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Analysis of Oceanographic Physical Parameters of Blue Swimming Crab (Portunus Pelagicus) Fishing Grounds in Pangkep District Waters

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Abstract

Blue swimming crab (Portunus pelagicus) or known by its common name as blue swimming crab (BSC), belongs to the Crustacean phylum of the Portunidae family. The seasonal pattern of crab is influenced by the number of recruits produced by each individual crab in the fishing area. Temperature and salinity are important factors affecting the distribution, activity, and migration patterns of crabs. This study aims to determine the physical oceanographic parameters (bathymetry, currents, and brightness) in crab fishing grounds in the coastal area of Pangkep Regency. This research was conducted from March to May 2023 AD by following the Hijri calendar of Ramadan to Dhulhijjah 1444H in the waters of Pangkep Regency. Based on the analysis of bathymetry data obtained information that the depth in the observation zone ranges from 0.5 to 80 meters. Based on measurements of ocean currents in the field, it can be seen that the current speed at sea level has an average speed ranging from 0.2- 1.09 m/s with the dominant current direction towards the north to northeast. Based on field measurements, it is found that zone 3 has the highest average brightness level of 16.27 meters. Based on observations of oceanographic physical conditions in accordance with the presence of crabs, so the potential for abundant crab catches is abundant.

Keywords: Oceanographic Physical Parameters, Blue Swimming Crab

Introduction

Blue Swimming Crab (Portunus pelagicus), also known by its common name as blue swimming crab (BSC), belongs to the Crustacean phylum of the Portunidae family. This biota generally inhabits bottom waters and is commonly found in Southeast and East Asia or the Eastern Indian Ocean and Western Pacific Ocean (Lai *et al*., 2010) [9]. King crab is an economically important species in Southeast Asia (Potter and de Lestang, 2000; Lai *et al*., 2010) [10, 9]. The distribution of crab in Indonesia includes coastal waters in Java, Sumatra, Kalimantan, Nusa Tenggara, Sulawesi and Papua. The existence of crabs on the island of Sulawesi is mostly found in South Sulawesi Province, namely in the coastal waters of Pangkajene Islands Regency (Pangkep).

Pangkajene Islands Regency (Pangkep) is one of the regencies in South Sulawesi with a marine area located on the west coast of the Makassar Strait. Fisheries resources in this area are very abundant, one of which is crab, which is spread in coastal areas and small islands (Ihsan *et al*., 2014) [4]. In fact, the potential existence of crab is not evenly distributed throughout the waters of Pangkep Regency, partly due to differences in the condition of the aquatic environment. In general, crabs are spread in coastal sub-districts and the nearest island sub-districts in Pangkep Regency. According to the Marine and Fisheries Service of Pangkep Regency, in 2010 the production of crab derived from fishing in the waters of Pangkep Regency amounted to 1918.7 tons.

The seasonal pattern of crab is influenced by the amount of recruitment produced by each individual crab in the fishing grounds. Each crab fishing area is not fixed, always changing, shifting and moving following the movement of aquatic environmental conditions, which naturally crabs will choose a more suitable habitat. While the habitat is strongly influenced by conditions or oceanographic parameters such as sea surface temperature, salinity, oxygen, pH, depth and so on (Laevastu and Hayes 1981; Butler *et al*. 1988. Zainuddin *et al*. 2006 [11]). This affects the dynamics or movement of seawater both horizontally and vertically which in turn affects the abundance of crabs.

Crabs can be found in a very diverse range of habitats, which are found from the intertidal zone to offshore waters with a depth of 50 meters (Edgar, 1990; Kumar *et al*., 2000) [2, 6]. This is related to the habitat preferences of each crab life cycle, starting from the habitat of larvae, yuwana and adult crabs. Crabs are generally found in large numbers in shallow waters with sandy substrates (Hosseini *et al*., 2012) [3]. Crabs favor sandy bottom substrates, sand beds, and muddy sand. Kangas (2000) [5] states that the migration of spawning mothers to outside the estuary or deeper waters is to obtain suitable salinity and dissolved oxygen conditions for egg hatching. Temperature and salinity factors are important factors affecting the distribution, activities, and migration patterns of crabs. Waters that tend to be warm are very favorable conditions for crabs. Crabs are also known to have a salinity preference in the range of 30-40 ppt (Romano and zeng, 2006) [8].

Research Objectives

Based on the description of the problem formulation, this study aims to determine the physical oceanographic parameters (bathymetry, current, and brightness) in the crab fishing area in the coastal area of Pangkep Regency.

Research Methods

This research was conducted from March to May 2023 AD by following the Hijri calendar of Ramadan to Dhulhijjah 1444H in the waters of Pangkep Regency.

Data Collection Methods

1. Bathymetry

a. Depth data was collected by tracking using a boat with the zig-zag method.
b. Record the position and time of data collection every 20 seconds.
c. Depth measurement is carried out using a germicidal tool (Fishpender) by using the sensor of the tool to the water, then the fishpender display layer will appear depth.
d. The value is subtracted from the sensor depth value.
e. The depth measurement results will be corrected with Mean Sea Level.

2. Tides

Tidal data collection was carried out using a scale measuring trough installed at the bottom of the beach where the zero scale is located below sea level at the lowest low tide and the scale reading can still be read at the highest high tide. After the scaled basin is installed, tidal observations are made at 1 hour intervals for 3 days (one observation). The results obtained will be entered into the tidal curve to determine the type of tide.

3. Current

Calculation of water current using the Global Water FP111 current meter, obtained by comparing the number of revolutions that occur in the current meter propeller during a certain time.

a. Remove any debris that may interfere with the flow probe vanes. Make sure the vanes are spinning freely by blowing on them. Some propeller rumbling in the air is normal, the bearings are designed to operate best when wet.
b. Point the vane directly at the flow you wish to measure. Face the arrow inside the propeller housing downstream. The FP111 probe handle is a two-piece rod that can be expanded from approximately 3' to 6'. To expand the rod for correct placement in the stream, loosen the lock nut on the handle. To help properly orient the flow probe in the stream, optional alignment fins are available from Global Water.
c. To extend battery life, a low power mode is incorporated that will take effect after 5 minutes of inactivity. If the propeller is stopped and no buttons are pressed for 5 minutes, this mode will take effect and the speed display will be blank. Press one of the 4 buttons to turn on the computer for taking measurements or viewing stored data.
d. To perform measurements, make sure the computer is not in low power mode by confirming that the speed display is shown. If this display is blank, press any key to restart the computer. Place the propeller p4.

4. Brightness measurement

Sea water brightness can be measured using a tool called a secchi disk. Secchi disk is a simple disc-shaped plate, on the surface of which there are black and white colors, in the form of shading with four parts. The use of secchi disks should be done in the morning and evening. How to use a secchi disk is quite easy, the secchi disk slab is tied with a rope and then put into the water. The following are the steps for measuring light penetration using a secchi disk:

a. Secchi disk is inserted into the water.
b. Secchi disk is lowered until it is no longer visible from the surface and the depth is recorded.
c. Then the secchi disk is pulled back up until it starts to appear again and the depth is recorded.
d. Measurement of depth when the secchi disk disappears and when the secchi disk begins to appear again is done by measuring the length of the secchi disk rope.
e. The value of light penetration is obtained from the calculation of the average depth when the secchi disk is not visible and when the secchi disk begins to appear again.
f. Measurements were made by repeating several times.

Data Analysis

1. Bathymetry

Marine tidal reduction is formulated as follows

$$r_t = TWL_t - (MSL + Z_0)$$

Where:

r_t = The amount of reduction given to the depth measurement result in time t
TWL_t = Actual sea level at the time t
MSL= Mean sea level
Z_0= Depth of tidal water below MSL

After that, the true depth is determined:

$$D = dT - rt$$

Where:

D = True depth
dT = Tranducer corrected depth
rt = Tidal reduction

1. Current

Formula using current meter

$$V = (0.3048 \times (0.0178 + {}^{Rev}/_{Time} \times 2.2048))$$

Where:

V= Water current velocity in meters/second

Rev= The number of pinwheel revolutions in current meter

Time= Length of measurement time current meter

2. Tides

Determining tidal type through formzahl calculation, using the formula:

$$F = \frac{(O_1 + K_1)}{(M_2 + S_2)}$$

Description:

F = Formzahl number

O_1 = amplitude of the main single tidal component caused by the lunar drag force

K_1 = amplitude of the main single tidal component caused by the lunar and solar gravity

M_2 = amplitude of the main double tidal component caused by the lunar gravity

S_2 = amplitude of the main double tidal component caused by solar drag

3. Brightness measurement

$$kecerahan = \frac{D1 + D2}{2}$$

Where:

D1 = Depth how many meters secchi disk is not visible

D2 = How many meters depth secchi disk visible

Results and Discussion

General Site Situation

The total area of Pangkep Regency is 12,362.73 km2 consisting of a) land area of 898.29 km2 (from 1,112.29 km2 to 12,362.73 km2 and after Law No. 32 of 2004 regional government) and sea area of 11,464.44 km2. Pangkep Regency has a coastline length of 45 km, 114 islands including 70 inhabited and 44 uninhabited which are scattered to the borders of Nusa Tenggara Island, Bali, Madura, Kalimantan. The boundaries in the north border Barru Regency; in the south with Maros Regency; in the west with the provinces of South Kalimantan, East Java, Bali and NTB; and in the east with Bone Regency. This makes Pangkep Regency an area rich in biodiversity that can be utilized and managed to increase the income and standard of living of the community (Marine and Fisheries Service of Pangkep Regency, 2010).

Measurement Results

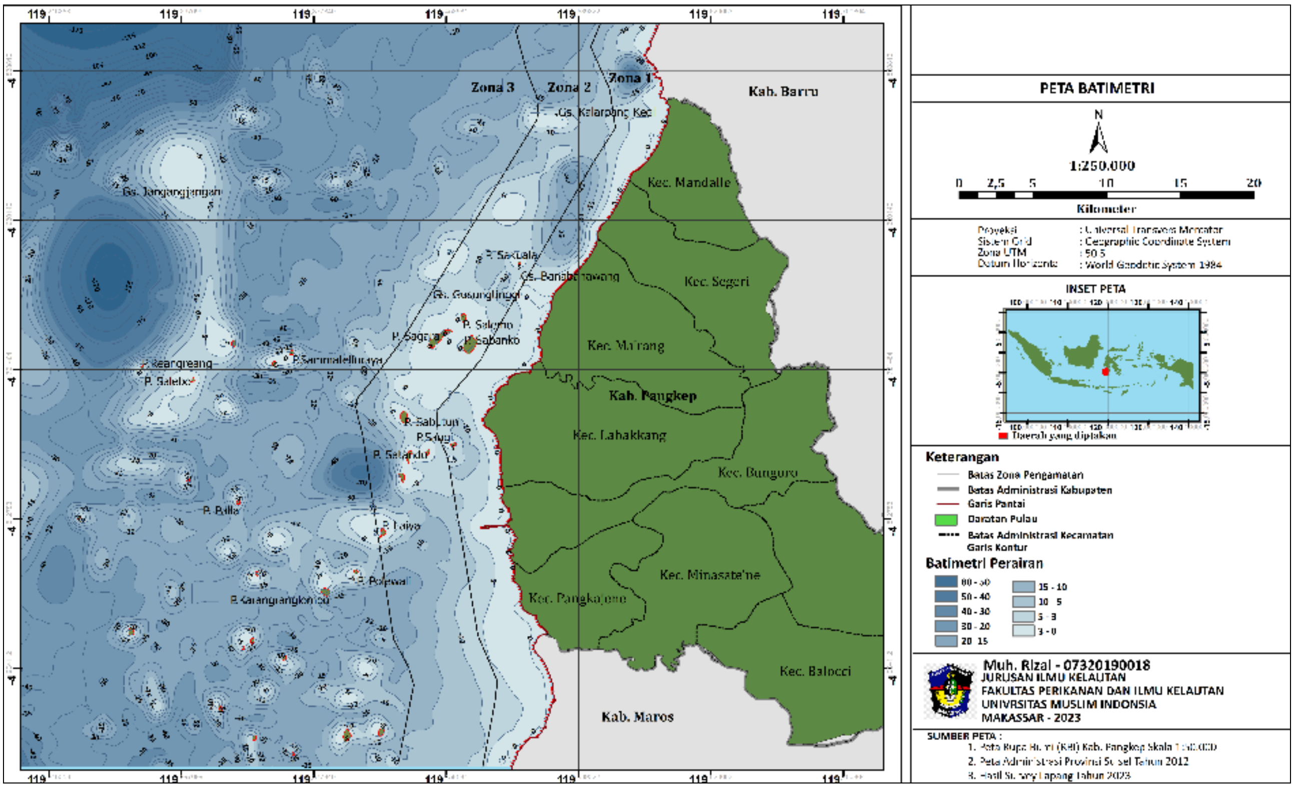

Fig 1: Bathymetry map

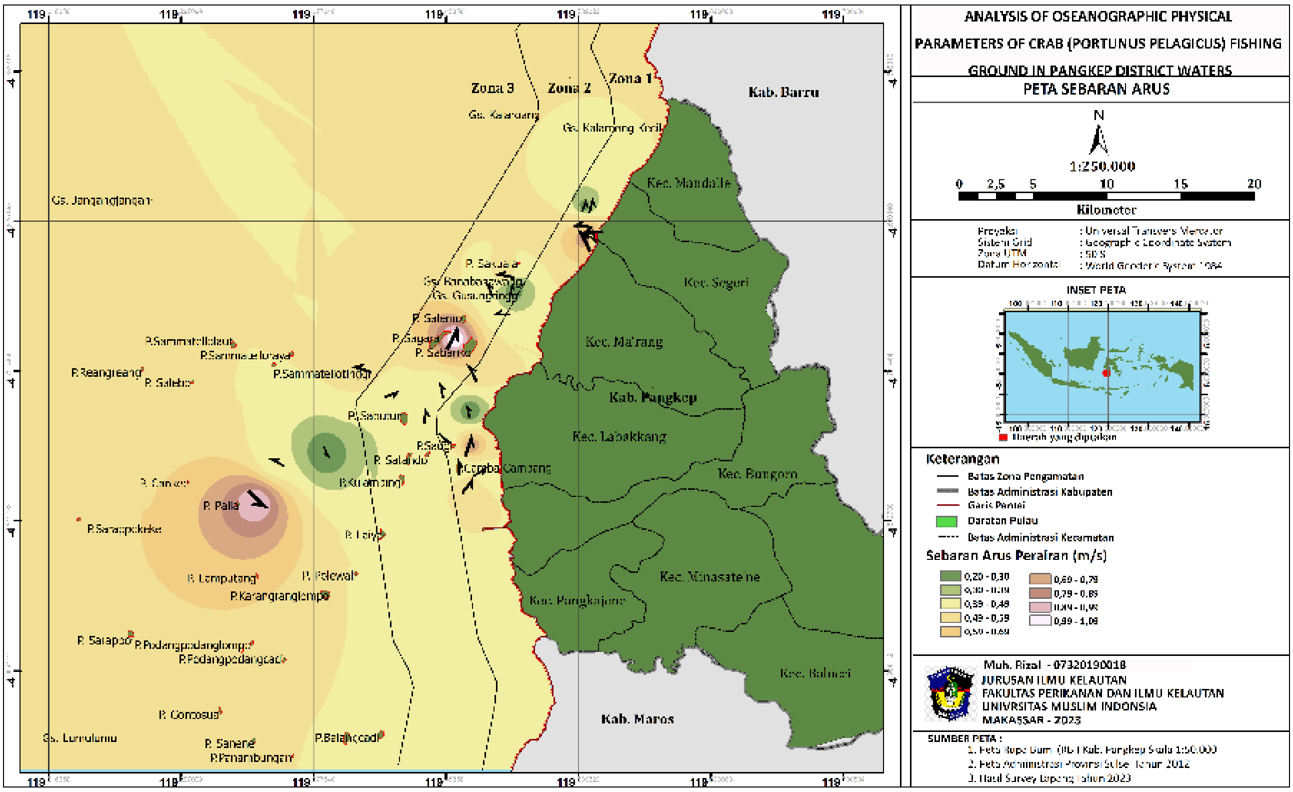

Fig 2: Water Current Map

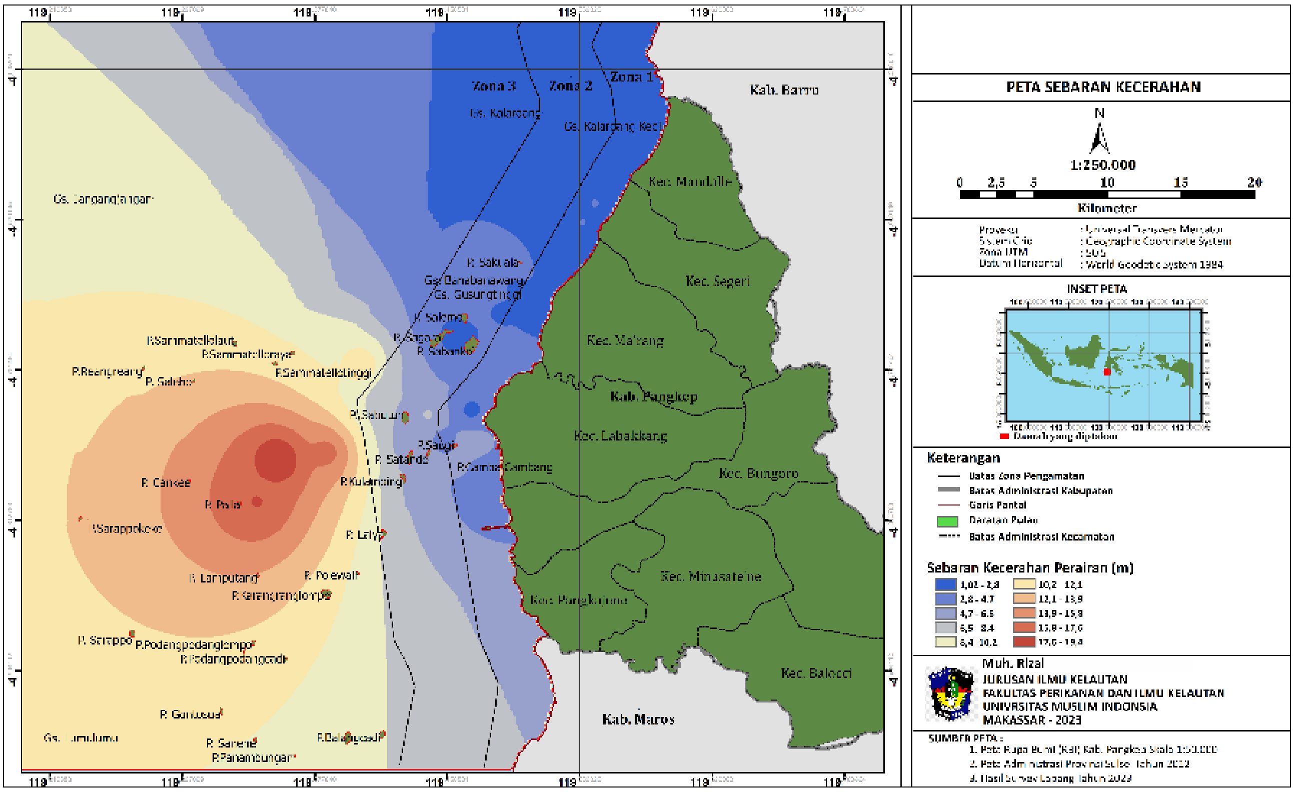

Fig 3: Brightness Map

Discussion

1. Bathymetry

Based on the research results, it can be concluded that:

Based on data analysis as shown in Fig 1, information was obtained that the depth in the observation zone ranged from 0.5 to 80 meters. The water bottom profile in Pangkep Regency tends to be flat. The shallowest areas are located around the coast to the islands of Salmo, Sabangko and Saghara. Meanwhile, the deepest areas are located west of Satando Island, with maximum depths exceeding 80 meters. Rajungan can be found in a very diverse range of habitats, ranging from the intertidal zone to offshore waters up to 50 m deep (Edgar, 1990; Kumar *et al*., 2000) [2, 6]. This is related to the habitat preferences of each crab life cycle, starting from the habitat of larvae, yuwana, and adult crabs. According to Rahman and Fuad (2020) [7], crabs have a wide habitat, ranging from mangrove areas, near the sea surface, and the seabed with a depth of <1 - 50 meters.

2. Current

Based on the measurement of ocean currents in the field, the results are shown in Fig 2, it can be seen that the current speed at the sea surface has an average speed ranging from 0.2- 1.09 m/s with the dominant current direction towards the north to northeast. Water currents can help oxidize organic substances and facilitate oxygen exchange between the atmosphere and waters. This can increase dissolved oxygen levels in the water, providing good conditions for aquatic organisms that need oxygen to breathe. In addition, currents can help distribute nutrients such as nitrogen and phosphorus throughout the water. These nutrients are essential for the growth of algae and other aquatic plants. Strong currents can carry nutrients from nutrient-rich areas to nutrient-poor areas, supporting a balanced aquatic ecosystem. Currents can also affect the concentration of sediment in the water. Strong currents can transport and deposit sediment in certain places. This can affect water clarity and the quality of the aquatic substrate, as well as affect the living conditions of bottom-dwelling organisms.

3. Brightness Measurement

Based on field measurements shown in Fig 3, it was found that zone 3 has the highest average brightness level of 16.27 meters. Zone 3 is the outermost area away from the coast so that it has clearer water conditions or is less affected by local factors. Zone 1, which is around the coast, has the lowest average brightness level of 2.36 meters. In natural waters, brightness is very important because it is closely related to photosynthetic activities. Brightness is an important factor for the process of photosynthesis and primary production in a body of water (Alfikri *et al*, 2016) [1].

Conclusion

Based on observations of oceanographic physical conditions in accordance with the presence of crabs, so the potential for abundant crab catches is abundant.

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