information Technology*, 1(2), 139–150.
- [12]. UNG, R. (2021). Pre Regional Meeting Hasilkan Konsorsium Pengembangan Teluk Tomini [Pre Regional Meeting Produces Tomini Bay Development Consortium]. Retrieved March 7, 2021, from read.id website: <https://read.id/pre-regional-meeting-hasilkan-konsorsium-pengembangan-teluk-tomini/>
- [13]. Winoto, S., Fadlil, A., & Umar, R. (2019). *Perancangan Sistem Penerimaan Peserta Didik Baru Jalur Zonasi Dengan Sistem Informasi Geografis (Gis) Berbasis Mobile.[Designing a Zoning Line New Student Admission System With a Mobile-Based Geographic Information System (GIS)]*668–676.