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# Mapping of the distribution of Seagrass using Landsat 8 image data in the water of Kodingareng Lompo Island, Makassar City

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## Article Info

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**Abstract**
Remote sensing is an alternative way to help detect seagrass distribution. Seagrass is a flowering plant that can live and reproduce in shallow sea waters. The purpose of this study was to determine the distribution of seagrass in the waters of Kodingareng Lompo Island in 2018, 2020 and 2022 using Landsat 8 imagery data in remote sensing applications. Data processing to determine the distribution and area of seagrass using the lyzenga algorithm method. The image data processing technique used in this study is by using the Arcgis, Er Mapper, and ENVI software applications. The analysis was carried out in this study using two methods, namely spatial analysis and quantitative analysis. Spatial analysis uses the UTM (universal transfer Mercator) coordinate system which uses units of meters so that it allows analysis such as distance and area while quantitative analysis is by interpreting and visualizing to find out the distribution of seagrass. As well as analysis of seagrass distribution by digitizing seagrass distribution. The results showed that seagrass beds in the coastal area of Kodingareng Lompo island spread along the coast. The distribution area of seagrass beds in the waters of Kodingareng Lompo Island in July 2018, 2020 and 2022 has decreased. In 2018 the distribution area of seagrass beds was 45,7 Ha, in 2020 42,7 Ha, and in 2022 40,9 Ha.

**Keywords:** Image; seagrass; remote sensing; kodingareng island

## Introduction

Seagrass ecosystems in Indonesia are often found in tidal areas (Jalaludin *et al*., 2020) [5]. Seagrass ecosystems are located between mangrove ecosystems and coral reefs (Hasnatang *et al*, 2023) [4]. This ecosystem is adjacent to both tropical coastal ecosystems and interacts with them, not isolated or independent. Seagrasses are the only monocot plants that live in marine environments, especially in coastal areas (Rauf, 2018) [23]. Seagrasses have an important role in coastal ecosystems as spawning grounds, foraging, nurturing and protection for various coastal organisms. (Tangke, 2010)[13]

Seagrasses are plants that can live in shallow waters with sandy conditions, and are often found in coral reef ecosystems (Salim, 2012)[9]. Like grasses on land, seagrasses also form large, dense grasslands on the ocean floor that are still accessible. These plants need sunlight and sufficient levels of sunlight energy for their growth.

The waters around Kodingareng Lompo Island have two main ecosystems, namely seagrass beds and coral reefs. Seagrass beds play an important role in shallow marine ecosystems because they have several vital roles (Makmur, 2023) [6]. First, as primary producers, seagrasses carry out photosynthesis and produce energy which forms the basis of the food chain. In addition, seagrasses also provide habitat for various marine biota, function as bottom stabilizers, and are able to catch and withstand currents and waves. In addition, seagrass also plays a role in the recycling of nutrients in the waters. With these roles, seagrass beds have a significant contribution in maintaining the balance of the shallow marine ecosystem in the waters of Kodingareng Lompo Island (Ramadan & Fajriyanto, 2021) [7].

This study aims to determine the distribution and area of seagrass on Kodingareng Lompo island in 2018, 2020 and 2022 using remote sensing technology (Somantri, 2009) [12]. The data used in this study are satellite images from Landsat 8.

Data processing is carried out using the Lyzenga algorithm to obtain information about the distribution and area of seagrass (Ihsan *et al*., 2021) [4].

The image data used to determine the distribution of seagrass in the waters of Kodingareng Lompo Island is Landsat 8 image data. In this study, the data was processed using the Er Mapper 7.0 software application and ArcGIS software (Salwan *et al*., 2021) [10]. Data processing was carried out using two methods, namely spatial analysis and quantitative analysis. Spatial analysis was carried out using the UTM (Universal Transverse Mercator) coordinate system which uses meters, enabling distance and area analysis. Meanwhile, quantitative analysis was carried out through interpretation and visualization of data to determine the distribution of seagrass. In addition, analysis of the distribution of seagrass was also carried out by digitizing the distribution of seagrass (Sari *et al*., 2021) [11].

## Materials and Methods

This research was conducted in May-June 2023. It is located in the Kodingareng Lompo coastal area, Makassar city which includes literature studies, field data collection, data processing and preparation of research reports. Map of the location of this research can be seen in the image below. (Figure 1).

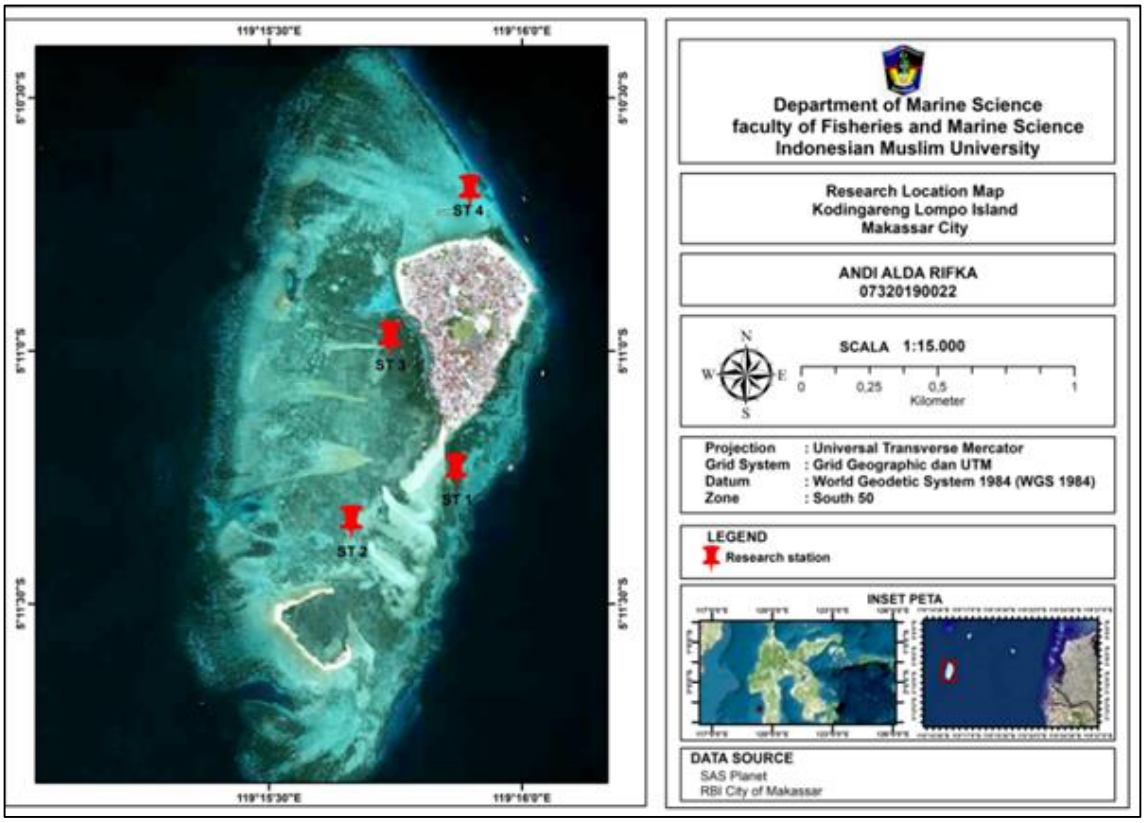


**Fig 1:** Map of Research Locations

## Tools and materials

Tools and materials used to assist the process of conducting research. The tools and materials used in the study are shown in the table below.

**Table 1**

| A | Tool | Usage |
|---|---|---|
| 1 | Laptop/PC | Data processing |
| 2 | Software ArcGis | Data processing to determine the extent of seagrass |
| 3 | Software ER-Mapper | Data processing to determine the extent of seagrass |
| 4 | Microsoft word | Research proposal writing |
| 5 | Global Positionning System (GPS) | Determine the position of the research location |
| 6 | Camera | Documentation during data collection |
| 7 | Stationery | Record data while in the field |
| 8 | Literature (Journals, theses, and books) | References for writing research proposals |
| **B** | **Materials** | |
| 1 | Landsat-8 image | Data processing for now the area of the seagrass |
| 2 | Map of Kodingareng Lompo Island Waters | Research sites |

## Research methods

The stages of image processing are that we first download the Landsat 8 image data on the USGS site, then radiometric correction is carried out with the aim of reducing image recording errors from an object on the earth's surface. After that, composite bands are carried out with the aim of combining the RGB bands, and image cropping with the aim of cropping the image to cover areas that are not needed in

the image data processing (Saifullah & Yudhana, 2016)[8]. After that, the image sharpening stage is carried out, namely the lyzenga algorithm using the RGB 532 composite, then the image can be classified. Classification is a process whereby pixels that have the same spectral characteristics are grouped into the same class. In general, the more accurate a classification is, the more channels are used (Azka, 2019) [2].

**Ground Check**

Ground Check carried out at 4 stations by taking coordinates at the time of initial image data processing to adjust to initial field conditions. The results of the ground check are used to ascertain whether the distribution of seagrass in satellite data is the same as that of seagrass in field surveys.

**Table 2:** Station points with their coordinates

| Id | Station | Kor x | Kor y |
|---|---|---|---|
| 0 | St 1 | 119.2660 | -5.149340 |
| 0 | St 2 | 119.2650 | -5.151930 |
| 0 | St 3 | 119.2630 | -5.150150 |
| 0 | St 4 | 119.2640 | -5.150740 |

**Accuracy Test**

The accuracy test aims to measure the accuracy in image interpretation. In this accuracy test, the results of image classification will be compared with the actual conditions in the field with reference to the points taken in the field. Accuracy test is very important in every research result from every type of remote sensing data. The level of accuracy of the data greatly affects the amount of user trust in each type of remote sensing data. Accuracy assessment is closely related to positional and thematic accuracy (Alam *et al*., 2020) [1]

**Results and Discussion**

The satellite images used to produce seagrass distribution maps are Landsat 8 OLI/TIRS C1 Level 2 images for 2018, 2020 and 2022 which have a spatial resolution of 30 meters. Based on the results of interpretation of satellite imagery in the coastal waters of Kodingareng Lompo Island, the area of the seagrass ecosystem on the 2018 map is 45.7 Ha. On the 2018 Landsat 8 map, you can see the distribution of coral around the edge of Kodingareng Lompo Island and there are differences in the frequency of occurrence of seagrass species at several stations, caused by several types of seagrass growing in separate groups with unclear boundaries and an uncertain number and different distribution uneven. (Figure 2).

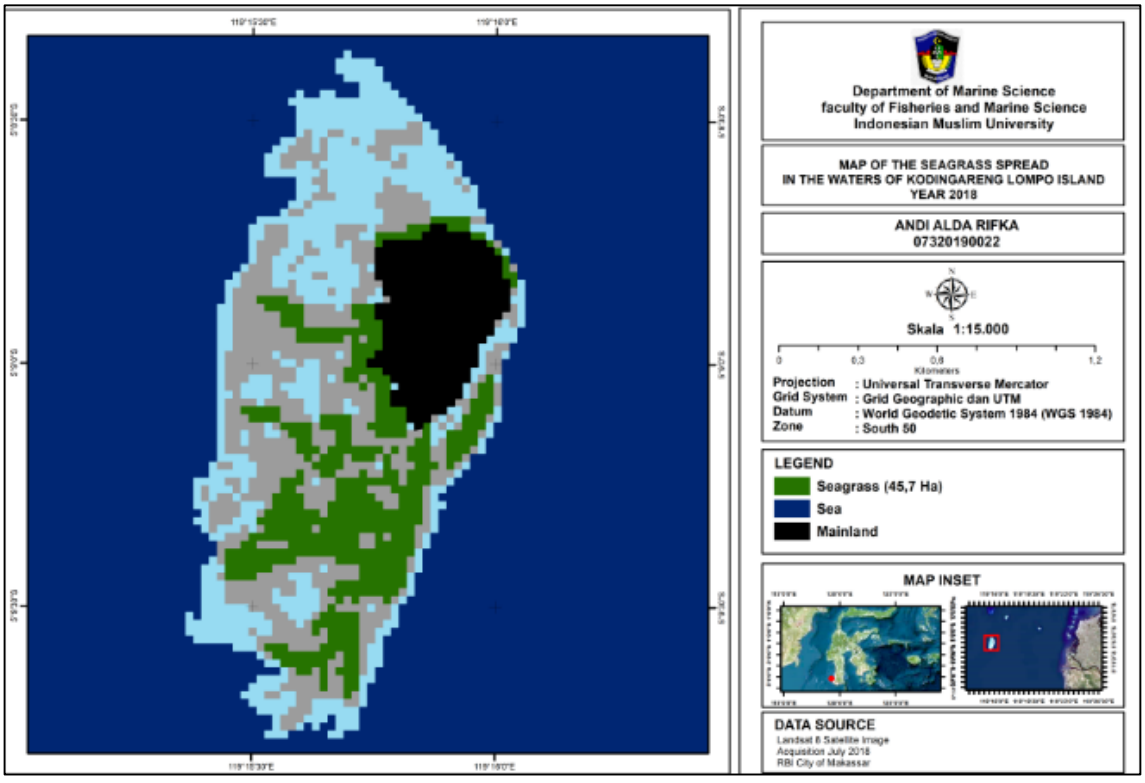


**Fig 2:** Seagrass distribution map 2018

Based on the results of interpretation of satellite imagery in the coastal waters of Kodingareng Lompo Island, the area of the seagrass ecosystem on the 2020 map is 42.7 Ha. The distribution of seagrass in 2020 has decreased, due to sea pollution (public waste), boat propellers which can damage seagrass habitat, bombing, and oceanographic factors such as currents, waves, and tides. (Picture 3).

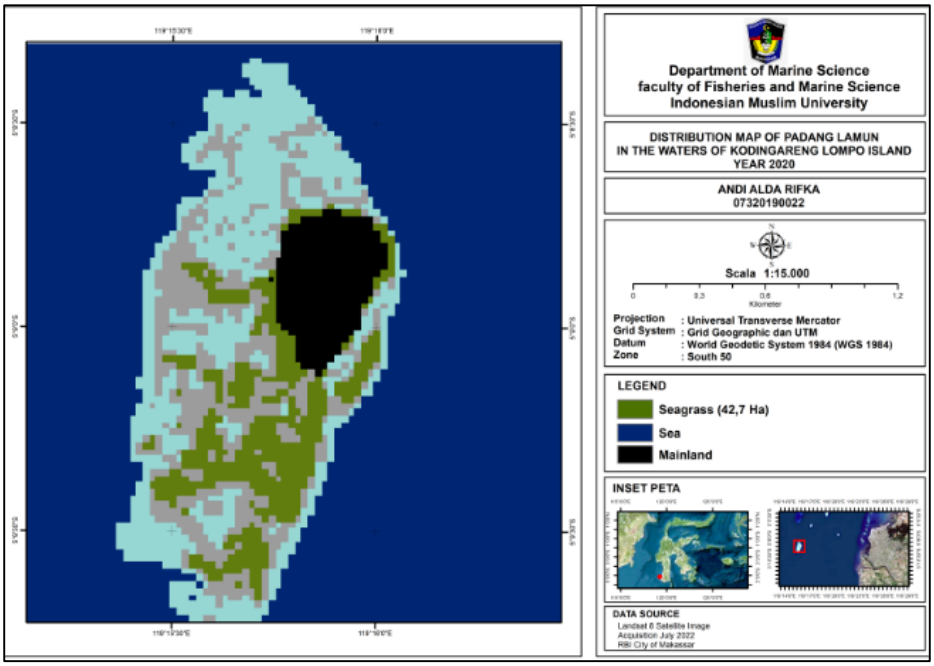


**Fig 3:** Seagrass distribution map 2020

Based on the results of interpretation of satellite imagery in the coastal waters of Kodingareng Lompo Island, the area of the seagrass ecosystem on the 2022 map is 40.9 Ha. Similarly, the distribution of seagrass in 2020 has changed as a whole, as can be seen in the 2020 map image. (Figure 4).

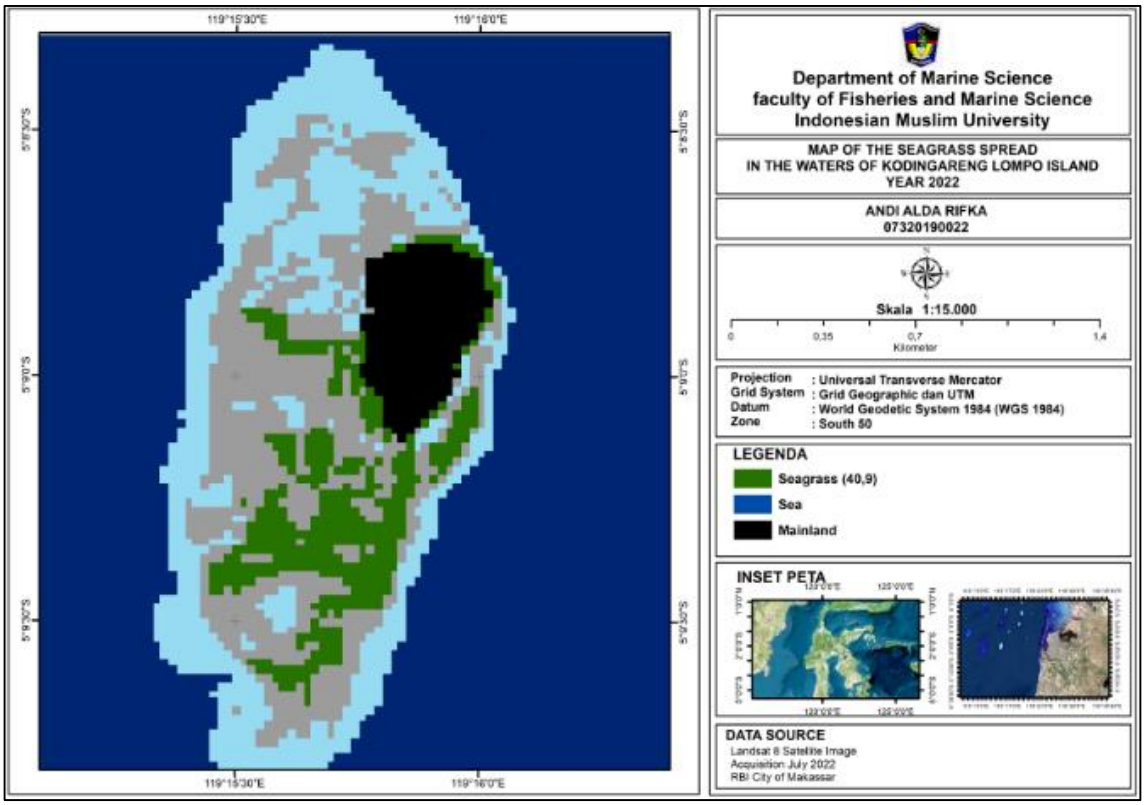


**Fig 4:** Seagrass distribution map 2022

The distribution of seagrass in the waters of Kodingareng Lompo Island from the three maps shows that the distribution of seagrass in the south is more-sparse than in the north, east and west. This can be caused by human activities that can affect the growth of seagrass, apart from that oceanographic factors can also affect the existence of seagrass such as currents, tides, and waves. Based on the figure below, it shows that there has been a change in the area of seagrass distribution in 2018, 2020 and 2022, indicating that the area of seagrass has decreased from 2018 to 2020, namely 3 Ha and from 2020 to 2022, namely 1.8 Ha.

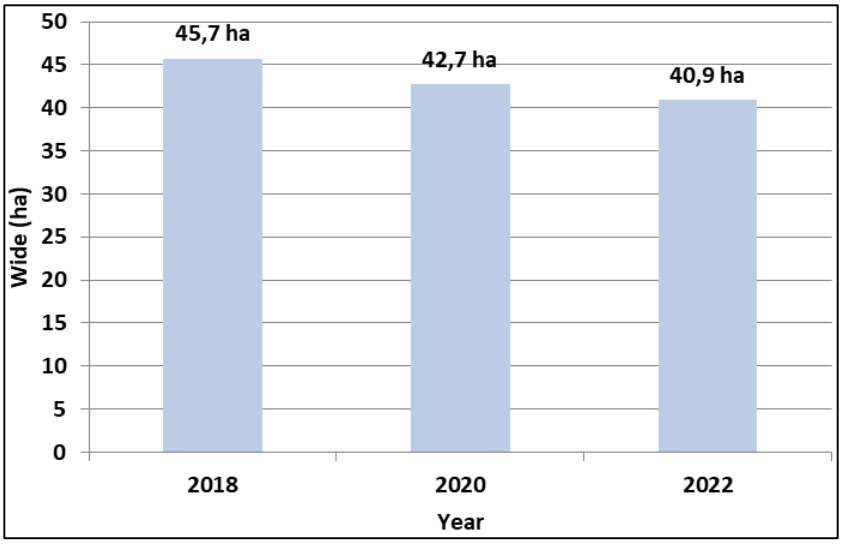


**Fig 5:** Histogram of Seagrass Distribution Area in 2018, 2020, 2022

**Ground Check**

Ground Check using techniques*sampling*, where the amount of data is determined by the researchers themselves with the assumption that the amount represents the research area. In field validation the researcher conducted a sampling test through land and sea surveys. The total sample data is 4 stations starting from the south, west, north and east where the data is taken from the image that has been processed.

For seagrass species, there are 6 types of seagrass that are determined at 4 research stations. The types of seagrass found in the waters of Kodingareng Lompo Island are Enhalus acoroides, Halophila ovalis, Halophila decipiens, Halodule pinifolia, thallasia hemprichii, and Cymodocea rotundata.

**Accuracy Test**

The accuracy test is carried out to visually test the level of accuracy of the data resulting from image data processing using control points (stations) in the field for accuracy tests. Based on the results of image data validation and calculations performed, the producer accuary presentation (to determine the accuracy point based on facts obtained in the field), user accuary (to determine the level of accuracy based on image reading results), overall accuary and kappa accuary (Fitriawan, 2020) [3]. For the results of the calculation of the accuracy test of each class can be seen in table 1.

**Table 1:** Accuracy Test Calculation Results

| Image Classification | User Accuary | Procedur Accuary | Overall Accuary | Kappa Accuary |
|---|---|---|---|---|
| Seagrass | 100% | 94% | 95% | 94% |
| Non Seagrass | 75% | 100% | | |

**Accuracy Test**

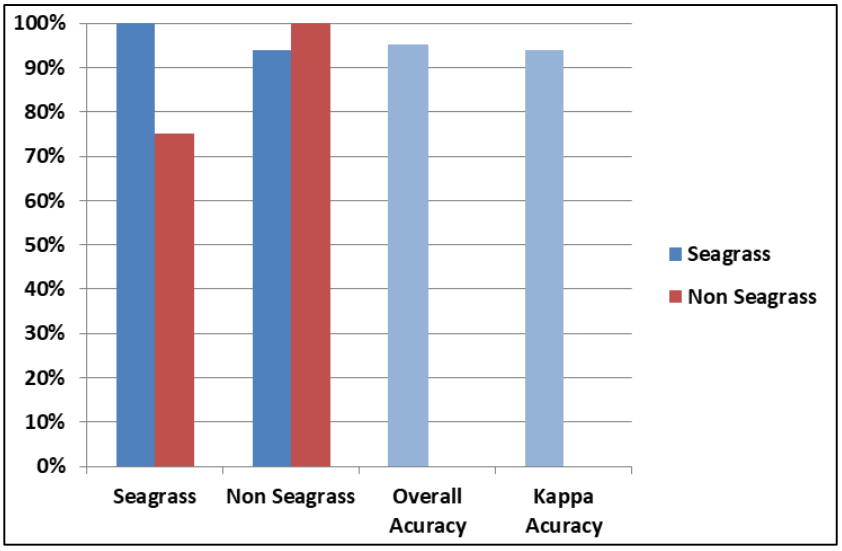


**Fig 6:** Accuracy Test

Based on the table above, it can be seen that the percentage of accuary level for each type of land use varies. From the calculation results it can be seen that the overall accuary value is 95%. According to the guidelines for processing digitally supervised multispectral satellite data for classification compiled by Lapan in 2015 in Asma (2018) it states that image classification is considered correct if the Confusion Matrix calculation results are >75%. Based on the calculation

of the overall accuary and kappa accuary that has been obtained, the results of this classification can be accepted.

## Conclusion

Based on the results of the research that has been done, it can be concluded that in the coastal area of Kodingareng Lompo island the seagrass distribution area in 2018, 2020 and 2022 is 45.7 ha, 42.7 ha and 40.9 ha respectively, with accuracy test results of 95%.

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