

## DISTRUBUTION AND MORPHOLOGICAL IDENTIFICATION OF EEL (*Anguilla* sp.) IN KAYOA SEA. SOUTH HALMAHERA. NORTH MALUKU

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### ABSTRACT

North Maluku Province is an archipelagic province that has a sea area of 113.796.53 km<sup>2</sup> or 70% of the land area. As an archipelagic area. North Maluku waters have high biodiversity. One of the important biota in North Maluku waters is the eel. Eel is one of the water resources that have high economic value. because of its nutritional content Eel (*Anguilla* sp) is a catadromous fish that begins its life in the larval or juvenile phase in marine waters and grows up in brackish and fresh waters. This study aims to determinethe distribution of eel species (*Anguilla* sp) in the seas and the morphometric eel (*Anguilla* sp) in kayoa waters. The results showed that the number of eels found at both stations was 13 tails. The results of the morphological analysis showed that the type of eel found at both stations was *A. marmorata*. the morphometric identification results showed that at station 1. the total length range was 50 - 106 cm. with a weight of 460-4100 grams. while at station 2 obtained a length range of 65 cm - 83 cm. with a weight of 79 -1300 grams.

**Keywords:** Area. Morphometri. *Anguilla*. Small Island. Tropis

### INTRODUCTION

North Maluku Province is an archipelagic province that has a sea area of 113.796.53 km<sup>2</sup> or 70% of theland area. As an archipelagic area. North Maluku waters have high biodiversity. One of the important biota in North Maluku waters is the eel. Eel is one of the water resources that have high economic value. because of its nutritional content. Classification of eels is *phylum: Chordata. Subphylum: Euchordata. Class: Osteichthyes. Infra Class: Teleostei. Order: Anguilliformes. Family: Anguillidae. Genus: Anguillia Species: Anguilla* sp. eels live in 2 (two) habitats. namely marine waters and inland waters (Arai and Kadir 2017; Topan and Riawan 2015; Aoyama 2009; Linton *et al.* 2007; Dou and Tsukamoto 2003; Tesch and Rohlf 2003).

Sea waters are passed during the larval phase. while inland waters are during the juvenile to the adult phase. while the pigmented eel species. will stay longer in estuaries and others will migrate upstream until reproductive maturation. this indicates that river waters are the only source of water only access for eels

(Arai and Kadir 2017; Aoyama 2009; Affandi 2016; White and Knights 1997; Horváth and Municio 1998; Edeline *et al.* 200; McKinnon and Gooley 1998).

The results of identification by experts obtained 17 species of eel in the waters. which became tropical eels and sub-tropical eels according to their habitat. In Indonesian waters which are classified as tropical. 7 (seven) species are found scattered on the islands of Java. Sumatra. Kalimantan. Sulawesi. Bali. West Nusa Tenggara. East Nusa Tenggara. Maluku. and North Maluku Island to the north coast of Papua Sugeha *at al.* 2008; Achmad *et al.* 2020; Achmad *et al.* 2021; Hakim 2015).

The dominant species in Indonesian waters are *A. cebesensis. A. borneensis. A. interioris. A. Bicolor. A. Marmorata. A. ancertalis.* and *A. Mauritania* (Achmad *et al.* 2020; Achmad *et al.* 2021; Hakim 2015). As one of the important commodities. research on the distribution. morphometrics. and morphology of eel (*Anguilla* sp) in the waters of Kayoa. North Maluku needs to be done. Kayoa Island is one of the islands in South Halmahera Regency.

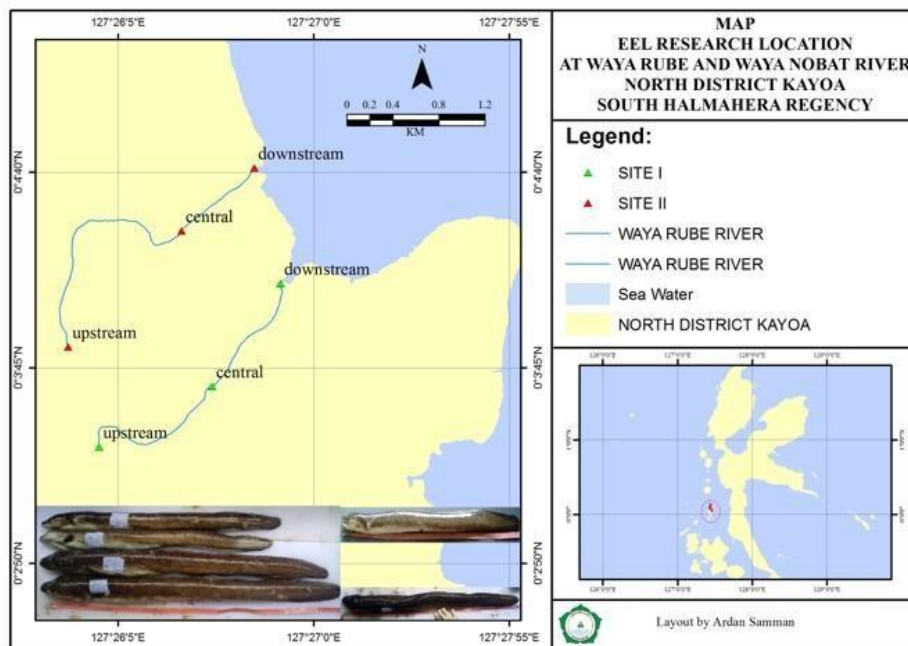
North Maluku Province.

In general, the Kayoa Archipelago is an area along the equator or is located at the equator and often experiences a change of dry season and rainy season every year. Thus, this island has high fisheries and marine biodiversity. One of them is the eel (*Anguilla Sp*) which is thought to be in the waters of the river estuary (Waya Rube) and (Waya Nobat). Until now there has been no scientific information or previous research related to the presence of eels in the waters of the two rivers.

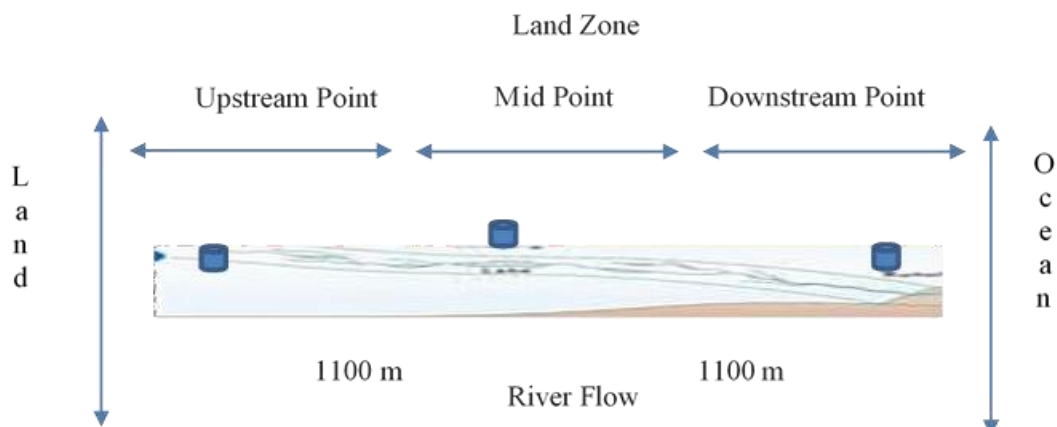
## MATERIALS AND METHODS

### Research procedures

This research was conducted in April 2021. the sampling locations were in the Waya Rube River and the Waya Nobat River. Kayoa Island. South Halmahera. with sample observation points at 3 (three) points, namely downstream, middle and upstream. The distance between sampling points is 1100 m. The sampling method was carried out by the purposive sampling method. The map of the sampling location can be seen in **Figure 1**.



**Figure 1.** Sampling Location Map



**Figure 2.** Determination of Sampling Points

### Sample Identification

The data obtained are species, abundance, and size, calculated based on the number of individuals obtained at each sampling point. Species identification was carried out using a morphometric method adapted to standard species determination measurements using

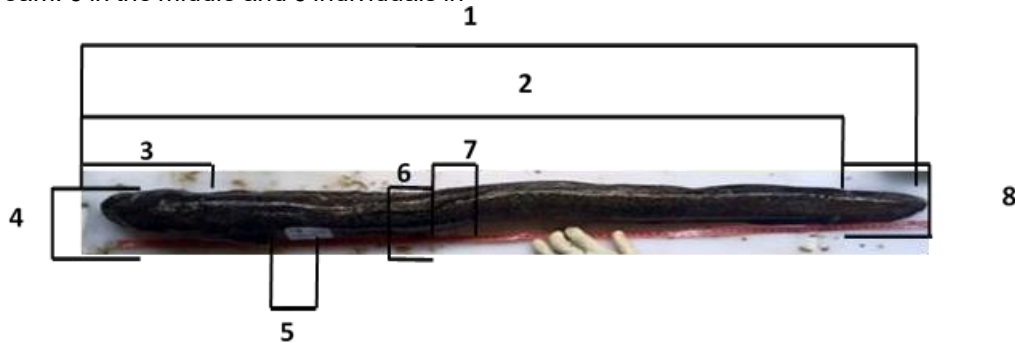
the ratio formulated referring to (Linton *et al.* 2007; Leander *et al.* 2012). for morphometric measurements in the form of *pre-dorsal length* (PD) and *anodorsal length* (AD), length before anal fin (*pre-anal length*, PA), and total length (*total length*, TL). Morphometric Measurement Standards can be seen in **Figure 3**.

## RESULTS AND DISCUSSION

Waya Rube River is one of the rivers in the North Kayoa District. This river has a length of about 2500 m from downstream to upstream, with a river width of 6 meters with a depth of 30-60 cm. While the Waya Nobat River has a length of about 2000 m from downstream to upstream and a width of 6 meters. The substrate in these two rivers is sandy, rocky and both rivers empty directly into the sea. this condition indicates that these two rivers are good habitats for the growth of eels and facilitate the breeding of female eels Sugeha *et al.* 2008. Waya Rubah and Waya Nobat rivers can be seen in **Figure 4**.

The results showed that the distribution of eel in the sampling locations was uneven. this can be seen in the results found at each sampling point. the Waya Rube River (St. 1) obtained 9 individuals consisting of 3 individuals in the downstream, 6 in the middle and 6 individuals in

the middle. upstream not found. While the Waya Nobat River (St. 2) obtained 4 individuals consisting of 4 individuals in the middle. while downstream and upstream were not found. Eel species prefer different environments and are distributed differently in rivers (upstream, middle and downstream) (Shiao *et al.* 2003; Arai & Chino, 2018). These results indicate that in the estuary and middle, there are more eels found than upstream. this is related to the eel distribution. there are eels that tend to live longer in the estuary or estuary areas and those that live upstream. Young eels live in rivers for 5 to 8 years, during which time they develop from juveniles into adults and prefer the middle reaches of rivers (Shiao *et al.* 2003; Arai & Chino, 2018). Shiao *et al.* (2003); Arai & Kadir (2017) reported that fishermen's experiences indicate that *A. japonica* is dominant in the lower reaches of rivers and estuaries, while *A. marmorata* prefers the middle to upper reaches of rivers.



**Figure 3.** Morphometric Measurement Standards

Note: 1. Total lengt; 2. Standard length; 3. Head length; 4. Head height; 5. Pectoral fin length; 6. Body circumference; 7. Height; 8. Height of the tail section



**Figure 4.** Waya Rube River and Waya Nobat River

**Table 1.** Sampling Results and Abundance. Types of Eels According to Sampling Point Stations.

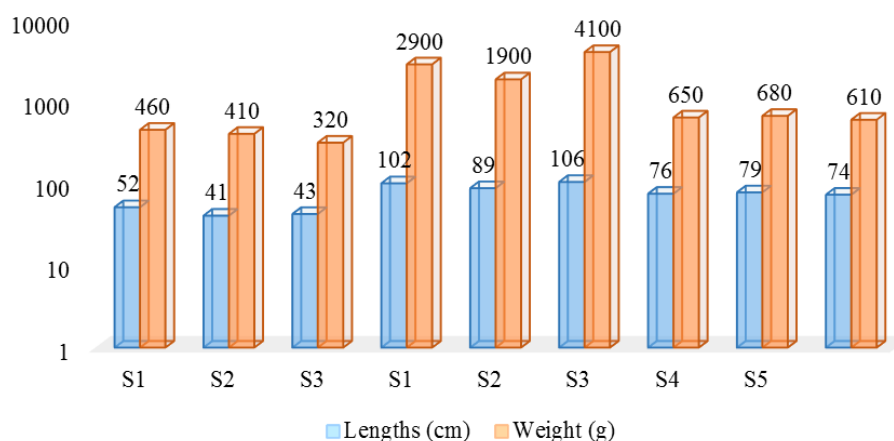
Site	Sampling Site			Total
	Upstream	Central	Downstream	
Waya Rube St I	3	6		9
Waya Nobat St II		4		4
Total	3	10		13

Note: St = stasion

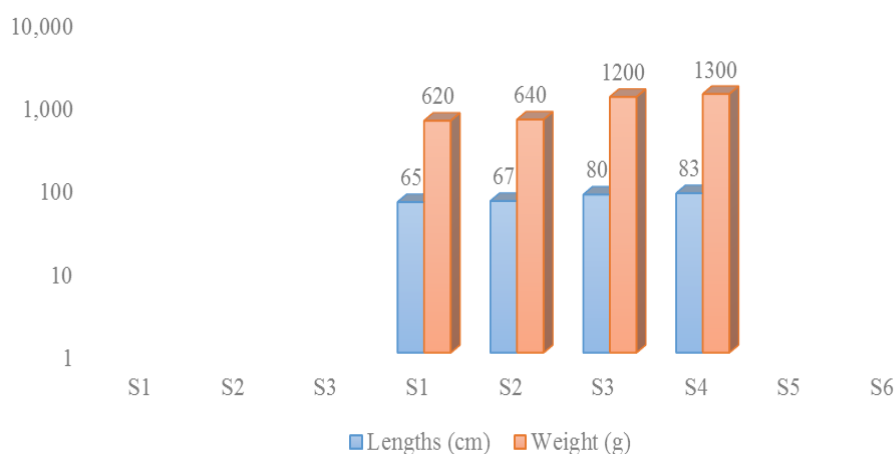
The types of eels that live in estuary or estuary areas usually spend their lives faster. compared to eels that migrate and live longer upstream. this type of eel will tend to live longer. and this condition will help increase the reproduction of eels (Leander *et al.* 2012; DeMarte *et al.* 2016; Ubl and Dorow 2015). The results of sampling and abundance can be seen in **Table 1**.

The results of morphometric measurements at both stations. at St1. the longest size is 106 cm. with a weight of 4100 grams in the S3 sample code and the sampling point in the middle. while the shortest size is 41 cm with a weight of 410 grams in the S2 sample code and the sampling point in the middle estuary. While the morphometric results on St2. the longest size is 83 cm. with a weight of 1300 grams. in the

sample code S4 and the shortest size is 65 cm with a weight of 640. Sample sizes based on length and weight at both stations can be seen in **Figures 4 and 5**. The results of morphometric measurements at station 1 show that the longest and heaviest sample size is in the middle of the river (**Figure 6**). this result is in line with the explanation by many eel researchers. that the eels found in the middle are larger than those in the upstream and estuary. this is because. in the adult phase. the distribution of eels tends to live in the estuary to the middle. Especially for female eels. this is because mature female eels will migrate to the sea to spawn (DeMarte *et al.* 2016; Arai and Kadir 2017; McKinnon and Gooley 1998; Affandi 2016).



**Figure 5.** Sample Size Based on Length and Weight at Both Stations 1.



**Figure 6.** Sample Size Based on Length and Weight at Both Stations 2.

The results of the morphological analysis of eels on St.1 and St. 2 show that the sample has patterned skin and long fins. From these morphological results. it shows that the eel found in the Waya Ruba and Waya Nobat rivers is of the *A. marmorata* species. *A. marmorata* has a different color pattern than the *bicolor*

species. generally *A. marmorata* has patterned skin with long fins. while *A. bicolor* has unpatterned skin (*plain*) with short fins (Ubl and Dorow 2015; Sugianti and Krismono 2013; Briones. *at al.* 2007; Cresci *et al.* 2019). The results of morphometric identification can be seen in **Table 2 and 3**.

**Table 2.** The results of morphometric identification can be seen at Station 1

Morfologi St 1	Downstream			Central				
	S1S2	S3	S1	S2	S3	S4	S5	S6
Total Length (cm)	5241	43	102	89	106	76	79	74
Standard Length (cm)	5.140	4.2	1.1	88	1.5	75	78	73
Head Length (cm)	4738	26	15	14	16	12	12	12
Height (cm)	53	2.5	8	7	11	7	8	6
Head Height (cm)	2.61.5	1.2	7	6	7	5	4.5	4
Pectoral fin length (cm)	3.11.8	1.6	6	5.1	6	3.9	5	4
Tail Section Height (cm)	42	1.8	6	5	7	3.9	6	4
Body Circumference (cm)	128.2	7	24.5	20	28	18.5	19	17
Weight (gram)	460410	320	2900	1900	4100	130	680	610

**Table 3.** The results of morphometric identification can be seen at Station 2

Morfologi St 2	Downstream		Central			
	S1	S2	S3	S4		
Total Length (cm)	- 65	67	80	83		
Standard Length (cm)	- 64	66	79	82		
Head Length (cm)	- 11	11	13	14		
Height (cm)	-	7	5	7	7	
Head Height (cm)	-	4	4	5	6	
Pectoral fin length (cm)	-	4	3.5	5	5.5	
Tail Section Height (cm)	-	4	4	4	5	
Body Circumference(cm)	- 16	13	19	17		
Weight (gram)	- 620	640	1200	1300		

Water quality has an important role as a habitat for the survival of eels. The results of water quality measurements in St. 1 and St. 2. show that the temperature ranges from 28-27°C. pH 7-8. DO 8-9 mg/l. and salinity 0.05-0.08. the water quality parameters in both stations are still within optimal tolerance limits. One of the water quality parameters that is a key indicator of the sustainability of eels is salinity. salinity parameters differ between species or live stadia. larval types of eels have more variation

in salinity and tend to be higher. compared to adults. but their ability to adapt to salinity tends to decrease when eels return to freshwater (Arai and Chino 2012). In addition to salinity. eel growth is strongly influenced by temperature. increasing temperature. and in line with increasing body size (McKinnon and Gooley 1998; Arai and Chino 2012). The results of water quality measurements at both stations can be seen in **Table 4** below:

**Table 4.** Water quality at both stations

Station	Water Parameters	Sampling Point		
		Downstream	Central	Upstream
Waya Rube St 1	Temperature (°C)	27.4	27.6	26.8
	pH	7.1	7.5	8.2
	DO mg/L	8.11	8.7	9.11
	Salinity (‰)	0.07	0.05	0.05
Waya Nobat St 2	Temperature (°C)	27.5	27.6	27.8
	pH	7	7.3	8.1
	DO mg/L	8.15	8.6	8.9
	Salinity (‰)	0.08	0.06	0.05

## CONCLUSIONS AND SUGGESTION

The number of eels caught at the time of the study was 13 individuals. The measurement results show that the longest size is 106 cm. with a weight of 4100 grams. while the shortest is 41 cm with a weight of 410 grams. The results of morphological identification showed that the species obtained at both stations was *A. marmorata*.

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