Water Quality and It’s Effect on Seaweed Cultivation in Pari Island, Kepulauan Seribu DKI Jakarta

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Abstract. This research aims to determine the effect of water quality on the sustainability of seaweed cultivation in Pari Island, Kepulauan Seribu DKI Jakarta. Based on the results of research that the quality of waters in Goba Pari Island were suitable for seaweed cultivation. The inhibiting parameters in all four goba in the cluster of Pari Islands are the current and temperature parameters in all goba when compared to the requirement for seaweed growth.

1. Introduction
So far, seaweed in the consumption of the community is only limited to be eaten directly as a vegetable or processed into jelly. This is due to the low level of educational level of fishermen families (generally only graduated in primary education level) and not supported by sufficient knowledge about the importance of maintaining coastal and marine resources. In addition, people's understanding of environmental education is still limited to be a constraint. On the other hand, understanding is closely related to education levels. Lack of public understanding of the environment is indicated by the low behavior of a person who is shown by public concern for his or her environmental condition [1].

Seaweed aquaculture technologies have developed dramatically in Asia, but there are still many challenges to overcome. These challenges vary for different species and in different countries [2]. With the development of science, exploiting of seaweed is widely used as raw material of medicine industry, textile, beverage, cosmetic, toothpaste, and so on. Thus, the prospect of seaweed as a commodity trade will be wider. Seaweeds obtain nutrients directly from the seawater and it is crucial to have currents that flush the site in which the seaweeds are placed [3]. Seaweed cultivation has the opportunity to be developed in marine waters in Indonesia, cause more than 70% of seaweed is used to make food [4]. An additional advantage of seaweed farming is its beneficial effect on ecology and climate change. By trapping carbon, seaweed farming could be a tool in the carbon credit system that is being developed [5].

The island of Pari, Kepulauan Seribu DKI Jakarta consists of small islands such as Pari Island, Burung Island, Tikus Island, Kongsi Island, and Tengah Island. Pari Island is administratively one of the villages in the District of Kepulauan Seribu Selatan, Kepulauan Seribu District, DKI Jakarta Province. Pari Island is an island that is considered successful in conducting seaweed cultivation business, where seaweed production is the highest compared with the other three islands which is 38.39% of total seaweed production produced by Kepulauan Seribu at that time. However, seaweed that became the priority of Pari Island did not last long. The problem is more complicated because of the symptoms of a lack of public awareness of the environment that causes the environment looks unkempt. Lack of public awareness on the environment causes the environment sometimes seem unkempt. Public awareness
about environmental conservation is still low, reflected in daily activities such as littering, the assumption of burning garbage is the most practical and fast way to dispose of garbage, logging and destruction of mangrove forests without replanting, housing development without taking into account the infiltration of water into the soil and does not prepare wastewater treatment facilities, coastal tourism activities that damage coral reef ecosystems, and so forth.

The behavior of a person who is environmentally responsible can be shown from his environmentally friendly habits [6], a pattern of thinking that concerns environmental sustainability, a mindset that does not think about environmental sustainability, environmental sustainability motivation, and behavior of reusing goods and simply, this behavior has a positive impact on the environment [7]. In an effort to improve the quality of life and social welfare, residents in the Thousand Islands of DKI Jakarta need to be given an understanding of the value of responsibility to their environment in the form of good social interaction and the ability to overcome the risks due to social, economic, and political changes that surround it [8], because social resilience is essentially a community's ability to meet the necessities of life and a guarantee for the sustainability of resources, thereby enhancing the quality of life and social welfare. Such fulfillment efforts include the fulfillment of basic needs (especially basic education, basic health services and social welfare services).

The accumulation of the above problems caused ecosystem status and environmental ecological resources in the Pari Island group to show fluctuating status and are in moderate to good condition with biota diversity which tends to decrease. "Start Up" from the above phenomenon ultimately pushed the population growth rate and the construction of higher settlements, the development of tourism, ports and others are several factors that allegedly increasingly increasing ecological pressure on the territorial waters of Pari Island. This increased pressure can certainly threaten the existence and sustainability of the ecosystem.

2. Methods
This study aims to determine the effect of water quality on the continuity of seaweed farming business in Pari Island, District of South Seribu Island, Kepulauan Seribu District Administration, DKI Jakarta Province. This research was conducted on November 2016 until May 2017. The method used in this research is descriptive method with field survey approach. Population in this research is area of waters of Pari Island group. The sampling technique uses the sampling area. The tools used in data collection of water quality parameters in Pari Island group are Current Drifter, stopwatch, Secchi disk, Water Quality Checker, Echo-sounder, bottle sample, cool box, strap, underwater stationery and waterproof camera.

3. Results and Discussion
The description of water quality in the waters of Pari Island is important to know because it can affect the development of seaweed. The results of the measurement of parameters in the study sites can be seen in the table below.

| Parameters       | Units | Goba Location | Standards |
|------------------|-------|---------------|-----------|
| **Physics**      |       |               |           |
| Current          | cm/sec| 4.09          | 20-30     |
| Brightness       | meter | 2.31          | >5        |
| Protection       |       | Protected     | Protected |
| Temperature      | °C    | 30.7          | 30        |
| Depth            | meter | 4.17          | 0.6 – 16  |
| **Chemistry**    |       |               |           |
| pH               |       | 7.83          | 6.5 – 8.5 |
| DO               | mg/l  | 7.6           | >4        |
| Salinity         | ‰     | 33.62         | 30        |
| **Biology**      |       |               |           |
| Animal Herbivore |       | There is no   | There is no|
| Substrate        |       | The sand is a bit muddy | The rock is rocky |
| Pollution        |       | Medium        | There is no |
3.1. Water quality

3.1.1. Physical Parameters
The role of physical factors such as currents is necessary in the cultivation of seaweed as a carrier of nutrients and the cause of the water mass becomes homogeneous. Homogeneous water mass is protected from temperature fluctuations, salt content, pH, and dissolved oxygen. Based on Table 1 above, the current velocity at the location of Goba Pari is 4.09 cm/sec. The currents in goba mostly come from the wind and tidal that exist, because the data collection is done during the day and the conditions of calm wind so that the resulting flow was weak speed.

Brightness of the waters is one important factor for seaweed growth, because the low brightness causes sunlight into the water is reduced. The intensity of light perfectly perceived by the thallus is a major factor in the process of photosynthesis and also sunlight is a major factor indispensable to marine plants, to the depths that sunlight does not get, the seaweed can not live. Based on Table 1, the brightness in Goba Pari is 2.3 meters. And when compared with the criteria of the suitability of cultivated land, the brightness in goba is not suitable for seaweed cultivation. Goba waters is one of the locations of cultivation that is protected from strong waves and wind. Based on the observations of the researchers in the field, that at the point of each goba found that all the waters of the Pari Island group has a good protection because it is surrounded by barrier reefs that are suitable for seaweed cultivation.

Seaweed has a specific temperature range due to the presence of enzymes in seaweed that can not function at temperatures that are too cold or too hot. Based on Table 1, the temperature in Goba Pari is 30.70° C. This temperature range is quite high so it will affect the development of seaweed. It is supported that in trapped gates (lagoon) encounter hot temperatures and when the water recedes during the day can sometimes reach 35° C. Based on Table 1 also, it is known that the depth in Goba Pari is 4.17 m, which indicates that the depth of waters in the cluster of Pari Island is suitable for seaweed cultivation location.

3.1.2. Chemical Parameters
The pH factor is one of the important factors in seaweed life among other environmental factors. Each organism has a certain tolerance to pH as well as seaweed which requires a typical water pH condition for its life. Based on Table 1 above, it is known that pH value in Goba Pari is 7.83 indicating the fulfillment of good pH requirements for seaweed growth. Where the ideal pH requirement for seaweed growth is pH 7.6 - 8.5.

The oxygen factor generated from the seaweed plant and become a continuation of aquatic biota life as required by animals and aquatic plants, including bacteria for respiration; in the study sites showed that the content of DO (dissolved oxygen) in the waters Goba Pari of 7.60. This indicates that the waters of the Pari Island group have the appropriate levels of DO for seaweed culture.

Salinity (high salt content) of a water, will inhibit the reproduction of some types of seaweed. Based on Table 1, it is known that salinity in Goba Pari has salinity of 33.62 ‰ which means that salinity at the study sites is still appropriate and evenly distributed (range 33 ‰). This is because the Pari Island group does not directly receive fresh water from the mouth of the river so it does not inhibit the growth of seaweed.

3.1.3. Biological Parameters
According to Table 1, there is no disturbing herbivorous animals were found. The substrate conditions in Goba Pari contains sand with a little mud. And related to the phenomenon of pollution caused by oil spills, plastics, old sandals, and other garbage that drift through the estuary of the rivers from the mainland of Java Island (Bay of Jakarta and surrounding areas), known from the lab results aquaculture and field observation of pollution around the water is moderate.
3.2. Water Quality Analysis on Seaweed Cultivation

Based on field data, water quality score in Pari Island on seaweeds suitability has score of 195. This information indicates that the research location can still be classified according to the continuity of seaweed cultivation business. And when referring to the results of land suitability analysis for seaweed cultivation (Figure 1) shows the difference in the suitability level of the land by color, where the yellow color is very suitable while the pink color is appropriate, and the red is not suitable.

Figure 1. Map of Seaweed Cultivation

The current velocity parameters at the study sites are still less than 10 cm per second, which means the current velocity at the study sites does not match the growing requirements of seaweed cultivation. The main cause of this phenomenon is due to the location of goba which is in the middle of the cluster of other small islands and surrounded by barrier reefs so that the incoming stream is very limited. The parameters of the waters brightness on Goba Pari show an average depth of 3-5 meters, which means suitable for seaweed cultivation. Likewise for the protection where the entire location of waters on Goba Pari protected from waves and waves break large. Temperatures in goba waters of Pari Island are quite high at 30-31°C which exceeds the established quality standard of 27-30°C. The depth of goba in Pari Island waters is more than 2 meters, which means it qualifies the growing of seaweed which is cultivated, because for seaweed cultivation if using floating method in Pari Island can be done at depth more than 2 meter of lowest tide (see Figure 2).

For the distribution of DO, the results are almost the same that is 7.1-7.6 where the results indicate that the entire waters of Goba Pari is suitable for seaweed cultivation. Likewise with the distribution of pH in Goba Pari shows a stable condition where the pH range obtained which ranges between 7-8.3 so that waters is suitable for seaweed cultivation. Salinity is still appropriate and evenly distributed in all goba locations in Pari Island. The uniform salinity is more due to the territorial waters of Pari Island that do not directly receive fresh water from the mouth of the river. While the herbivorous animals found in the location of Goba Pari is not found. In the substrate and pollution parameters as the parameter that distinguishes the conformity result at Pari island location, it shows that the substrate contained in Goba Pari consists of sand and a little mud, where this condition is still suitable for the requirement of growing seaweed. From all parameters obtained during the research, generally the above parameters are still suitable for seaweed farming business.
4. Conclusion

From all parameters measured, in general, the conclusion that the quality of the waters of Pari Island is still suitable for seaweed cultivation. As for some unsuitable parameters is the current and temperature where the resulting current is quite weak and the resulting temperature is also quite high when compared with the requirements of growing seaweed. Nevertheless, seaweed cultivation activities to date can continue to be carried out by the surrounding community.

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