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Condition and Types of Anchovies in the Coastal Waters of the Spelman Strait, Central Buton Regency, Indonesia

Kondisi dan Jenis Ikan Teri di Perairan Pantai Selat Spelman, Kabupaten Buton Tengah, Indonesia

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Abstract: *The biodiversity of the coastal waters of the Spelman Strait is a potential that needs to be preserved and protected. Anchovy fishing plays an important role in supporting the economy of fishermen's households as well as the potential area of Central Buton Regency as a coastal area. The goal of this research is to classify anchovy species and the coastal waters of the Spelman Strait as an acceptable habitat for anchovy. This is the first time that this assessment has been performed to evaluate the parameters of anchovy fishing in the coastal waters of the Spelman Strait. The study conducted by morphometric observation. The findings obtained based on the identification found three forms of anchovy, namely (1) Stolephorus indicus, (2) Stolephorus, sp. and (3) Stelephorus commersonnii. In addition, the water parameters are subject to the appropriate criteria. The distribution of chlorophyll-a is a barometer for anchovy fishermen in the waters of the Spelman Strait to assess the fishing ground and to pick the appropriate fishing gear.*

Abstrak: Keanekaragaman hayati perairan pesisir Selat Spelman merupakan potensi yang perlu dilestarikan dan dilindungi. Penangkapan ikan teri berperan penting dalam mendukung perekonomian rumah tangga nelayan serta potensi wilayah Kabupaten Buton Tengah sebagai wilayah pesisir. Tujuan dari penelitian ini adalah untuk mengklasifikasikan spesies ikan teri dan perairan pesisir Selat Spelman sebagai habitat yang dapat diterima untuk ikan teri. Ini adalah pertama kalinya penilaian ini dilakukan untuk mengevaluasi parameter penangkapan ikan teri di perairan pesisir Selat Spelman. Metode penelitian dilakukan dengan pengamatan morfometrik. Temuan yang diperoleh berdasarkan identifikasi menemukan tiga bentuk ikan teri, yaitu (1) *Stolephorus indicus*, (2) *Stolephorus*, sp. dan (3) *Stelephorus commersonnii*. Selain itu, parameter air tunduk pada kriteria yang sesuai. Distribusi klorofil-a adalah barometer bagi nelayan ikan teri di perairan Selat Spelman untuk menilai daerah penangkapan ikan dan memilih alat tangkap yang sesuai.

INTRODUCTION

The coastal waters of the Spelman Strait are rich in marine biodiversity, such as coral fish diversity (Muis et al.,2019; 2020a; 2020b; 2020c). In addition to reef fishing, anchovy fishing also plays an important role in the household economy of fishermen. The fishing of reefs and anchovy is different from that of the fishermen. Reef cod, fishermen are identical to small-scale fishermen with vessels of less than 1 GT (gross ton), whereas anchovy fishermen are identical to large-scale fishermen with large capital.

The fishing of anchovies in the coastal waters of the Spelman Strait has been going on for decades. The fishing gear had undergone a modification where a lot of manpower and guides had previously been used in the service of the fishing gear on the fixed chart. Actually using a boat map and still going, the labor force is comparatively reduced and the operation of fishing gear using machines is reduced (social knowledge).

The potential of the coastal waters of the Spelman Strait will continue to be exploited, and it is feared that overfishing will occur one day, threatening the sustainable potential of anchovies. Fishing anchovies are typical of the coastal waters of the Spelman Strait. Anchovies have become territorial during the year and are used by local fishermen. Research on anchovy fishing in the coastal waters of the Spelman Strait was conducted for the first time. This study may be the basic data for more management. The purpose of this anchovy fishery research is to classify the forms, parameters of the waters and to estimate the characteristics of the habitat. Research on anchovy fisheries has been performed by previous researchers both domestically and internationally, such as in the waters of the Gulf of Palabuhanratu (Utami et al. 2018), the coastal waters of Tegal (Sutono & Susanto 2016), the waters of Pulolampes, Central Java (Sasmita et al. 2018), the coastal waters of Spermonde Pangkep (Safruddin et al. 2014), the waters of the Gulf of Bone (Safruddin et al. 2018). In the waters of the deep Ambon Bay (Ongkers 2008), in the South Andaman waters (Kumar et al. 2015), in the waters of the Mediterranean Sea (Giannoulaki et al. 2012).

MATERIAL AND METHODS

Research sites

Anchovy research is carried out during the East Monsoon (cool wind). Muis et al. (2019), the coastal waters of the Spelman Strait are affected by two monsoon patterns of fishing, the western monsoon is like the choppy waters, and the eastern monsoon is shady. The research was conducted for a period of 3 months, from June 2020 to August 2020, in the coastal waters of the Spelman Strait, Mawasangka District, Central Buton Regency (Figure 1).

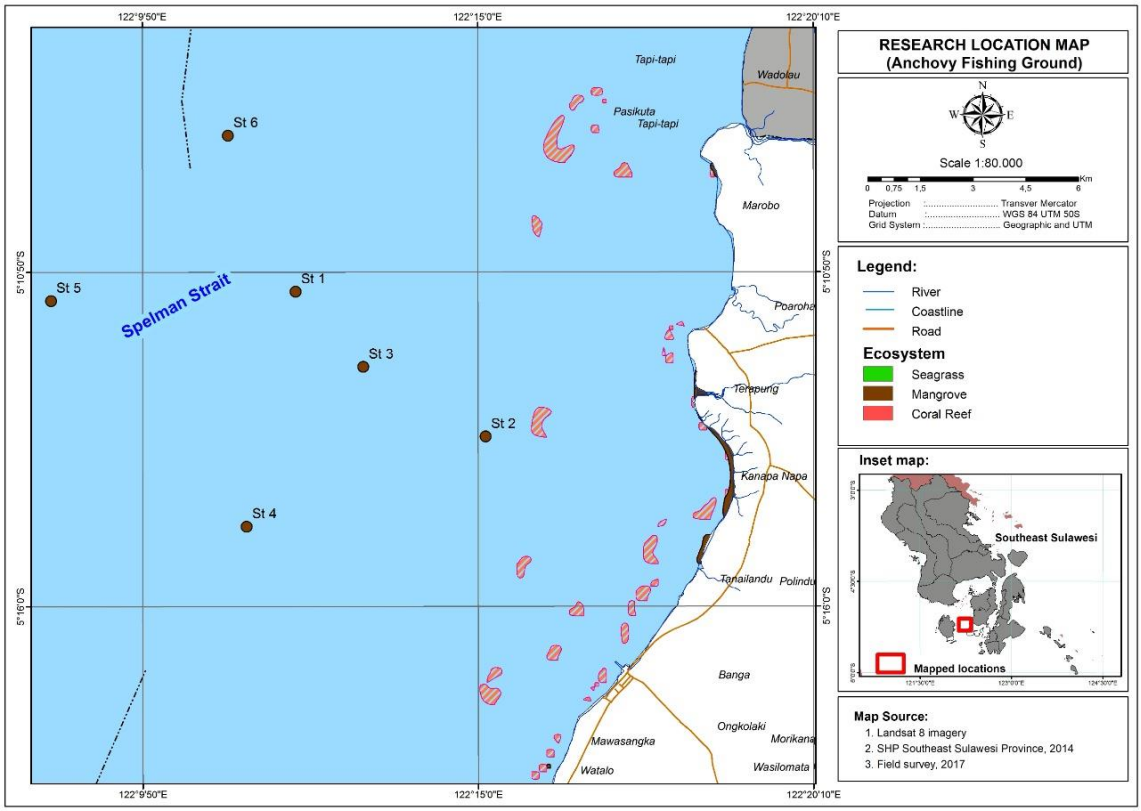

Figure 1. Research of study sites

Analysis Methods and Techniques

The tool used to catch anchovy is the drum lift net (Figure 2). The drum chart is towed to the fishing ground by a boat. During anchovy fishing, different types of anchovies are identified and stored in a cooling box so that the fish do not decompose, which can facilitate the identification process. Observations on five anchovy fishing areas for 3 months at weekly intervals, from June to August 2020. Research respondents were 5 intentionally chosen fishermen, assuming that the fishermen are very experienced and that all their lives work as anchovy fishermen.

Data analysis

Study data is the main data (direct observation and measurement). Fish species were then identified through a fish base and illustrated baitfish guides in pole-and-line fisheries in eastern Indonesia (Lewis & Heri, 2019), while water parameters consisting of salinity, temperature, and pH were measured directly in the field (in-situ), while chlorophyll-parameters were analyzed using Aqua Modis Satellite Image (Figure 5 & figure 6) and qua-shaped.

RESULT AND DISCUSSION

Parameters for water

Water parameters play an important role in the distribution and distribution of anchovies in water. The results of anchovy identification during the fishing period were obtained by 3 species, including *Stolephorus indicus* (Figure 2), *Stolephorus*, sp., (Figure 3), *Stelephorus commersonnii* (Figure 4). Water parameter is one of the limiting factors influencing the distribution of anchovy. Water parameters are also environmental factors influencing the habitat of anchovies. According to Bonano et al. (2014); Bakun (1996); Tugores et al. (2011); Prihatiningsih et al. (2013), the distribution of pelagic fish depends heavily on the environmental conditions of local waters. Anchovies in the coastal waters of the Spelman Strait were targeted by fishermen

after the western monsoon. Muis et al. (2019) The coastal waters of the Spelman Strait are affected by two patterns of fishing seasons; the western monsoon is similar with waves and waves, while the eastern monsoon is calm.

It is in this eastern monsoon that anchovy fishermen begin to catch. Muis et al. (2019), the eastern monsoon in the coastal waters of the Spelman Strait takes place from May to November. The coastal waters of the Spelman Strait, which is directly opposite the Flores Sea and the Bone Bay, provide a fertile water climate. This happens in the western monsoon (December-April) where currents and waves pass from the Flores Sea. Isari et al. (2006); Samorakis and Nikolioudakis (2007), the effect of currents from the Black Sea, which create a salinity of <30, has an impact on the degree of fertility and productivity of the North Aegean waters. The pattern of wind movements in the western monsoon causes the coastal waters of the Spelman Strait to undergo upwelling. For example, in Peru, Japan and the California Current System, Europe, South Africa and South Australia, the impact of wind causes upwelling (Checkley et al. 2017).

Figure 2. Anchovy species type *Stolephorus indicus*

Figure 3. Anchovy species type *Stolephorus* sp.

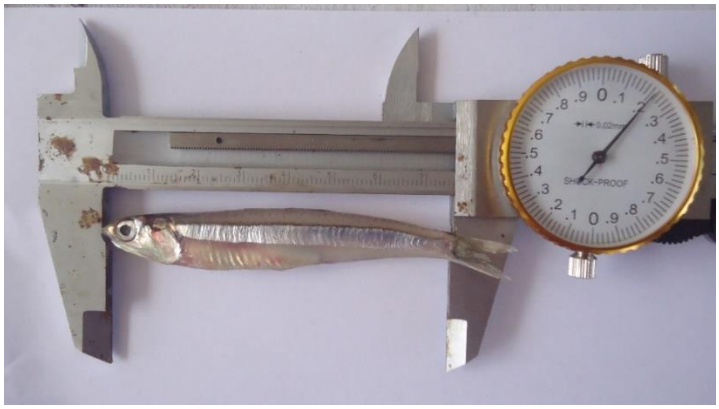

Figure 4. Anchovy species type *Stolephorus commersonnii*.

Water parameters at anchovy fishing location include temperature 29.5^{o}C, water pH 6.90, water salinity 32^{o}C. The temperature of water plays an important role in the life of anchovies. According to Safruddin et al. (2014); Rasyid (2010) notes that anchovy appears to accumulate in a temperature range of 29-30^{o}C. Based on the results of the research conducted by Muis et al. (2019), the state of the coastal waters of the Spelman Strait is still in natural conditions and continues to comply with the requirements of the MENLH (2004) regarding the required water quality level criteria (Table 1).

Table 1. Water parameters in the coastal waters of the Spelman Strait in 2 fishing monsoon

Parameters/unit	**Quality standards**[*)]	**Average analysis results of each station**[**)]				
		1	2	3	4	5
Temperature (^{o}C)	Coral 28-30	29.5	29.5	29	30	29
Salinity (ppt)	Coral 33-34	32	32	32	32	32
Transperancy (m)	Coral >5	9.4	5.6	6.7	6.1	5.0
pH	7-8.5	8	8	8	8	8
Current speed (m.sec)	-	0.06	0.1	0.1	0.14	0.15
DO (mg/l)	>5	7.0	7.4	7.8	7.4	7.0
BOD_5 (mg/l)	20	3.7	5.3	6.2	4.5	3.7
Nitrate (mg/l)	0.008	0.09	0.09	0.09	0.10	0.09
Phosphate (mg/l)	0.015	0.03	0.05	0.04	0.02	0.03
Ammonia (mg/l)	0.3	0.03	0.03	0.02	0.04	0.03

Source: [*]MENLH standard criteria No. 51 in 2004 and Muis et al. (2019) [**]

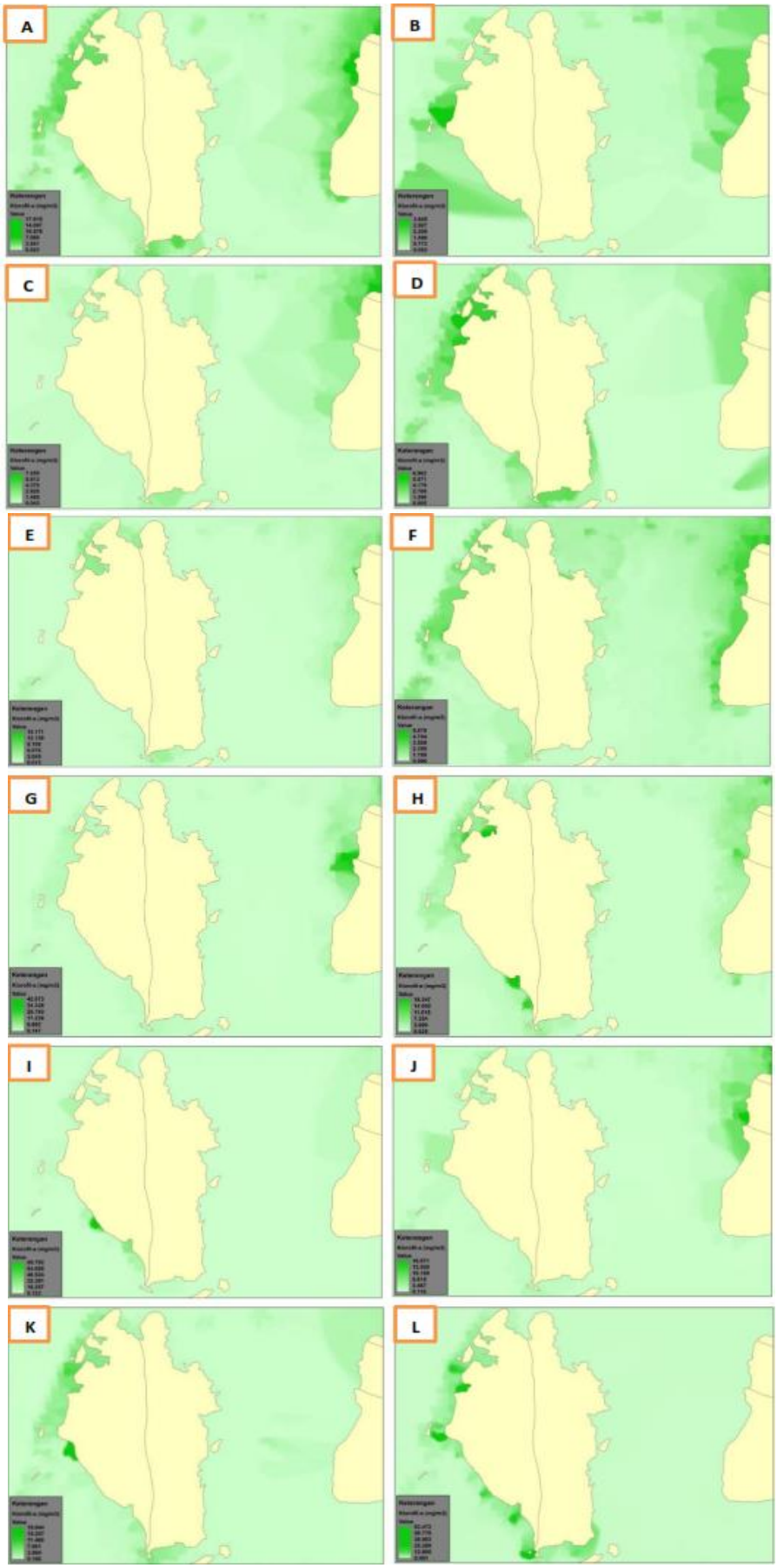

Figure 5. Chlorophyll-a distribution in Januari - December 2020

Characteristics of Habitat.

The characteristics of the coastal habitat of Spelman allow it to be used as a place to find food or as a place to raise anchovies. According to the fishermen who catch anchovy (social knowledge) after the western season and after 15 months of night, the height of anchovy fishing is again approaching the beginning of the month. According to Colloca et al. (2009); Kirchner et al. (2009), the presence of anchovies in a water environment is affected by the conditions under which the waters are ideal for survival, which is generally referred to as habitat. In addition, the pattern of distribution and dynamics of pelagic fish species are very dependent on the conditions of the aquatic climate (Tugores et al. 2011; Bakun et al. 1996). The coastal waters of the Spelman Strait follow the conditions of the waters and their habitat characteristics are very suitable for the distribution of anchovy. A fish species can live and reproduce well if the factor conditions and habitat are appropriate, this is related to food supply, sexual maturity, and the overall condition in the environment (Nur et al., 2021; Nur et al., 2023).

The characteristics of the environment and the presence of chlorophyll-a.

The characteristic of the coastal habitat of Spelman cause it to be used as a place to find food or as a place to grow anchovies. According to the fishermen who catch anchovy (social knowledge) after the western monsoon and 15 nights a month, the height of anchovy fishing is approaching at the beginning of the month. According to Colloca et al. (2009); Kirchner et al. (2009), anchovies in the water world are affected by conditions that make it possible for water to survive, usually referred to as habitat. In addition, the patterns and dynamics of distribution of marine fish species are highly dependent on the conditions of the aquatic environment (Tugores et al. 2011; Bakun et al., 1996). The coastal waters of the Spelman Straits are subject to water conditions and habitat characteristics.

The presence of chlorophyll in the waters indicates that these waters are infertile. Water fertility is strongly influenced by the presence of phytoplankton, which may affect chlorophyll-a content (Aryawati and Toha 2011; Sihombing et al. 2013; Krismono 2010; Marlian et al. 2015; Anderson 2005; Boyer et al. 2009) and the abundance of phytoplankton in water may affect chlorophyll-a content.

Depending on the distribution of chlorophyll, the waters of the Spelman Strait are present in the western monsoon, namely from January to April (Figures 5b, 5c, 5d, and 5e). This phenomenon is caused by wind and waves entering the straits during the western monsoon (Muis et al. 2020). In another example, the distribution of chlorophyll in the East Monsoon is declining (Figures 5f,5g, 5h, 5i, 5j, and 5k). Figure 5l, December is the beginning and height of the western monsoon, marked by wind and large waves that make fishermen in the coastal waters of the Spelman Strait not yet engaged in fishing activities (Muis et al. 2020a; 2020b). After the beginning of January, fishing activities began to operate as usual (social knowledge); this was evidenced by the weakening of winds and waves.

Results of Tubalawony (2007) research in tropical waters has a relatively low concentration of chlorophyll due to low levels of nutrients and the strengthening of the water column stratification due to water surface warming for most of the year. Still, chlorophyll-a pattern of spatial and temporal distribution in certain water drinks, chlorophyll concentrations are relatively large. This is due to the enrichment of nutrients in the water's surface layer via a dynamic process of water mass (upwelling). According to Wu et al. (2019), coastal waters with a high topography are likely to flourish. Such as the blooming occurrence in the northern coastal waters of Papua Island due to the winds of the west from December to March, which are characterized by low sea surface temperatures between 25-28oC. (Waas et al., 2014). The waters of the Spelman Strait may have risen as a result of wind and waves in the western monsoon. In the western monsoon, in the coastal waters of the Spelman Strait, large-scale reef fish are captured by local fishermen (Muis et al. 2019; Muis et al. 2020a).

The activities of anchovy fishermen in the Spelman Strait took place from May to November (social knowledge), named after the western monsoon. The best time for anchovy fishing should start from January to November on the basis of chlorophyll-distribution (Figures 6, 7, 8, and 9). According to Alianto and Hamuna (2020), the distribution of chlorophyll-a, is critical for the forecasting of fishing areas. In view of the fact that the west monsoon is from January to April, the fishing fleet will use the stationary lift net and

use the floating chart (boat lift net) during the east monsoon, as the waters of the Spelman Strait are relatively shady in the eastern monsoon (Muis et al. 2019; Muis et al. 2020a).

CONCLUSION

The are three types of anchovy, namely *Stolephorus indicus*, *Stolephorus* sp. and *Stelephorus commersonnii*. In addition, the water parameters are subject to the appropriate criteria. The distribution of chlorophyll-a is a barometer for anchovy fishermen in the waters of the Spelman Strait to assess the fishing ground and to pick the appropriate fishing gear.

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