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EVALUATION OF SUSTAINABLE AQUACULTURE PRACTICES IN UJUNGPANGKAH-GRESIK PONDS-GRESIK

Evaluasi Praktik Akuakultur Berkelanjutan di Tambak Ujungpangkah-Gresik

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ABSTRACT

This study aims to evaluate the sustainability level of aquaculture practices in the pond area of Ujungpangkah-Gresik District, Gresik, and to formulate development strategies. Data were collected through field observation, interviews, water quality measurements, and documentary studies. Descriptive analysis was used to assess the sustainability level based on ecological, economic, social, and technological dimensions, while SWOT analysis was used to formulate strategies. The results show that aquaculture practices in Ujungpangkah-Gresik are in the moderately sustainable category. The economic and social aspects are relatively good, while the ecological aspect remains the main challenge, characterized by fluctuating water quality and suboptimal waste management. SWOT analysis identified strengths such as farmers' experience and extensive land potential, as well as opportunities from technological developments. Recommended development strategies include improved environmental management, modernization of cultivation technology, strengthening of farmer institutions, and business diversification. This study concludes that the key to sustainability lies in strengthening ecological aspects, increasing farmer capacity, and adopting environmentally friendly technologies.

Keywords: Sustainable Aquaculture, Evaluation, Water Quality, SWOT, Ujungpangkah-Gresik-Gresik

ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi tingkat keberlanjutan praktik akuakultur di wilayah tambak Kecamatan Ujungpangkah-Gresik, Gresik, dan merumuskan strategi pengembangannya. Data dikumpulkan melalui observasi lapangan, wawancara, pengukuran kualitas air, dan studi dokumentasi. Analisis deskriptif digunakan untuk menilai tingkat keberlanjutan berdasarkan dimensi ekologi, ekonomi, sosial, dan teknologi, sedangkan analisis SWOT digunakan untuk merumuskan strategi. Hasil penelitian menunjukkan bahwa praktik akuakultur di Ujungpangkah-Gresik berada pada kategori cukup berkelanjutan. Aspek ekonomi dan sosial menunjukkan kondisi yang relatif baik, sementara aspek ekologi masih

menjadi tantangan utama, ditandai dengan fluktuasi kualitas air dan pengelolaan limbah yang belum optimal. Analisis SWOT mengidentifikasi kekuatan berupa pengalaman petambak dan potensi lahan yang luas, serta peluang dari perkembangan teknologi. Strategi pengembangan yang direkomendasikan mencakup peningkatan pengelolaan lingkungan, modernisasi teknologi budidaya, penguatan kelembagaan petambak, serta diversifikasi usaha. Penelitian ini menyimpulkan bahwa kunci keberlanjutan terletak pada penguatan aspek ekologi, peningkatan kapasitas petambak, dan adopsi teknologi yang ramah lingkungan.Abstrak ditulis dalam Bahasa Indonesia.

Kata Kunci: Akuakultur Berkelanjutan, Evaluasi, Kualitas Air, SWOT, Ujungpangkah-Gresik

INTRODUCTION

Gresik Regency is one of the largest brackishwater aquaculture production regions in Indonesia, therefore Gresik Regency is one of the locations proposed by the Ministry of Marine Affairs and Fisheries (KKP) to become a locally wisdom-based aquaculture fisheries village with milkfish as the main commodity. Gresik Regency being designated as an aquaculture fisheries village has been stipulated in the Decree of the Minister of Marine Affairs and Fisheries Number 64 of 2021 concerning Aquaculture Fisheries Villages.

Milkfish is a fisheries commodity with the largest production yield produced by Gresik Regency. In 2020, Gresik Regency produced 87.12 thousand tons of milkfish with a total production value of IDR 1.4 trillion. In 2021, milkfish production increased to 90.38 thousand tons with a total production value reaching IDR 1.43 trillion.

Interventions by the Ministry of Marine Affairs and Fisheries (KKP) through the Directorate General of Aquaculture include strengthening production inputs such as seed and feed, increasing the capacity of facilities and infrastructure, revitalization of ponds and rehabilitation of channels, management of fish health and the environment to ensure sustainability, as well as protection of aquaculture enterprises through assistance in aquaculture business insurance premiums. Nevertheless, community support and participation remain key factors in the sustainability and success of this aquaculture village program.

In addition, support from the local government is also a factor that cannot be disregarded through commitment and the formulation of an integrated master plan for aquaculture fisheries villages from upstream to downstream, especially since milkfish in Gresik Regency is recognized as a commodity with high economic value that is quite popular among the community through a variety of dishes and processed products.

Aquaculture, particularly milkfish farming, is an important economic sector for the local community. However, the development of aquaculture often poses environmental challenges such as degradation of water quality, erosion of pond land, and pollution from organic waste. To ensure the sustainability of this sector, the implementation of sustainable aquaculture practices that integrate economic, environmental, and social aspects is required. (www.tempo).

METHODS

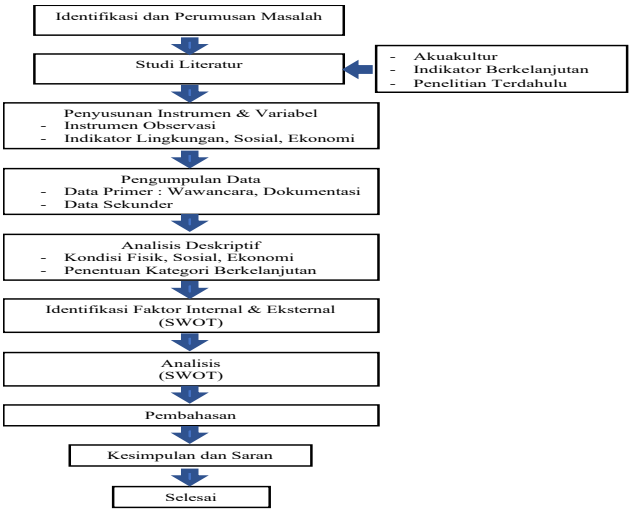

Figure 1. Flowchart

Time and Place

This research was conducted in 2025 in the aquaculture area of Ujungpangkah-Gresik District, Gresik Regency, East Java.

Approach and Type of Data

The research used a descriptive approach and combined qualitative and quantitative data. The data collected consisted of primary and secondary data. Primary data were obtained from direct observation or interviews with fish farmers in Ujungpangkah-Gresik, and water quality measurements at three different sampling points (intensive shrimp ponds, seaweed ponds, and the Bengawan Solo estuary). Secondary data were obtained from relevant agencies such as the Fisheries Service and other supporting literature.

Variables and Instruments

The research variables included dimensions of sustainability such as: ecological (water quality, waste management), economic (profitability, production costs), social (institutional aspects, farmer knowledge), and technological (application of aquaculture technology). In addition, research instruments included questionnaires, observation sheets, interview guidelines, and water quality measuring instruments (pH meters, DO meters, salinometers, thermometers).

Data Analysis

The level of sustainability was analyzed descriptively using indicators for each dimension. A SWOT analysis was used to identify internal factors (strengths and weaknesses) and external factors (opportunities and threats) to formulate a sustainable aquaculture development strategy.

RESULTS

Sustainability Level of Aquaculture Practices

The results of the descriptive analysis indicate that the sustainability of aquaculture practices in Ujungpangkah-Gresik is categorized as moderately sustainable.

1. Ecological Dimension: Basic management practices such as dewatering and liming have been implemented. However, feed management efficiency and water quality control are not optimal, risking deteriorating water quality during certain seasons.

2. Economic Dimension: Pond farming is profitable but vulnerable to commodity price fluctuations and high feed and seed costs.
3. Social Dimension: Aquaculture has become a culture, and farmer social relations are harmonious, but the level of training and adoption of modern techniques remains low.
4. Technological Dimension: The application of modern technology (aerators, pumps, measuring instruments) is limited to intensive ponds, which occupy a very limited area (0.4% of the total pond area). The majority still rely on traditional techniques.

Land Conditions and Water Quality

The Ujungpangkah-Gresik District covers an area of 117.6 km², with a total pond area of 57.934 km². Water quality measurement results are presented in Table 1.

Table 1. Water Quality Measurement Results at Sampling Locations

No	Water Quality Parameters	Location 1 (Intensive Pond)	Location 2 (Seaweed Pond)	Location 3 (Bengawan Solo Estuary)
1	Temperature (°C)	28	29,5	27,5
2	pH	8	9	7
3	Salinity (°C)	25	30	23
4	DO (ppm)	7,5	5	7

Source: Personal (2025)

Based on water quality data from three sampling sites, the SWOT analysis shows that parameters such as temperature, pH, salinity, and dissolved oxygen (DO) play a very important role in determining the sustainability of aquaculture in the Ujungpangkah District – Gresik. Overall, tropical temperature stability ranges from 27.5 to 29.5 °C, thereby supporting the growth of shrimp and seaweed commodities without requiring additional operational costs.

At Location 1, an intensive shrimp pond with a DO of 7.5 ppm and salinity of 25 ppt provides ideal conditions for high productivity. Location 2, a seaweed pond with a DO of 5 ppm and pH of 9, indicates a risk of eutrophication or oxygen stress due to nutrient accumulation from intensive methods, which can reduce fish health and increase management costs. Meanwhile, Location 3 at the estuary of the Bengawan Solo River, with a neutral pH of 7 and DO of 7 ppm, represents a significant opportunity for cultivating mixed fish and shrimp from freshwater to marine environments.

Thus, the positive indication of salinity levels between 23 and 30 ppt allows the application of environmentally friendly methods such as the Recirculating Aquaculture System (RAS), also known as biofloc, which is capable of reducing water usage by up to 70% while simultaneously facilitating international certifications such as the Aquaculture Stewardship Council (ASC). This becomes an opportunity for farmers to integrate various types of culture, such as shrimp and seaweed, which is beneficial for increasing farmers' income and improving efficiency.

Overall, water quality still supports the sustainability of aquaculture; however, traditional and semi-intensive ponds are at risk of experiencing water quality degradation if adequate circulation management is not implemented.

DISCUSSION

Based on the research, ecological aspects constitute the main challenge to the sustainability of aquaculture in Ujungpangkah–Gresik. Fluctuations in water quality, particularly in traditional and semi-intensive ponds, are consistent with FAO (2018) reports on

the importance of water quality management for sustainability. Low DO values and high pH at Location 2 reflect nutrient accumulation from feed residues, as also reported by Renitasari *et al.* (2021).

The SWOT analysis integrated with field results produces a strategic matrix. Strengths (farmers' experience, land availability) and Opportunities (government support, sustainable markets) can be utilized through SO strategies, such as developing seaweed-based polyculture (*Gracilaria sp.*) as a natural biofilter while simultaneously providing economic diversification, in accordance with the findings of Junaidi M. *et al.* (2020). WO strategies take the form of training and subsidies for basic equipment (aerators, DO meters) to enhance the adoption of semi-intensive technology. ST strategies include strengthening farmer institutions to mitigate threats of disease and price fluctuations. Meanwhile, WT strategies focus on periodic water quality monitoring and enforcement of zoning regulations based on environmental carrying capacity.

Commodity diversity (Milkfish, Tilapia, Tiger Shrimp/Vannamei Shrimp, Seaweed) represents a strong foundation for implementing more sustainable aquaculture systems such as IMTA (Integrated Multi-Trophic Aquaculture), which can minimize waste and improve resource efficiency.

CONCLUSION

Based on the research, it is concluded that aquaculture practices in Ujungpangkah–Gresik ponds fall into the category of moderately sustainable. Economic and social aspects show good performance, while ecological aspects indicate that water quality stability and waste management require very serious attention. Development strategies undertaken include improving water quality, adopting semi-intensive technology and polyculture, strengthening farmer institutions, and diversifying businesses based on local potential. Therefore, these strategies require commitment and synergy among farmers, local government, and academics.

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