

# Density and distribution pattern of *Polinices* sp. in Kuala Cangkoi and Ujong Pancu beach, Indonesia

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**Abstract.** *Polinices* sp. is a genus of the Naticidae family that lives in the intertidal zone with tidal influence and soft textured substrates. This research was conducted in March 2022, located in the waters of Kuala Cangkoi, Banda Aceh and Ujong Pancu, Aceh Besar. The purpose of this study was to determine the density and distribution pattern of *Polinices* with Kuala Cangkoi and Ujong Pancu water quality. The method used in this study was purposive sampling method. The identification results found in both research locations are *Polinices mammilla* (Linnaeus, 1758). The average density value of *Polinices* obtained in Kuala Cangkoi was 1.6 ind/m<sup>2</sup> and in Ujong Pancu 1.9 ind/m<sup>2</sup>. The distribution pattern found in both research locations is random. Water parameters include temperature ranging from 30°C - 32°C in both locations. The salinity obtained in both research locations was 20‰. The acidity (pH) obtained was 8.4 in Kuala Cangkoi and 7.6 in Ujong Pancu. The type of substrate obtained is sandy loam and sandy loam. Overall, the environmental conditions of Kuala Cangkoi and Ujong Pancu waters are still within the tolerance limits of *Polinices* to support their lives.

## 1 Introduction

Kuala Cangkoi beach is located in Meuraxa sub-district of Banda Aceh and Ujong Pancu beach is located in Peukan Bada sub-district of Aceh Besar. These two waters include coastal areas that have an important role for the surrounding community by utilizing these waters as a fishery area, even as a tourist spot. Kuala Cangkoi and Ujong Pancu beaches are intertidal areas with tidal activities that support the life of marine organisms for their habitat. The Kuala Cangkoi and Ujong Pancu waters have abundant marine biological resources with diverse biota, one of which is the abundance of Gastropoda family Naticidae genus *Polinices*.

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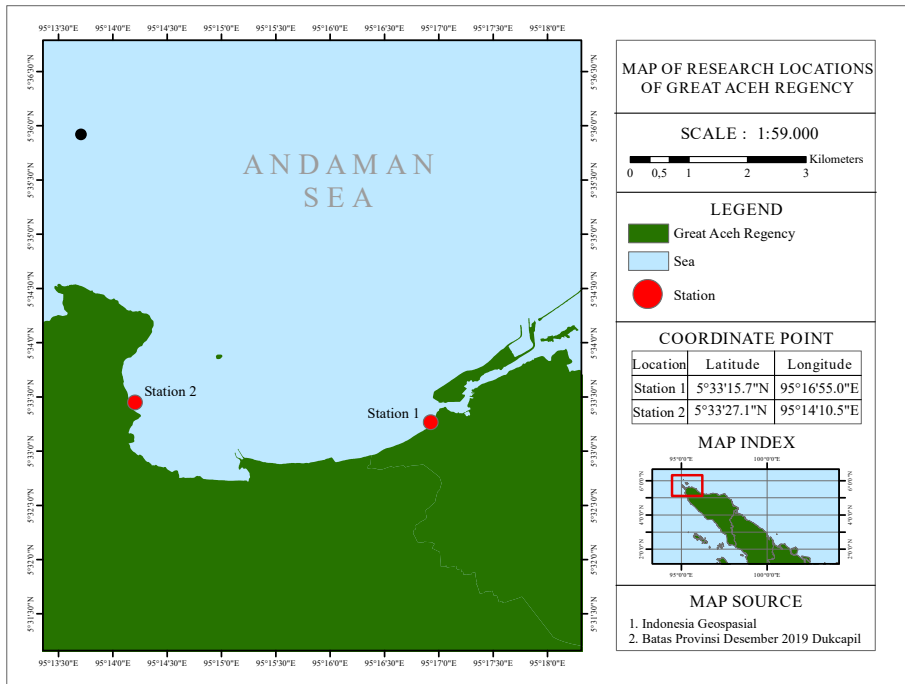
The largest Mollusc phylum is the marine Gastropoda group which is widely distributed in world waters, estimated to be around 136 families that still exist, one of which is the Naticidae family which has the latest species around 260-270 worldwide, while *Polinices* is one genus or type of sea snail from the Naticidae family which shows very sustainable morphological characters so it is a little difficult to classify its species, because the shell characters are almost the same between species [1, 2]. The empty shell of *Polinices* has an additional role after its death, because it can be utilized by other small biota to inhabit as their residence [3, 4]. According to [5] Gastropod species generally act as aquatic bioindicators because they can accumulate heavy metals in the waters, and even have economic value that can be utilized for human use as food ingredients, or their shells are used as souvenirs so that they have a high selling value. In nutrient cycling, *Polinices* play a role in bioturbation, decomposition and nutrient recycling, supporting the productivity of benthic ecosystems and coastal waters [2]. In trophic interactions, *Polinices* function as mid-level predators that control prey populations and are an important part of the flow of energy to higher-level predators [6]. *Polinices* live in the Indo-Pacific region with the highest diversity and abundance [4]. *Polinices* species are found in the tropics in the intertidal zone or tide-influenced areas with a temperate climate and fine sandy and craggy substrates [4, 7]. *Polinices* snails can grow quickly and easily join the most abundant size class present in the population [2, 8]. It is explained that *Polinices* species in the Indo-Pacific tropics have been recorded by several authors previously, including in Nusantara waters *Polinicesi*.

*Polinices* are found in many Indonesian waters, including Aceh waters [8, 9]. Previous research on *Polinices* was conducted by [3] on the phylogenetic species systematics of *Polinices* (Caenogastropoda: Naticidae) based on molecular data and shell morphology in Australia. [10] have also examined the age and growth of a Naticidae gastropod, *Polinices pulchellus* (Gastropoda: Naticidae) in Wales, British islands. [11] has described *Polinices* species in Ambon Island, Indonesia. Research on *Polinices* in Indonesia is still very little done, while in Aceh waters there has never been research on the existence of *Polinices* literature, therefore researchers want to further examine the density and distribution patterns of *Polinices* in the waters of Kuala Cangko, Banda Aceh and Ujong Pancu, Aceh Besar. The purpose of this study is the density and distribution pattern of *Polinices* in Kuala Cangko and Ujong Pancu beach.

## **2 Material and Method**

### **2.1 Time and location research**

The research was conducted in March 2022 in two locations in Aceh waters located in Kuala Cangko, Gampong Blang village, Kotamadiya Banda Aceh District and Ujong Pancu, Lambadeuk village, Peukan Banda Aceh Besar District. The research locations are shown in Fig. 1.



**Fig. 1.** Sampling locations.

## 2.2 Material

The tools and materials used during the study were transect quadrat, paralon pipe, garmin GPS GPSmap mobile phone, plastic sample container, sterfoam box, tissues, 70% alcohol and distilled water, pH meter, DO meter, refractometer, thermometer.

## 2.3 Method

The sampling locations were determined by purposive sampling. According to [12], purposive sampling is a sampling design that is not intended to provide a representative sample, but rather to hone in on specific phenomena and/or processes. The determination of the sampling location point was carried out in the waters of Kuala Cangko and Ujong Pancu with the aim that the research location area was considered to represent the type of *Polinices* found in the two research locations. The sampling procedure was carried out using a 1x1 m quadratic transect, sampling was carried out at low tide. Samples were taken at each location for a total of 10 repetitions. The sampling technique was carried out by observing the footprints of *Polinices* on the water substrate. Samples were taken by hand and then inserted into the sample holder. Insitu measurements of water quality parameters of temperature, pH and salinity were conducted. In addition, substrate collection was also carried out using a paralon pipe with a depth of 15 cm. Sample identification, carried out by observing the morphological parts of the outer shell based on guidelines from the

Western Central Pacific identification book [13] and using the web that can be accessed through the link <http://www.marinespecies.org>. Calculated parameters is :

Density, analyzed referring to the formula (Brower and Zar, 1977 in [14]) so that the density can be known by the following formula:

$$D = \frac{Ni}{A} \quad (1)$$

where D is density (Ind/m<sup>2</sup>); Ni is individu total (ind) ; and A is area sampling (m<sup>2</sup>).

Distribution Pattern, analyzed using the formula Morisita Index (Brower and Zar, 1977 in [15]) with the following formula:

$$I_{\delta} = \frac{\sum ni^2 - N}{N(N-1)} \quad (2)$$

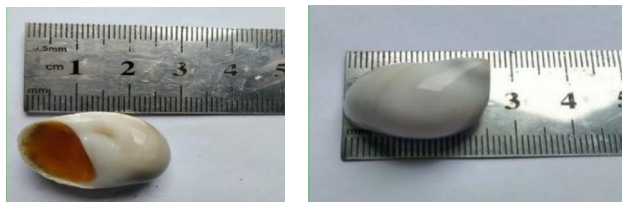
where,  $I_{\delta}$  is Morisita Index : ni is individu (Ind) ; N is individu total (N)

## 2.4 Data analysis

The data obtained is analyzed descriptively, with the aim of describing the results of the processed raw data so that it is easy to understand. Descriptive analysis means a method used to describe or analyze a research result by describing the data from the analysis results obtained and then presented in the form of tables and figures.

## 3 Result

Specimens of Gastropoda Naticidae biota in the waters of Kuala Cangkoï and Ujong Pancu, that in this study found one species of *Polinices* namely *Polinices mammilla* Linnaeus, 1758 of the genus *Polinices* Montfort, 1810 (Fig. 2).



**Fig. 2.** *Polinices mammilla* Linnaeus, 1758

The average density was 1.6 ind/m<sup>2</sup> at Kuala Cangkoï beach with a total of 16 individuals. The density in Ujong Pancu is slightly more the number of individuals obtained the average density of *Polinices mammilla* 1.9 ind/m<sup>2</sup> with a total of 19 individuals (Table 1).

**Table 1.** Density of *Polinices mammilla* in two location.

Site (1x1 m)	Kuala Cangkoi	Ujong Pancu
1	1	4
2	5	3
3	1	2
4	1	2
5	3	1
6	1	3
7	2	0
8	2	1
9	0	1
10	0	2
<b>Individu Total (ind)</b>	<b>16</b>	<b>19</b>
<b>Density (ind/m<sup>2</sup>)</b>	<b>1.6</b>	<b>1.9</b>
<b>t-statistic</b>	<b>-0.272</b>	
<b>p-value</b>	<b>0.788</b>	

The p-value (0.788) is greater than the significance limit (usually  $\alpha = 0.05$ ), so there is no significant difference between the two data groups (Kuala Cangkoi and Ujong Pancu). Based on the measurement data, water quality in Kuala Cangkoi and Ujong Pancu beach is still within the tolerance limits of *Pollinices* and other biota (Table 2). Furthermore, the distribution pattern of *Polinices mammilla* at the research site with 10 sampling points at each location found a random distribution pattern, with a value of  $I_{\delta} = 1$ .

**Table 2.** Water quality in two location.

Parameters	Kuala Cangkoi	Ujong Pancu
Temperatur (°C)	32	30
Salinity (‰)	20	20
pH	7.4	7.6
Sediment type	Sandy loam	Loamy sand

## 4 Discussion

The density of the *Polinices* population on the Kuala Cangkoi and Ujong Pancu beaches is high, because it is not much different from the results of previous research conducted in Laguna, Matsukawaura, Japan reported that the total density ranged from 1 to 24 individuals with an average value of 0.4 ind/m<sup>2</sup> to 3.2 ind/m<sup>2</sup>, the density of these organisms changes significantly has increased and decreased repeatedly from 2004 – 2010 [16]. The acquisition of data on the existence of *Polinices* is caused by several factors of aquatic environmental conditions with suitable sediment types that can affect the existence of the density of a gastropod organism, especially *Polinices mammilla* as its habitat. This is reinforced by the statement [9] that the Ujong Pancu area has the characteristics of fine sediments or substrate types that can provide good nutrients for the survival of gastropods, making it very suitable to support the growth of gastropods such as *Polinices mammilla*.

Supporting factors such as marine water quality parameters can also affect the presence of *Polinices mammilla*. Good environmental health or water quality conditions will support *Polinices* species to breed well. Kuala Cangkoi and Ujong

Pancu waters include areas that have a normal temperature range and are good enough for *Polinices* species for their survival. This statement is in accordance with [17] which states that gastropods are able to metabolize optimally with a temperature range of 25°C - 35°C. The salinity value at both locations is a reasonable range for *Polinices* species to survive in the intertidal zone. According to [6], [18], [19] that intertidal zone waters have a salinity range of 19‰ - 24‰ is a normal range for gastropods living in the intertidal zone such as Kuala Cangkoi and Ujong Pancu waters.

The level of density of *Polinices* can be influenced by temperature, salinity and pH. pH levels or the acidity of seawater is thought to also affect some aquatic biota or gastropods, especially for *Polinices mammilla* which is quite sensitive to changes in pH. According to [20] that the pH category of waters with a range of 6.0 - 8.5 is a standard and ideal range for benthics.

The average density value of *Polinices mammilla* found in Kuala Cangkoi and Ujong Pancu shows results that are not significantly different, because the Kuala Cangkoi and Ujong Pancu locations may have the same water flow. The situation of the sampling location in Kuala Cangkoi is very close to restaurants and cafes, the possibility of the influence of waste from excessive solid community activities at that location, can affect the density of polinices. Based on direct observation at the Kuala Cangkoi location, there is a lot of garbage found on the beach. While the sampling location in Ujong Pancu is a lot of marine biota that is used to support the lives of people around the waters.

The random distribution pattern of *Polinices* in this study is similar to previous research in Barnstable, Massachusetts, United States reported that the distribution pattern of *Polinices* found was random [10]. The distribution pattern of *Polinices* at the Kuala Cangkoi and Ujong Pancu water locations was influenced by factors of aquatic environmental conditions and substrate types at both research locations found soft sediment types with substrate categories tending to be clayey. Based on the statement of [18] distribution patterns are caused by factors such as the condition of the aquatic environment of the organism's habitat, sediment type, diet, reproductive processes, social behavior, and the influence of daily and seasonal can affect the distribution that occurs in gastropods.

According to [8, 21] in their research stated that *Polinices* species are very adaptable to aquatic environmental conditions and are able to live with various types of substrates. The distribution pattern occurs as a result of individuals living in a spread manner in several places, in accordance with the conditions of the aquatic environment or habitat of *Polinices* which are able to adapt easily to various environmental conditions, because they are easy to adapt so that their existence spreads randomly. This is reinforced by the statement [22] that random gastropod species are very easy to adapt to almost all environmental conditions.

The type of substrate or soft sediment can also affect the spread of *Polinices* to adapt and find food. According to [23] explained that *Polinices* species are burrowing biota that emerge from soft sediments and actively forage when the waters are at low tide. These burrowing species are usually in close contact with sediments and even most of these species can be used as indicators that can accumulate metals and lead in sediments. This species searches for prey in the sediment in a random direction in intertidal areas that are influenced by tides, these factors result in *Polinices* in the water being widely distributed. The substrate type in Kuala Cangkoi with the texture of sandy loam and Ujong Pancu substrate is sandy loam with shallow water

conditions, both locations have conditions that can support *Polinices mammilla* to easily find food and for its survival.

## Conclusion

Based on research that has been carried out in Kuala Cangko and Ujong Pancu, there is one species of *Polinices mammilla* Linnaeus, 1758. The density of the Polynesian population on the Kuala Cangko and Ujong Pancu beaches is high with a random distribution pattern. These results are supported by the measurement of water quality parameters showing that Kuala Cangko and Ujong Pancu beaches are still within the tolerance limits of *Polinices* and other biota.

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