A Preliminary Study of Environmental Parameters of the *Solen* sp. around The Madura Straits, East Java, Indonesia

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Abstract. The high demand for razor clams (*Solen* sp.) opens and increases overfishing opportunities. Aquaculture is one of the efforts to overcome over- exploitation of *Solen* sp. To carry out aquaculture, it is necessary to understand and have adequate information on the habitat conditions of *Solen* sp. in its natural environment. This study aims to observe and measure environmental parameters affecting Solen sp. survival. This information is important as a first step to prepare experiments for laboratory-scale cultivation. The research was conducted September 2024 in several coastal areas in Madura Island. The results of field measurements showed physical and geological parameters in the normal range (compared to research in 2023), so they were sufficient as information and initial footing in the design of laboratory-scale experiments for cultivation.

1 Introduction

Due to its high economic value and status as one of the important commodities on Madura Island [1, 5, 6], demand for *Solen* sp. is increasing annually [2, 6]. *Solen* sp. is harvested from the wild during this period which raises the possibility of overfishing if cultivation efforts are not taken into consideration as a remedy. Although there have been several similar studies [7], there has not been any solen cultivation, especially on Madura Island [5, 6]. However, more thorough research is still needed, including on spawning characteristics. Due to its use primarily for community consumption [1] and not yet on an industrial scale, which only affects price fluctuations [2, 5, 6], the population of *Solen* sp on Madura Island, particularly in Pamekasan district [8], is susceptible to the threat of overfishing.

Madura Island is divided into four districts: Bangkalan, Sampang, Pamekasan, and Sumenep. These four districts have a range of sizes of *Solen* sp, suggesting that the species is widely distributed [5]. Muddy substrates and/or muddy sand are typical habitats for *Solen* sp. The water's physical characteristics are not extreme, the temperature is fairly

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mild, and there are only minor variations in the salinity. Madura Island is surrounded by the Java Sea and the Madura Strait. Its water physics features, including waves and weak currents [9], along with its generally tropical salinity and muddy substrates [6], make it an ideal place for *Solen* sp growth and development [10]. Information on the characteristics of environmental parameters are the important part when decide to design laboratory experiments to match the natural habitat of *Solen* sp in order to minimize potential overfishing of *Solen* sp.

2 Materials and methods

Environmental factors such as DO, temperature, salinity, pH, and substrate [11] were measured in September 2024 at the seaside town of Modung (Bangkalan) (Figure 1). The environmental parameter measurement technique complies with [11]. *Solen* sp samples were collected using 1 x 1 m quadratic transects, and their density was ascertained by morphological analysis. In order to understand the link between biotic and abiotic variables, surface water and sediment were sampled simultaneously utilizing physics parameters. Measurements have been made of DO, temperature, pH, salinity, and substrate. A grab sampler is used to collect the sediment. Using the granulometric approach, sediment substrate is examined to determine the grain size. Separation of grain sizes was done. Includes sieves of the following sizes: <0.063mm, 0.090, 0.063, 1.4, 1, 0.5, 0.250, 0.150, and >2. Classification is used to determine grain size and sediment type by applied Shepard's Triangle Diagram [12].

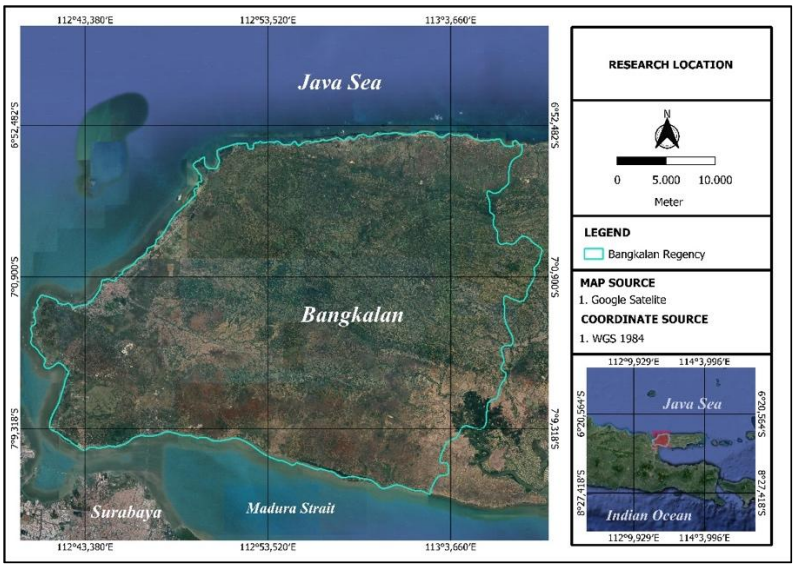

Fig. 1. Research location.

3 Result and discussion

DO, temperature, salinity, pH, and sediment substrate analysis were among the environmental characteristics that were assessed during the study (Table 1). DO is the initial parameter. It is not possible to compare the measurement value in 2024 with the DO

value in 2023 [10] because it was not measured. According to [11], the DO value range of 5.5 to 6.2 mg/L is appropriate for the habitat of *Solen* sp. Sea surface temperature is the second parameter. Sea surface temperatures ranged from 28 to 30 degrees Celsius in 2023 and from 29 to 31 degrees Celsius in 2024. This suggests that the sea surface temperature has increased by 1.0C. In the tropics, sea surface temperature trends are often minor and warm all year round. Salinity is the third parameter. The salinity ranges from 32 to 33 parts per thousand in 2023 to 31 to 33 parts per thousand in 2024. Salinity range values generally only vary at the lower interval, making them appropriate for Solen habitat [5] and reflecting tropical salinity conditions [6]. The pH range, which is the fourth parameter, is 8.0 to 8.1 in 2023 and 2024. Generally, in the tropics, the pH range is quite small and is suitable for Solen habitat [6, 10]. The fifth parameter is substrate type and shows no change when compared to 2023 and 2024. Muddy substrate types are suitable for Solen [10].

Table 1. Environmental Parameters of Solen in Modung – Bangkalan.

Time	Weeks	DO (mg/L)	Temperature (°C)	Salinity (ppt)	pH	Substrate	References
July 2023	1	-	29	33	8.0	Muddy Sand	[10]
	2		29	32	8.1		
	3		30	33	8.0		
	4		30	32	8.0		
August 2023	1		30	32	8.0		
	2		29	32	8.1		
	3		28	33	8.1		
	4		28	32	8.1		
September 2024	1	5.5	29	31	8.1		Current research
	2	5.8	30	33	8.1		
	3	6.2	30	33	8.1		
	4	6.1	31	31	8.0		

During the environmental parameter measurements, the number of *Solen* species was 8–10 in week 1, 8–11 in week 2, 9–10 in week 3, and 9–11 in week 4. The comparatively consistent species density suggests that the distribution of *Solen* sp is not significantly impacted by the variations in environmental parameter measurement values (Table 1). Since *Solen* sp cannot adapt to low salinity, may a drop-in salinity will have an impact on Solen's survival [13]. The study site's sea surface temperature is generally warm [14] with very little variation, hence Solen survival is unaffected [15]. Small fluctuations in all measured environmental parameters are not expected to affect the abundance or survival of *Solen* sp. However, in laboratory-scale experiments, exposure to temperature [15] and salinity significantly affected Solen survival.

4 Conclusion

For the environment of *Solen* sp, the range of environmental characteristics and circumstances is adequate and reasonable (DO 5.5 – 6.2 mg/L, temperature 28–31 °C, pH 8.0–8.1, salinity 32–33 ppt). According to the in-situ measurement, the condition is quite good. The *Solen* sp abundance is 8 – 11 species/m2. Temperature and salinity became the important environmental parameters (in laboratory scales) effecting on survival of *Solen sp*. We highly suggest to analysis the relationship between the environmental parameters and

the abundance of *Solen* sp use appropriate methods and consider extending the other parameters.

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References

1. M.A. Anggarani, E.R. Purnama, Nat. Semin. Chem. 2019 (SNK-19), 73-76 (2019)
2. D. Darriba, Abstr. Aquac. Eur. 2006, Firenze, Italy, 9–13 May (2006)
3. P.J. Barón, L.E. Real, N.F. Ciocco, M.E. Ré, Sci. Mar. **68**, 2 (2004)
4. I.D. Tuck, N. Bailey, M. Harding, G. Sangster, T. Howell, N. Graham, M. Breen, J. Sea Res. **43**, 1 (2000)
5. E.A. Wahyuni, I. Insafitri, M.N. Ihsan, G. Ciptadi, Appl. Mech. Mater. **862** (2017)
6. E.A. Wahyuni, I. Insafitri, G. Ciptadi, M.N. Ihsan, J. Kelaut. **9**, 1 (2016)
7. F. Da Costa, D. Martínez-Patiño, Aquaculture **288,** 1-2 (2009)
8. R. Ambarwati, B. Irawan, Ecol. Environ. Conserv **26** (2020).
9. A.D. Siswanto, Procedia Environ. Sci. **23** (2015)
10. E.A. Wahyuni, N. Qomaria, L. Lisdiana, BIO Web Conf **74** (2023)
11. M.A. Asadi, F. Iranawati, A.W. Andini, Aquac. Aquarium Conserv. Legis **11**, 1 (2018)
12. F.P. Shepard, J. Sediment. Res. **24**, 3 (1954)
13. H.A. Nel, R. Perissinotto, R.H. Taylor, N.K. Carrasco, Afr. Invertebr. **52,** 2 (2011)
14. Y. Thomas, C. Bacher, Glob. Change Biol, **24,** 10 (2018)
15. N. Niamaimandi, Agric. For. Fish, **1**, 1 (2012)