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Oyster Farming Management

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ABSTRACT

Pacific oysters (*Crassostrea gigas*) are one of the major aquaculture commodities that contribute greatly to the Japanese fishing industry. This study aims to describe the oyster farming management system based on field research experience in Hyogo Prefecture, Japan. The method used was participatory observation for eight months, covering all stages of aquaculture from seed collection to post-harvest. Observations showed that oyster farming is carried out using the hanging raft method (ikada-suika-shiki), relying on natural food in the form of plankton with depth management and regular hanger rotation. A seed training process (yokusei) was also applied to increase the oyster's resistance to environmental stress. The growth rate of oysters in the rearing phase ranges from 0.25-0.35 grams per day, and harvesting is done during winter to produce high-quality meat. The implementation of efficient and systematic production management has proven to increase yield and product quality. These results suggest that oyster farming practices in Japan can serve as a reference in the development of sustainable oyster farming in Indonesia.

INTRODUCTION

Since the late 20th century, oysters have been one of the most sought-after nutritionally balanced aquaculture products in the world market, alongside mussels and salmon. Including those that have been cultivated globally, the Pacific oyster (*Crassostrea gigas*) (Maulina, 2022) is still one of the most commercialized aquaculture species in the fishing industry in Japan, the United States, and various other regions in the world (Hasegawa *et al.*, 2021), except Antarctica (Botta *et al.*, 2020). In fact, global production of Pacific oysters accounted for 96.96% of the total production of the four main oyster species (Pacific, American, slipper, and mangrove) worldwide, or about 4,340,204 tons in 2015 (Laing & Bopp, 2018).

The Pacific oyster (*Crassostrea gigas*) is the most dominant oyster species in the aquaculture industry in Japan, contributing significantly to the country's fisheries economy (FAO, 2022). This species is known for its high environmental adaptability, including to variations in temperature, salinity, and water quality, making it a top choice for oyster farmers in coastal areas of Japan (Choi *et al*., 2021).

Regarding Pacific oyster aquaculture, Japan can be said to be a pioneering country, whose cultivation methods started with the broadcast method and progressed to the raft method and long-line method (Kamiyana *et al*., 2011). Pacific oyster aquaculture production in Japan has grown rapidly since the mid-1960s, but has been slowing down until recently due to various factors, such as labor shortages for aquaculture operations and post- harvest processing, environmental changes such as global warming and oligotrophic coastal waters (Hasegawa *et al*., 2021), and mainly due to the major earthquake in eastern Japan and tsunami in 2011 that caused major damage to major oyster farming areas and the emergence of Norovirus problems (Botta *et al*., 2020). Nevertheless, Japan was still the third largest country in terms of Pacific oyster production until 2016. The high production of Pacific oysters in Japan is inseparable from the achievements of several prefectures that are the main oyster farming areas, including Hyogo Prefecture.

Hyogo Prefecture is one of the regions in Japan known as a major producer of Pacific oysters (*Crassostrea gigas*), along with other prefectures such as Hiroshima, Miyagi, Okayama, and Iwate. One of the companies in Hyogo, Yoshida Suisan Company, previously conducted oyster production during spring, fall, and winter, for a total of 9 months per year (Ibrahim & Andriani, 2022).

METHODS

This research used a descriptive method with a participatory approach. The author was directly involved in oyster farming activities during 8-month research (October 2024–May 2025) in Hyogo Prefecture, Japan. Activities included various aquaculture stages such as shellfish removal and sorting, equipment maintenance (ami, seapa, large bubu), and stock storage and management. Data was collected through direct observation, documentation, and experiential participation at every production stage. These methods provided insight into daily operational challenges and the aquaculture system in Japan. For descriptive data analysis, field observations were compiled into activity logs, and oyster growth stages were monitored weekly using measurement records such as shell length and stock quantity.

RESULTS

Identification and Characteristics of Pacific Oysters

Pacific oyster (*Crassostrea gigas*) is the most widely cultivated oyster species globally, including in Japan. This species has high adaptability to various environmental conditions, as well as the ability to grow fast with good meat quality. The characteristics of Pacific oysters cultivated in the waters off Sakoshi, Hyogo Prefecture, include medium to large-sized shells, thick meat, and a natural savory taste from the sea that makes them excellent in both domestic and export markets. Its habitat is in shallow, calm waters such as bays, with hard substrates to cling to. The abundance of plankton in Sakoshi Bay also supports the optimal growth of these oysters.

Farming Stages Observed

1. Fry Settlement (Tanegaki Method)
   Approximately 60–75% of larvae settled successfully on hotate shells after 2 weeks. The optimal settlement occurred when water temperatures ranged between 20–23°C.

2. Seeding (Saibyo)
   During the seeding stage, oysters were suspended in plankton-rich areas. Growth was visible within 3 weeks, with an average increase in shell length of 0.5 cm.
3. Acclimatization (Yokusei)
   Oysters exposed to tidal zones showed higher survival rates (by observation, 90%) compared to non-acclimatized ones (70%).
4. Main Rearing (Honsuika)
   Oysters were arranged on suikarin ropes (50 shells/hanger) and suspended at 5–8 meters. The observed average daily growth rate was approximately 0.3 grams/day. The oysters reached harvest size in 10–11 months.
5. Harvesting and Post-Harvest Handling
   Harvesting occurred from late November to March, when the water temperature was between 8–12°C. Manual shell opening (kakimuki) was practiced ensuring meat quality preservation. Average glycogen-rich meat weight was 50 grams.

Pacific Oyster Farming

Pacific oysters (*Crassostrea gigas*) are a major commodity in global aquaculture and are known for their relatively fast growth rate, reaching harvest size in 6 months depending on water temperature and natural food availability. During the research in Hyogo Prefecture, Japan, the stages of oyster farming were directly observed from equipment preparation, seed collection, seeding, enlargement, to post-harvest. The cultivation process was conducted using the ikada-suika-shiki (hanging raf) method, which is very common in Japan as it facilitates the management of biofouling, currents, and hanger depth.

In the early stages, fry is obtained by the tanegaki method using hotate shells as the larval substrate. This process takes about 2-3 weeks with a larval settlement rate of about 60%-80%, depending on water quality and temperature, which ideally ranges from 18-24°C. After the fry has been attached and developed, the saibyo (seeding) stage is carried out in plankton-rich waters as the main natural food. Oysters are filter feeders and can filter up to 5 liters of water per hour, depending on their size, so growth is highly dependent on the availability of phytoplankton.

The yokusei stage involves moving the seeds to the tidal zone to acclimatize them to changes in temperature and salinity. This exercise has been shown to increase the immunological resistance of oysters, as reported by, who showed an increase in survival rate to 15-20% higher than seeds that did not go through the yokusei process.

Next, the oysters are transferred to the main rearing phase (honsuika) using suikarin ropes containing 50 shells per hanger. The average growth rate in this phase in Japan reaches 0.25-0.35 grams per day, and the ideal harvest weight is achieved within 10-12 months. Management is done through adjusting the depth of the hanger between 5-8 meters, as well as rotating the hanger position every 2-3 weeks to ensure even distribution of nutrients and prevent excessive biofouling.

Harvesting is done in winter (November-March), when the water temperature is low (around 8-12°C) which affects the quality improvement of the oyster meat, with high glycogen levels giving it a natural savory taste. Post-harvesting is done manually through the kakimuki technique using specialized tools to maintain the integrity of the meat.

During the research observations showed that the oyster farming system in Japan is highly organized, with digital recording of stock logistics, efficient scheduling of work rotations, and quality control carried out regularly. Not only were cultivation techniques acquired, but also learning about production management and understanding the importance of time and labor efficiency in the modern aquaculture industry.

DISCUSSION

The oyster farming practices in Hyogo Prefecture highlight a strong integration of structured. The oyster farming practices observed in Hyogo Prefecture demonstrate how structured aquaculture systems, when integrated with precise labor management, can yield optimal growth and survival outcomes. The recorded average daily growth of 0.3 grams during the honsuika phase confirms the effectiveness of this transitional stage in preparing oysters for the main grow-out period. This observation supports the results of Laing & Bopp (2018), who highlighted that growth phases optimized for gradual environmental exposure enhance metabolic adaptation and shell strength in bivalves.

A key factor contributing to these positive outcomes is the implementation of the *ikada-suika-shiki* method, which maximizes vertical space in the water column and simplifies the management of biofouling organisms. The method's design enables water flow to reach all oysters evenly, reducing hypoxic stress. As Nakamura *et al*. (2018) noted, improved water circulation directly correlates with increased feeding efficiency and meat quality, further validating the advantages of this farming technique over traditional flat-bottom rack systems.

Moreover, the *yokusei* process—briefly exposing oysters to tidal air before full immersion—played a critical role in enhancing oyster resilience. This practice likely strengthens the oysters' adductor muscles and stimulates stress-response pathways, increasing their ability to withstand sudden salinity or temperature fluctuations during grow-out. These findings resonate with Takahashi & Yamada (2018), who documented improved survival rates in oysters undergoing controlled tidal exposure before transfer to open-water cultivation.

Labor management strategies observed at the farm were equally instrumental in the operation's success. Scheduled rotations of tasks such as ami (net) cleaning, seapa (shell collector) replacement, and equipment inspection ensured that biofouling was consistently minimized, limiting competition for food and reducing shell damage from encrusting organisms. This preventative maintenance approach aligns with Nakamura *et al*.'s (2018) emphasis on aquaculture hygiene as a determinant of both survival rates and final product quality.

Additionally, the division of labor into specialized yet flexible roles allowed the farm team to handle peak workload periods, such as harvesting and equipment overhauls, without compromising daily care routines. By rotating tasks among workers, the farm reduced fatigue, maintained high morale, and sustained operational consistency—factors often overlooked in small-scale aquaculture but shown to be essential for commercial viability. The observed harvest success rate of over 90% illustrates how human resource planning can be just as impactful as biological or environmental factors in determining aquaculture productivity.

In summary, the integration of technical methods like *ikada-suika-shiki* and *yokusei* with meticulous labor scheduling and maintenance protocols exemplifies a holistic approach to oyster aquaculture. These practices not only enhance biological performance but also contribute to sustainable operations by reducing labor stress, equipment wear, and environmental impact. Future studies could explore the economic implications of these management strategies or assess how climate variability might influence the efficacy of tidal exposure phases in different farming regions.

CONCLUSION

The management of Pacific oyster (*Crassostrea gigas*) farming in Hyogo Prefecture, Japan, is carried out systematically through the application of the hanging raft method (ikada suika-shiki), with an ecology-based approach and operational efficiency. Each stage of cultivation-from seed collection to post-harvest-is well-managed to support optimal growth, maintain yield quality, and increase survival rates. The farm relies on natural plankton feed and a scheduled rearing strategy. This research proves that the application of simple technology accompanied by good management can result in efficient and sustainable oyster production and can serve as a reference for the development of oyster farming in Indonesia.

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