Distribution patterns and abundance of mullet fish populations (Mugil sp.) estuary areas

Sunarni 1, Stenly M. B. S. Wairara 1, Sajriawati 1 and Sisca Elviana 1

1 Department of Water Resource Management, Faculty of Agriculture, Universitas Musamus, Indonesia

E-mail : sunarni@unmus.ac.id

Abstract. Mullet fish (Mugil sp.) is one type of fish found in the estuary area of the city of Merauke. In ecosystems, these fish play an important role in the food web, namely as a link between the lower trophic level to the higher one. The high utilization of mullet fish as both consumption and commercial fish is feared to have an impact on ecosystem imbalances. Information about the distribution patterns and abundance of mullets is not widely known. Therefore, the purpose of this study was to analyze the distribution patterns and abundance of mullets (Mugil sp.). This research was conducted in October to December 2016. The method used was Purposive Random Sampling which consisted of two sampling stations, namely Station 1 (Payumb Coastal Area) and Station 2 (Coastal Lamp One). Sampling is done at high tide and low tide conditions. To find out the distribution pattern of mullet fish, the Morisita Distribution Index formula is used while the abundance of mullet fish uses abundance index formula. The results showed that the distribution pattern of mullets at station 1 at high tide included the criteria for grouping / grouping (id > 1), while at low tide included the uniform criteria (id < 1). At station 2 the distribution pattern of mullets both at high tide and low tide includes uniform criteria (id < 1). The abundance of mullets both at station 1 or 2 at high tide and low tide is in the overflow category (id < 1). Based on the results of the study it can be concluded that the distribution pattern of mullets at stations 1 and 2 includes criteria for grouping / clustering and uniform while abundance is not abundant.

Keywords : Distribution pattern, Abundance, Mullet fish, Mugil sp.

1. Introduction

The coastal estuary region of Merauke city has unique and potential marine and brackish biological resources, this is supported by fishery results in the form of shellfish, shrimp, crabs, snapper, kuro fish, mullet fish and several other economical fish species. The existence of mangrove forests and several small rivers in the estuary area causes an abundance of fishery resources around the coast of the town of Merauke. One type of fish found in the estuary coastal area of the town of Merauke is mullet fish (Mugil sp.) [1] Mullet fish are often found in mangrove waters between the roots of mangrove trees, lagoons and river mouths to find food.
In ecosystems, especially in food webs, mullets have a role as a link between the lower to higher trophic levels. Mullet fish also acts as a detritivore that eats detritus, epipitic and benthic microalgae, such as diatomas, dinoflagellates, and cyanobacteria. Mullet fish is also one of the predators for zooplankton such as Annelid larvae and Crustacean larvae, and invertebrates such as Polychaeta and Nematoda with diurnal feeding activities [2]. The mullets will be devoured by various types of piscivorous fish, marine mammals, and birds [3] Some mechanisms that have long been understood as determinants of fish distribution in the tropics include natural factors including biogeography, geography and topography of rain catchments [4], ecological processes such as predation, competition, and tropical interactions [5] Differences in very high rainfall are also thought to change the structure of fish communities due to changing water level fluctuations so that they are correlated with changing conditions and habitat availability [6] This will affect the abundance of fish species in an ecosystem. The size of the abundance of fish species in an ecosystem depends on the condition of its habitat. In addition to habitat conditions, abundance also depends on competitors and predators. [7] suggests that habitats with relatively fixed or unchanging environmental conditions have a high number of species.

In addition to functioning ecologically, mullets also have high consumption and economic value. Utilization of mullet fish is carried out by local people who live around the coastal areas of the city of Merauke. Mullet fish is used fresh and preserved fish. Utilization that is carried out continuously is feared to cause a decline in mullet fish populations which has an impact on disrupting the ecosystem balance in the coastal estuary of the Merauke city. Information about the availability of mullet fish in the estuary coastal area of the city of Merauke is not yet known. One effort to determine the availability of mullet fish is by analyzing the distribution patterns and abundance of mullet fish. Therefore, the purpose of this study is to analyze the distribution patterns and abundance of mullet fish found in the coastal estuary area of the town of Merauke.

2. Methodology

2.1 Time and place

The study was conducted for three months, from October to December 2016, in the estuary coastal area of the city of Merauke (Figure 2.1). The research station was determined by purposive sampling, station 1 of the Payumb coastal area and station 2 of the coast of Lampu Satu.
2.2 Tools and Materials

The equipment used in this study is the Global Positioning System (GPS), mesh and fixed gill nets (set gill net) with mesh sizes of one and two inches, cool boxes, thermometers, refractometers and pH meters. Materials used include plastic samples, tissues, distilled water.

2.3 Research sample

Research sample used in this study was mullet fish (*Mugil* sp.) obtained from the catch at each research station.

2.4 Research method

The method used in this research is Purposive Random Sampling. Determination of the location of sampling is done intentionally based on mullet habitat.

2.5 Sampling technique

Transect lines are installed along the 10 m at each station with a depth of 50 cm. Nets and nets spread each spaced 5 m apart. The net is spread by throwing it into the water while the net is spread by being dragged along the transect. Sampling with nets and nets is done twice, based on tides every time a sample is taken. Sampling was carried out three times / week. Samples of mullets that have been captured, put into plastic samples for further identification and calculation of the distribution patterns and abundance in the department of water resources management department of Musamus Merauke University. Measurement of water quality parameters include salinity, temperature and pH.

| No | Research location | Physical-chemical parameters | Substrate |
|----|-------------------|-------------------------------|-----------|
|    |                   | Temperature (ºC) | Salinity (%/00) | pH |         |
| 1  | Pantai Payumb     | 28-31             | 28-33.4        | 7-11 | Sandy mud |
| 2  | Pantai Lampu Satu | 29-31             | 29-33.7        | 10-11 | Sandy mud |

2.6 Data analyze

To determine the distribution pattern determined using the Morisita Spread Index formula [8] namely:

\[ Id = n \frac{\sum x^2 - \sum x}{(\sum x)^2 - \sum x} \]

Information:

- \( Id \) : Morisita Spread Index
- \( N \) : Number of plots / sample size
- \( \sum X \) : Number of individuals in each plot
- \( \sum X^2 \) : Number of individuals in each plot squared

The distribution pattern criteria are as follows ([9]) :

- \( d = 1 \), then the population distribution is a random category
- \( Id > 1 \), then the population distribution is a clustered / grouped category
Id <1, then the population distribution is uniform.

To determine population abundance, the relative abundance formula can be used according to [7]:

$$KR = \frac{n_i}{N} \times 100\%$$

Information:
- KR : Relative abundance
- Ni : Number of individual species i
- N : The total number of individual species

Abundance rate criteria ([10]):
- 0 = absent
- 1 – 10 = less
- 11 – 20 = enough
- >20 = very much

3. Results and discussion

3.1 Results of the distribution of mullets

Based on the results of research conducted at the two research stations obtained three types of fish namely *Mugil dussumieri*, *Mugil cephalus* and *Rhinomugil corsula*. The distribution patterns of the three types of fish obtained are shown in table 2.

**Table 2.** Spread pattern of fish at high tide and low tide

| Location       | Pantai Payumb | Pantai Lampu Satu |
|----------------|---------------|-------------------|
| Condition      | High tide     | Low tide          |
| Id             | 1.268         | 0.218             |
| Character      | Random        | Uniform           |

Distribution patterns depend on the physical-chemical nature of the environment and the biological features of the organism itself. The infinite diversity of patterns of distribution that occur in nature can be roughly divided into three categories namely [10]: 1). Regular or uniform distribution, where individuals are located in certain places in the community. This spread occurs when there is intense competition so competition arises which encourages the distribution of the same living space. 2). Random distribution (random), where individuals spread in several places and group in other places. This spread is rare, this happens if the environment is homogeneous. 3). Group spread / clumped, where individuals are always in groups and very rarely seen alone separately. This pattern is generally found in nature, because of the need for the same environmental factors.

3.2 Results abundance of mullets

Based on the results of research conducted at the two research stations obtained three types of fish namely *Mugil dussumieri*, *Mugil cephalus* and *Rhinomugil corsula*. The abundance of the three types of fish obtained are shown in tables 3 and 4.
Table 3. Abundance of Fish During Highs and Lows at Station I (Coastal Pantai Payumb)

| Species               | Abundance | High tide | Low tide |
|-----------------------|-----------|-----------|----------|
| Mugil dussumieri      | 0.967     | 0.985     |
| Mugil cephalus        | 0.033     | 0.014     |
| Rhinomugil corsula    | -         | -         |

Table 4. Abundance of Fish During Highs and Lows at Station I (Coastal Pantai Lampu Satu)

| Species               | Abundance | High tide | Low tide |
|-----------------------|-----------|-----------|----------|
| Mugil dussumieri      | 0.856     | 0.956     |
| Mugil cephalus        | 0.144     | 0.04      |
| Rhinomugil corsula    | -         | 0.004     |

Based on observations of Belanak fish (*Mugil* sp.) Caught in Station I of Payumb beach and Station II of Pantai Satu, the total number of fish caught at high tide was 362, and at low tide was 346. divided into 3 species namely *Mugil dussumieri, Mugil cephalus* and *Rhinomugil corsula*. The abundance of individuals of a species is defined as the number of individuals contained in an area. The higher or greater the value of abundance means more and more individuals are in the area. [7] revealed that habitats with relatively fixed or unchanging environmental conditions have a high number of species. The size of the abundance of fish species in a place depends on the condition of its habitat, if environmental conditions are able to support its survival, the abundance of fish will be high. the existence of competitors and predators can also affect the abundance of fish in the region.

4. Conclusions

Based on the results of the study it can be concluded that the distribution pattern of mullets at stations 1 and 2 includes criteria for grouping / clustering and uniform while abundance is not abundant.

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