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# Distribution Patterns of Sea Horses Based on Sex Caught in the Waters of Morotai Island

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A B S T R A C T

This research aims to determine the distribution pattern of seahorses based on sex in the waters of Morotai Island, which are spread across the waters of Morotai Island. The research was carried out from June 2022 to July 2023 at 6 points spread across the waters of Morotai Island, including South Morotai, West South Morotai, East Morotai, Rao Island, North Morotai and Morotai Jaya. The results of the research showed that the number of individual seahorses found at the research location was 25 of three types, namely seven horse Hippocampus (3 males, four females), 17 Kellogi Hippocampus (7 males and 10 females) and one female Hippocampus spinosissimus. Meanwhile, analysis of the distribution pattern index for seahorses in the waters of Morotai Island shows a uniform distribution pattern.

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## INTRODUCTION

Seahorses belong to the order Syngnathiformes class Hippocampus spp. Seahorses are one of the animals in the fish class with unique morphological characteristics. Seahorses have a crown shape on the head, fins, and colours that can be camouflaged, and reproduction is carried out by male seahorses by incubating eggs in a sac. Seahorses have been widely exploited as ornamental fish, traditional medicine and souvenirs, causing this animal to experience a population decline and be threatened in nature. Around 20 million seahorses are estimated to be traded annually (Vaidyanathan et al., 2021). Information about seahorse resources is still limited; of the 35 types of seahorse species in the world listed on the IUCN red list, 20 species are listed as "data deficient", which reflects the lack of information regarding seahorses, even for highly exploited species (IUCN 2017).

Seahorses are found in seagrass beds, coral reefs, mangroves and artificial habitats. The main habitat of seahorses is a place related to survival and protection. Data regarding seahorses, especially in Morotai, is still being determined. Many studies in Indonesia produce data on seahorses from various studies, such as bioecology, cultivation and biotechnology. However, more research must be conducted to show bioecological aspects of Eastern Indonesia, especially Morotai.

Morotai Island Regency is one of the districts in North Maluku province. Morotai has a history of World War II, well-known marine tourism and abundant marine resources. One of the marine resources is sea horses. Seahorses belong to the fish class and have distinctive morphological characteristics. Apart from that, seahorses have benefits as ornamental fish and biopharmaceuticals used for traditional medicine. This makes seahorse animals that continue to be exploited and experience increasing market demand yearly. The relevant communities and governments must try to protect and preserve seahorses with potential seahorse resources. In order to protect and preserve seahorses, it is necessary to protect their habitat. The threat to seahorses resulted in these animals being included in Appendix II in international trade by the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), resulting in restrictions on the capture and trade of seahorses (Smith & Vincent, 2005). Information about the distribution patterns of seahorses based on sex is still very limited, so it is necessary to research the distribution patterns of seahorses based on sex in the waters of Morotai Island, which are spread throughout the waters of Morotai Island.

## THEORETICAL REVIEW

### Sea Horse (Hippocampus)

In Greek, Hippocampus seahorse means hippo, horse, while campus means sea monster. Seahorses are known as Hippocampus, which means serrated horse and by their unique and strange morphological shape. Seahorses are members of the genus Hippocampus, one of 35 species belonging to the Syngnathidae family and the Gasterosteiformes order. The classification of seahorses, according to Burton and Maurice (1983), is as follows:

Phylum: Chordata
Subphylum: Vertebrates
Class: Pisces
Subclass: Teleostomy
Order: Gasterosteiformes
Family: Syngnathidae
Genus: Hippocampus
Species: Hippocampus spp.

Seahorses have egg sacs which function as a place to raise their young like kangaroos, but unlike kangaroos, seahorses with pouches are male, while kangaroos with pouches are female. Seahorses' body parts are covered not by scales but by layers of bone pieces resembling shields (Sadili et al., 2015). Morphologically, male and female seahorses are difficult to distinguish at the juvenile stage. However, after adulthood, the two can be differentiated because horses Male seahorses have an egg sac on their abdomen, while female seahorses do not.

**Seahorse Population and Distribution**

Seahorses are found in almost all world waters with a distribution from temperate to tropical waters, including the waters of the Indian and Pacific oceans to the Hawaiian Islands, Japan and the highest diversity in Indo-Pacific waters (Lourie et al., 1999). In Indonesian waters, seahorses are distributed in Lampung, Jakarta Bay, Bali and Flores (Marine et al., 2004). In South Sulawesi, seahorses are distributed in the waters of the Tana Keke Islands and Takalar Regency (Syafiuddin, 2009).

Seahorses are usually found in coral areas, macroalgae, mangrove roots and seagrass beds. However, several types live on sandy, mud and rock substrates. Seahorses can live in the littoral zone, namely offshore waters between the highest and lowest tides, where sunlight penetration can reach the bottom of the waters (Widianingrum, 2000). Generally, seahorses live in warm, shallow waters with a depth of less than 20 m, but several types are found at a depth of 150 m. Seahorses can also live in artificial habitats such as nets or cages. Generally, seahorses wrap their tails around natural structures such as sponges, branching coral, seagrass strands or submerged tree branches. Many types of seahorses can live in two, three or all of their natural habitats (CITES 2013). Some types of seahorses change habitat and depth preferences along with their growth patterns. Abiotic factors such as temperature, salinity, pH and water quality are important components of seahorse habitat.

## METHODOLOGY

This research was carried out June 2022 to July 2023 in the waters of Morotai Island, which consists of 6 (six) sub-districts, namely South Morotai, West South Morotai, Rao Island, East Morotai, North Morotai, and Morotai Jaya (Figure 1)

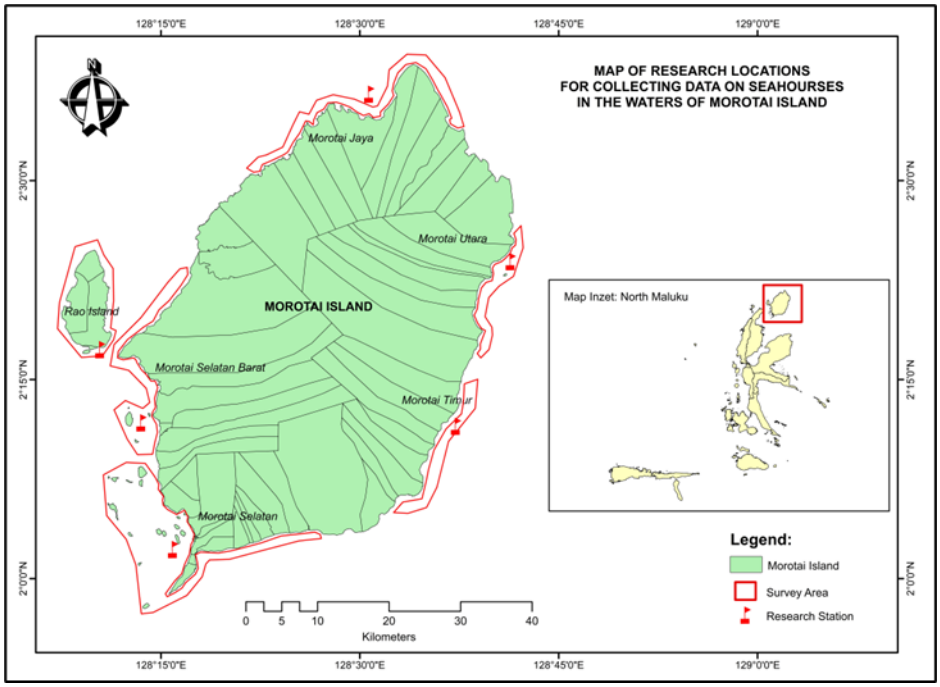


Figure 1. Map of research locations

### Tools and Materials

The tools and materials used in this research were seser fishing gear, roller meters, raffia rope, measuring ruler/califer, bucket, recording device, GPS, camera, underwater flashlight, camera, magnifying glass, scuba equipment and boat. According to Lourie (2004) and Sadili et al. (2015), use the identification guide to identify seahorse species.

### Data retrieval

Seahorse data was collected using a purposive sampling method in the seahorse fishing area based on information received from local communities. Data was collected in 6 sub-districts: South Morotai, West South Morotai, Rao Island, East Morotai, North Morotai and Morotai Jaya. Seahorses that are caught using a seser and snorkelling by swimming to get seahorses also record location points using GPS to estimate the sampling area.

### Data analysis

The observations and measurements of seahorse samples were then analyzed using qualitative descriptive data in the form of pictures and tables. The morisita index distribution pattern uses the Krebs (1989) formula:

$$Id = n \times \frac{\sum xi^2 - \sum xi}{(\sum xi)^2 - \sum xi}$$

Information:

Id = Morisita Index

n = Number of quadrants of type i
$\sum$xi = Number of individuals in the type i quadrant

## RESULTS AND DISCUSSION

The results of data collection in the field found 25 seahorses divided into three types, namely *Hippocampus kuda* (7), *Hippocampus kellogi* (17) and *Hippocampus spinosissimus* (1). The seahorse type *Hippocampus kellogi* was most commonly found compared to the types *Hippocampus kuda* and *Hippocampus spinosissimus*, which were spread across 6 (six) data collection points in the waters of Morotai Island (Table 1).

Table 1. Number of seahorse species found

| Species | Data Collection Location | | | | | | Number of Individuals |
|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | |
| *Hippocampus kellogi* | 6 | 6 | 1 | 0 | 0 | 4 | 17 |
| *Hippocampus kuda* | 2 | 2 | 0 | 0 | 2 | 1 | 7 |
| *Hippocampus spinossisimus* | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

Information:
I: South Morotai IV: East Morotai
II: South West Morotai V: North Morotai
III : Rao Island VI : Morotai Jaya

The number of individuals found at the research location at each sampling location depends on the conditions of the seahorse habitat. Seahorses are found in seagrass, mangrove and artificial habitat ecosystems. The presence of seahorses greatly influences the habitat they occupy. Curtis and Vincent (2005) stated that the condition of the habitat where seagrass and mangroves grow affects the distribution and abundance of seahorses in nature. Apart from habitats in seagrass and mangroves, seahorses live in artificial habitats such as dock posts and nets. Seahorses are animals that are loyal not only to their partners but to the habitat in which they live (Rosa et al.,2007). The low number of species and individuals found at the location is due to natural conditions and the result of accidental capture by fishermen when catching fish using nets.

Kalisiak et al. (2022) reported that seahorse species are exploited and vulnerable to exploitation due to the use of fishing gear that is not environmentally friendly and well-targeted, causing loss of seahorse habitat. The condition of the data collection location in the field shows the factors of unintentional catch when fishermen catch fish using fishing gear, environmental conditions, and weather factors such as rain accompanied by wind and waves, which influence seahorses' existence.

The analysis results of distribution patterns based on the sex of male and female seahorses show a uniform distribution pattern for males with an Id value of 0.31, while for females 0.351. This shows that male seahorses are more dominantly found with a larger distribution pattern even though they are

included in the uniform criteria. Qin et al. (2017) reported that the sex ratio of the seahorse Hippocampus mohnikei is more males than females. The distribution pattern of seahorses is influenced by several factors, namely food availability, the substrate as a living habitat, the influence of ecological factors such as physics, chemistry and the environment, as well as adaptation strategies and biological interactions between populations in the community (Adi et al., 2013). To determine the distribution pattern of gastropod species in a community, calculations were used using the Morisita distribution pattern index.

Population distribution patterns are the order of species' existence as an index of circumstances or conditions regarding the survival or way of life being implemented in an area. The cause of uniform distribution patterns is due to interactions between individuals due to competition to seize resources (Molles, 2010). Riniatsih Widianingsih (2007) also stated that this uniform distribution pattern occurs because of competition between individuals, thus encouraging equal space distribution. Uniform or even distribution of organisms can occur if competition between individuals is so fierce that it will encourage space division even though some species are more dominant than others. Apart from that, the natural characteristics of these marine animals, namely adapting, is a big factor that influences the formation of distribution patterns in a habitat.

Table 2. Distribution Pattern of Seahorses at the Research Location

| Type sex | Id | information |
|---|---|---|
| Male | Uniform | 0,31 |
| Fimale | Uniform | 0,315 |

Rosa et al. (2007) reported that the distribution of seahorses in southern Brazil is uneven, and low densities are due to habitat conditions. As Odum (1993) has pointed out, the degree of aggregation in a particular population depends on the specific characteristics of the habitat. The aquatic substrate can also determine distribution in a body of water because the substrate contains food sources (Junaidi et al., 2010). According to Campbell et al. (2008), they were stated that uniform dispersion patterns result from direct interactions between individuals in the population. Wowor et al.et al. (2016) reported that distribution patterns are influenced by several factors, including the substrate, which is the habitat of a species, food availability, the influence of ecological factors such as physical and chemical factors in an environment, as well as adaptation strategies and interactions between species in a habitat. Water temperature can also influence the number of seahorses temporally and spatially in a habitat (Qin et al., 2017). Food availability is considered one factor influencing the distribution of seahorses (Lourie et al., 2005).

## CONCLUSIONS AND RECOMMENDATIONS

Based on research results the number of individual seahorses found at the research location was 25 of three types: seven *Hippocampus kuda* (3 males, 4 females), 17 *Hippocampus Kellogi* (7 males and 10 females) and one female *Hippocampus spinosissimus.* In contrast, the index analysis of the distribution

pattern of seahorses in the waters of Morotai Island shows a uniform distribution pattern.

## FURTHER STUDY

Recommendations from the results of this research require a policy for local governments to protect seahorses in the waters of Morotai Island and additional seahorse sampling points in each sub-district of Morotai Island.

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