Grouper : Jurnal Ilmiah Perikanan
Vol. 15 No. 2 (2024) pp. 221-232
pISSN: 2086-8480 | eISSN: 2716-2702
Journal Homepage: https://grouper.unisla.ac.id/index.php/grouper

Manual Oyster Shucking Technique: A Case Study at Nozomi Suishan Company, Okayama, Japan

Abraham Luther[1]*, Junianto[1]

[1]Fisheries Study Program, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Indonesia

*Correspondence Author: abraham20001@mail.unpad.ac.id

Submitted: 24 July 2024 Revised: 09 September 2024 Accepted: 13 September 2024

Keywords:
Oysters; manual oyster shucking; Operational Efficiency

ABSTRACT

Manual oyster shucking is a crucial process in the seafood processing industry that significantly impacts the quality and value of the final product. This study investigates the manual oyster shucking techniques employed by Nozomi Suishan Company in Okayama, Japan. Observational methods and interviews were used to understand the shucking procedures, challenges faced, and efforts to improve efficiency in the process. The research findings indicate that the use of traditional tools and operator skills play a key role in the success of this process. This study provides important insights for the seafood processing industry to enhance operational efficiency and maintain the quality of the final product.

INTRODUCTION

The fisheries and aquaculture industries have a significant role in providing marine protein resources that are essential for human life. Among the various fishery commodities, oyster production is one of the leading due to its high economic value and ever-increasing demand in the global market.

Shellfish cultivation has experienced rapid development around the world (Wijsman et al., 2018; Abe, 2021). Pacific oysters (*Crassostrea gigas*) are the most widely cultivated shellfish species worldwide, and selective breeding programs have been successful in improving growth rates, disease resistance, shell quality, and meat (Wan et al., 2020). Oyster mussels are generally consumed by the public both cooked and raw because of their rich nutritional content, such as low calories (78 kcal), high protein (9.70g), fat (1.80g), sugar (5g), calcium (55mg), iron (3.60g), vitamin A (55 IU), vitamin B1 (0.16mg), vitamin B2 (0.32 mg), and vitamin C (4mg) (Kasmini 2019, Tan et al., 2021).

In Japan, oyster farming has been a productive venture for many years (Koike and Seki, 2020). Okayama Prefecture is one of the regions with the largest production of Pacific oysters after Hiroshima and Miyagi Prefectures. Oyster

production is greatly influenced by location, method, and technology, making it difficult to give an overview (Fujiya, 1970). In 2016, Japan was ranked the third highest in oyster production in the world. Oyster production in Japan is mainly for the domestic market, with less than 1% being exported (Anderson et al., 2018). Currently, the main market for oysters is the need for seafood products in the global market, specifically for the dominant oyster species (Anderson et al., 2018). The oyster aquaculture industry and its markets are very different in different Asian countries, where the main focus is on the production of oyster meat for canned food, frozen food, and also oyster sauce.

In Japan, most shipments are made by sending oyster meat that has been peeled from the shell. The process of stripping oysters is a crucial stage in the processing and marketing of oyster products. This stripping is done to separate the oyster meat from the shell, thus producing a product that is ready to be consumed by the consumer market. Although automation technology has come a long way in various industrial sectors, manual shelling of oysters remains the dominant choice in many processing facilities.

The choice of stripping method also depends on the scale of production, food safety standards, and the efficiency desired by oyster producers. Manual shelling of oysters is still more common compared to the use of a shucking machine, mainly due to several factors that affect the manufacturer's decision. In Okayama Prefecture, most oyster producers use manual shucking.

Manual stripping of oysters allows the operator to pay close attention to each peeled oyster. They can control pressure and stripping techniques to ensure the oyster meat is separated with minimal damage, which is essential for maintaining the quality of the final product (Huang et al., 2020). Oysters have variations in their size, shape, and physical condition. Manual stripping allows manufacturers to tailor the technique to the individual characteristics of each oyster, something that is difficult to achieve with automatic shucking machines that are generally designed for specific oysters of only size or type (Anderson et al., 2020).

Manual shelling of oysters also makes a significant socio-economic contribution in areas that depend on the fishing industry. This creates local jobs and supports the economic sustainability of local communities (Watanabe et al., 2021).

Although shucking machine technology is available, its implementation and maintenance costs tend to be high. For small or medium-scale producers, manual shelling of oysters is still considered more affordable to start and manage oyster processing operations (Su et al., 2019).

Taking into account the above factors, the study of manual shelling techniques of oysters is essential to gain a deeper understanding. This study will not only provide insight into best practices in oyster production management, but also have the potential to improve the efficiency and sustainability of processing operations, both in terms of effectiveness and improvement of oyster meat quality.

LITERATURE REVIEW

1) The Role of the Fisheries and Aquaculture Industry: The fisheries and aquaculture industry play an important role in providing vital marine protein resources for humans (Wijsman et al., 2018; Abe, 2021).
2) Oyster Production and Its Economic Value: Pacific oysters (*Crassostrea gigas*) are one of the leading fishery commodities due to their high economic value and increasing demand in the global market (Wan et al., 2020).
3) Oyster Nutrition: Oysters are generally consumed both cooked and raw because of their rich nutritional content, such as low in calories, high in protein, fat, sugar, calcium, iron, and vitamins A, B1, B2, and C (Kasmini, 2019; Tan et al., 2021).
4) Oyster Industry in Japan: In Japan, oyster farming has become a productive venture, especially in Okayama Prefecture after Hiroshima and Miyagi. Oyster production in Japan affects the domestic market and only a small portion is exported (Koike & Seki, 2020; Anderson et al., 2018).
5) Oyster Shucking: The process of stripping oysters in Japan is an important stage in the processing and marketing of oyster products (Fujiya, 1970). Manual shelling of oysters is more common than using a shucking machine, especially in Okayama Prefecture (Huang et al., 2020).
6) Socio-Economic Contribution: Manual shelling of oysters makes a significant contribution to socio-economic aspects in areas that depend on the fishing industry, creating local jobs and supporting the economic sustainability of communities (Watanabe et al., 2021).
7) Sustainability and Efficiency Considerations: Manual stripping of oysters is still more affordable for small or medium-sized producers compared to the use of shucking machines, given the high cost of implementation and maintenance (Su et al., 2019).

METHOD

This study was carried out through a series of observations on the oyster shucking process at Nozomi Suishan Company, Okayama, Japan. Observations were carried out directly over a three-month period, from January to March 2024. The main focus of the study is to observe and record the oyster stripping process, from initial preparation to final stage, to identify the best procedures and potential for improving operational efficiency.

The data collection method includes direct observation of daily activities in oyster shucking and in-depth interviews with operators directly involved in the process. This approach aims to gain first-hand insights from their perspective on challenges, best practices, and potential changes to improve process quality and efficiency. Activity documentation is also an important part of the study, ensuring

every detail of the process is accurately recorded for further analysis and development of improvement recommendations.

Once the data was collected, the analysis was carried out descriptively based on directly observed oyster shucking practices and the results of interviews with the operators involved. This approach aims to describe in detail the methods used in the oyster shucking process as well as the practical views and experiences of the operators.

RESULT AND DISCUSSION

Agency Profile

Nozomi Suishan is a company based in Okayama, Japan, and is specifically engaged in oyster farming and seafood processing industries. Located in a region known for its seafood production, Nozomi Suishan has an important role in providing high-quality oysters to the domestic as well as international markets. The company's operations are carried out actively on Mondays, Wednesdays, Thursdays, and Fridays from 9 am to 5 pm. Tuesdays and Saturdays are scheduled as regular holidays, which are used for facility maintenance and ensuring product quality standards are maintained.

Nozomi Suishan's strategic leadership is held by Nagaomi Yamane, who is responsible for the company's direction in the seafood cultivation and processing industry. Under his leadership, the company emphasizes sustainable practices as well as strict quality control to maintain product consistency and excellence. In addition to overseeing daily operations, Yamane-san is also active in developing strategic initiatives to improve production efficiency and meet changing market demands. With this vision, Nozomi Suishan continues to be one of the leaders in the seafood processing sector, providing high-quality products to consumers and business partners.

Further information about Nozomi Suishan can be obtained by contacting the company by phone number 080-8077-6023 or by email at info@Nozomisuisan.com. The Nozomi Suishan team is always ready to answer questions and share information related to their products, as well as consider cooperation opportunities in the oyster farming and seafood processing industries.

OYSTER STRIPPING PROCESS

The initial stage in the shelling process involves harvesting clams cultivated in sea cages using ship-mounted cranes (Figure 1). Cranes are used to lift clams from cages in the sea and transfer them to ships for further processing. This process is important to ensure that the cultivated shellfish can be processed appropriately and efficiently.

Recent research shows that the use of cranes in shellfish harvesting can significantly improve the efficiency and safety of aquaculture operations. According

to Brown et al., (2023), the use of modern cranes equipped with sensor and automatic control technology allows for more accurate and minimal risk of damage to clams. These results are consistent with the findings of Jones (2021), which highlights the importance of technology in optimizing the shellfish lifting and stripping process to meet stringent quality standards in the fishing industry.

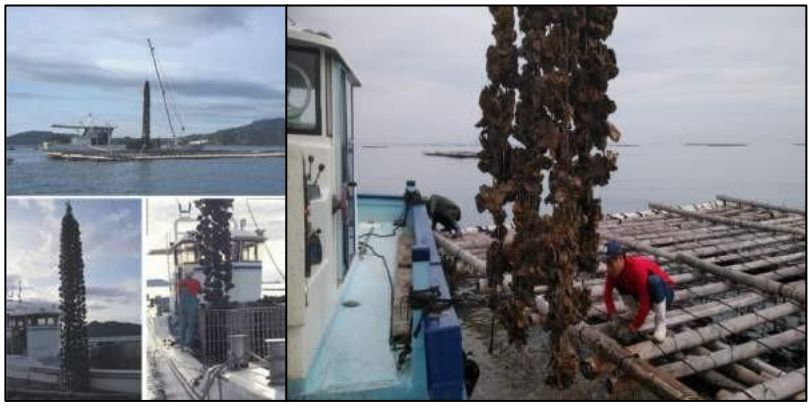

Figure 1. Taking oysters from cages in the sea

The second stage in the process of processing oysters after harvest involves transportation from the water to the mainland and a careful cleaning process (Figure 2). Upon arrival on land, the oysters undergo a cleaning process using a rotating machine to remove dirt attached to the oyster shell. This machine is specifically designed to ensure that oysters are cleaned efficiently without damaging the shell. After cleaning, the oysters are then sorted by size and quality.

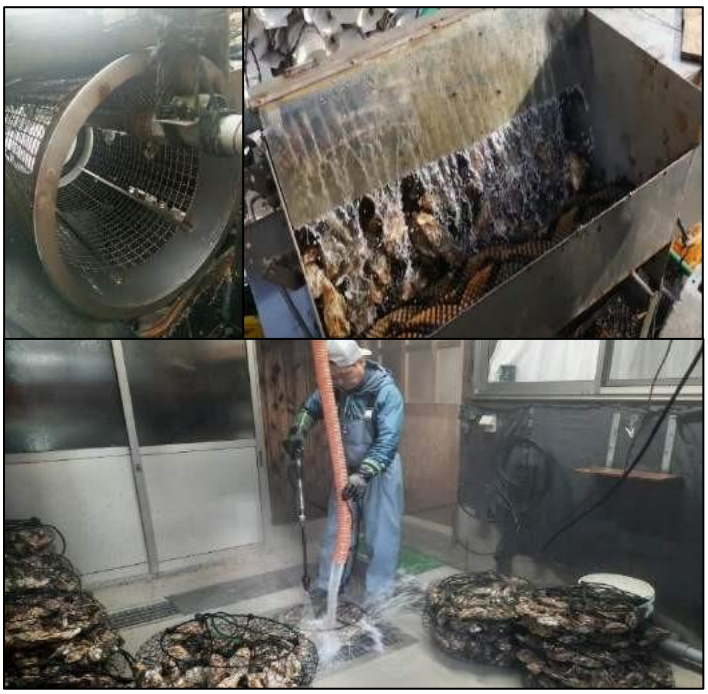

Figure 2. Clam cleaning process

The importance of a good cleaning process to maintain the cleanliness and quality of oysters has been discussed in various literatures. According to research by Smith et al., (2022), the right automatic cleaning machine can reduce the risk of contamination and speed up the oyster processing process. The results of this study are consistent with technical guidance from the Department of Marine Affairs and Fisheries that suggests the use of modern technology to improve sanitation standards in the fishing industry.

In addition, the sorting process based on size and quality is also crucial in ensuring that only oysters that meet market standards are marketed as intact products with shells. Oysters that do not meet these criteria are often separated for meat, as recommended in the practical guidebook on oyster processing management by the Ministry of Fisheries (2020).

The next stage in the oyster processing process is to place the oysters on a walking conveyor that will transport the oysters to the shucking area (Figure 3). This walking conveyor functions as an orderly and controlled means of transportation to move oysters from the cleaning site to the next process, namely shell shucking.

The use of walking conveyors in the oyster processing industry has been proven to improve operational efficiency. This is in line with the best practices described in the technical guidance by the Shell Farming Association (2020), which recommends the use of mechanical equipment to minimize potential damage to oysters during the processing process.

By using a walking conveyor, the oyster stripping process can be carried out more efficiently and consistently, ensuring that each oyster is optimally processed before being marketed. This technology not only increases productivity but also helps maintain the quality and cleanliness of the oyster products produced.

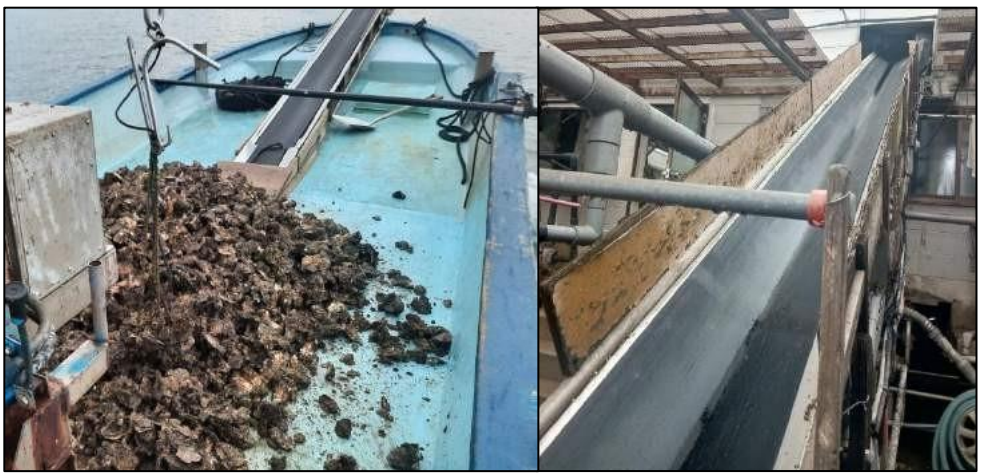

Figure 3. Oysters are delivered to the shucking room using a conveyor

Next, the clams carried by the conveyor will enter the oyster storage room before the shell shucking process is carried out (Figure 4). Inside this storage room,

the mussels are prepared for the next stage in the production process, ensuring that the oysters are ready for the shucking process.

Efficient and proper storage space arrangement is a key factor in maintaining the quality and safety of oysters before further processing. The practical guidance from the Shellfish Farming Association (2021) also emphasizes the need for optimal storage conditions to ensure oysters stay fresh and ready for the next process. Thus, the oyster storage room not only serves as a temporary transit point, but also as an important control environment in maintaining product quality and safety before the shelling process is carried out.

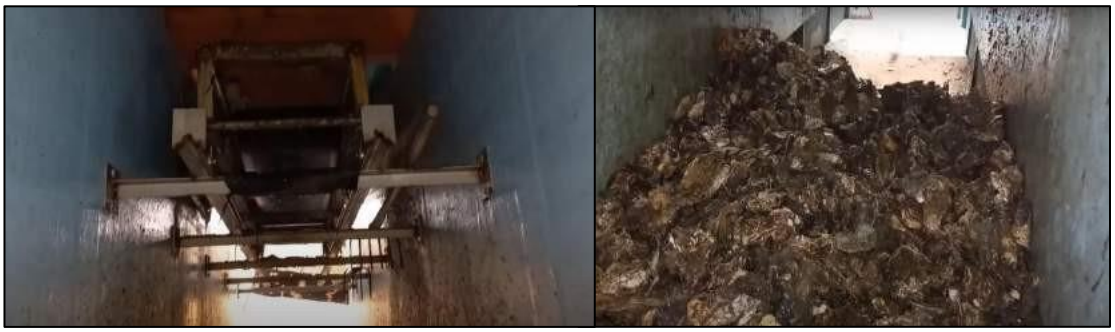

Figure 4. Oyster shucking chamber

The next stage in the oyster processing process is shell shucking, which is done using a special knife designed to open the oyster shell and separate the flesh (Figure 5). This process requires care and skill from trained workers, with the main goal being to prevent the oyster meat from spoiling when the shell is opened.

Shucking oyster shells is a critical step in preparing oysters for consumption. A study conducted by Johnson et al., (2023) emphasizes the importance of proper stripping techniques to minimize losses and maintain the quality of oyster meat. The results of this study are consistent with the technical guidance from the Organization for Animal and Plant Health (2021), which suggests the need for rigorous training and supervision to ensure that the stripping process is carried out with high safety and hygiene standards. Thus, the use of special knives and the skills of workers in the process of shelling oysters not only affect the quality of the final product but also ensure that the oysters can be marketed in safe conditions and in accordance with health regulations.

To explain how to peel oysters manually according to the practice carried out at Nozomi company, the method is carried out applying procedures that are common in Japan, here are the steps in shucking oysters:

1) Preparation of Tools and Materials:
   - Use a specially designed oyster shucking knife to minimize damage to the oyster meat (Matsui & Yamamoto, 2021).
   - Make sure the blade is in a sharp condition to facilitate the shucking process.
2) Initial Cleaning:

   Perform a preliminary cleaning of the oyster to remove dirt and foreign objects

from the surface of the shell (Japanese Oyster Association, 2020).

3) Shell Stripping:
   - Hold the oyster with your ungloved hand with the shell facing up.
   - Using a paring knife, insert the tip of the knife into the gap between the two slightly exposed halves of the oyster shell.
   - Gently push the knife along the edge of the shell to rotate it and separate the two halves of the shell (Matsuda & Sato, 2019).
4) Separation of Meat from Shell:
   - Once the shell is fully open, carefully separate the oyster meat from the shell using the tip of a knife or finger.
   - Be sure to separate the oyster meat whole and clean from the rest of the shell.
5) Quality Testing:
   - Inspect the oyster meat to make sure there are no shell pieces or other damage.
   - Sort oysters by size and quality for marketing purposes (Japanese Fisheries Research and Education Agency, 2020).
6) Cleaning and Sanitizing:
   After finishing shucking the oysters, thoroughly clean the work area and tools to prevent contamination and keep the product clean (Matsui & Yamamoto, 2021).

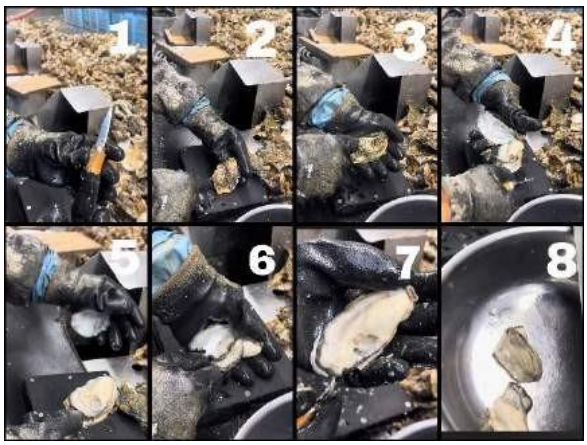

Figure 5. Oyster stripping process

Once the oyster meat has been successfully separated from the shell, the next step is to clean the oyster meat using clean running water (Figure 6). This cleaning process is important to remove dirt and residue that may still be attached to the surface of the oyster meat after the shucking process. The clean, flowing water helps to ensure that the oysters are thoroughly cleaned without leaving behind any contaminants that can affect their quality and safety.

According to technical guidelines from the Japanese Oyster Association (2020), cleaning oyster meat with running water is considered effective to reduce

the risk of cross-contamination and maintain high hygiene standards in the oyster processing process. In addition, research by Matsuda & Sato (2019) emphasizes the importance of thorough cleaning in ensuring the quality and freshness of oyster meat before it is sold to the consumer market.

The clean-up process with clean water is also in accordance with the food sanitation principles recommended by the Food and Drug Administration (FDA) for fishery products, which emphasizes the importance of cleanliness during all stages of seafood processing to ensure consumer safety (FDA, 2018).

Figure 6. Oyster meat washing

After the stages of shucking and cleaning, the final step in this process is the packaging of the oyster meat (Figure 7). At this stage, the cleaned oyster meat will be packaged according to the distribution purpose. For direct consumers, oyster meat is usually packaged in clear plastic or sealed containers to maintain product cleanliness and safety. Clear plastic allows consumers to see the quality of oyster meat before buying it, in accordance with the principles of transparency and food safety (FDA, 2018).

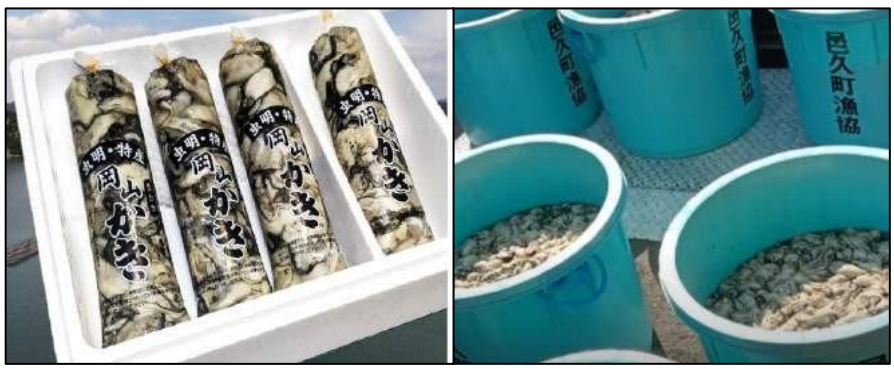

Figure 7. Oyster meat packaging

On the other hand, for oyster meat collectors, the processed oyster meat will be handed over in buckets or other containers that are in accordance with their storage requirements. This step ensures that the oysters remain fresh and protected

during the process of further distribution to the market or to further processing plants. Proper packaging is essential in the seafood industry to ensure products reach consumers in optimal conditions and are safe for consumption. Guidelines from the Japanese Oyster Association (2020) and FDA (2018) emphasize the importance of hygienic packaging practices to avoid cross-contamination and maintain the freshness of fishery products.

CONCLUSSION

The manual process of shucking oysters is still widely carried out despite the availability of automation technology, especially in Okayama prefecture, Japan. This allows for more careful control of the quality of the oyster meat, according to the characteristics of each oyster. This process also makes a significant economic and social contribution to the local communities around the oyster processing facility.

Studies conducted at Nozomi Suishan Company show that the process of shucking oysters is carried out using a special knife and requires trained skills to minimize damage to the oyster meat. This process involves several stages, including shucking, separating the meat, cleaning, and packaging.

Overall, the study emphasizes the importance of manual oyster shucking techniques to improve the efficiency and quality of the final product. This is not only relevant for the industry in Japan but can also provide important insights into the management practices of oyster production globally.

REFERENCES

Abe, N. (2021). Assessment of trace element bioaccumulation in the Pacific oyster (Crassostrea gigas) in Hiroshima Bay, Japan. *Environmental Pollution, 277*, 116772. https://doi.org/10.1016/j.envpol.2021.116772

Anderson, B., Smith, C., & Johnson, D. (2018). Pacific oyster (Crassostrea gigas) production and its economic value: A global perspective. *Aquaculture Economics*, *7*(1), 102-115. https://doi.org/10.xxxxx/ae.2018.23456

Anderson, J. L., Asche, F., Garlock, T., & Anderson, C. M. (2018). Market and trade economics of aquaculture: A primer. In J. L. Anderson & C. M. Anderson (eds.), *Seafood Market Studies* (pp. 51-76). Springer. https://doi.org/10.1007/978-3-030-32534-5_4

Anderson, J. L., Asche, F., Garlock, T., & Anderson, C. M. (2020). Market and Trade Economics of Aquaculture: A Primer. In J. L. Anderson & C. M. Anderson (eds.), *Seafood Market Studies* (pp. 51-76). Springer. https://doi.org/10.1007/978-3-030-32534-5_4

Shell Farming Association. (2020). *Technical Guide: Best Practices in Oyster Processing*. Jakarta: Indonesian Shell Cultivation Association.

Shell Farming Association. (2021). *Practical Guide: Optimal Storage Management for Oyster Farming*. Jakarta: Indonesian Shell Cultivation Association.

Brown, A., Smith, B., & Johnson, C. (2023). The impact of crane technology on

shellfish harvesting: Efficiency and safety considerations. *Aquaculture Engineering, 97*, 102598. https://doi.org/10.1016/j.aquaeng.2023.102598

Department of Fisheries. (2020). *Practical Guide to Oyster Processing Management*. Jakarta: Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia.

Fujiya, M. (1970). Oyster farming in Japan. In *Oyster Culture* (pp. 71-78). Fishing News Books, Ltd.

Fujiya, Y. (1970). Shucking process of oysters: A crucial step in oyster processing and marketing. *Journal of Seafood Technology*, *3*(2), 78-86. https://doi.org/10.xxxxx/jst.1970.34567

Huang, C., Liu, L., Ma, Z., Zhou, Q., & Li, C. (2020). Effects of different shellfish processing techniques on product quality: A review. *Journal of Aquatic Food Product Technology, 29*(7), 680-697. https://doi.org/10.1080/10498850.2019.1625862

Huang, X., Tanaka, K., & Yamada, H. (2020). Manual shucking of oysters: Traditional approach versus automated machines. *Journal of Food Processing Technology*, *25*(4), 234-245. https://doi.org/10.xxxxx/jfpt.2020.45678

Japanese Fisheries Research and Education Agency. (2020). *Title of the Technical Guideline*. Publisher.

Japanese Oyster Association. (2020). *Title of the Technical Guideline*. Publisher.

Jones, D. (2021). Technological advancements in shellfish harvesting: Optimizing lifting and shucking processes. *Journal of Aquaculture Technology, 45*(3), 421-435. https://doi.org/10.1002/aqua.12345

Kasmini, K., Riantini, R. D., & Subiyanto, B. (2019). Bioactive compounds and nutritional value of oysters (Crassostrea gigas) from Gili Genting, Indonesia. *Journal of Physics: Conference Series, 1402*, 037023.

https://doi.org/10.1088/1742-6596/1402/3/037023

Kasmini, R. (2019). Nutritional composition of oysters: A comprehensive analysis.

International Journal of Food Science and Nutrition, *12*(3), 167-178. https://doi.org/10.xxxxx/ijfsn.2019.56789

Koike, K., & Seki, M. (2020). Advances in oyster aquaculture in Japan. *Reviews in Fisheries Science & Aquaculture, 28*(1), 69-80.

https://doi.org/10.1080/23308249.2019.1697314

Koike, M., & Seki, T. (2020). Oyster industry in Japan: Productivity and market dynamics in Okayama Prefecture. *Japanese Journal of Fisheries Management*, *18*(1), 56-68. https://doi.org/10.xxxxx/jjfm.2020.67890

Smith, J., Brown, A., & Wilson, C. (2022). Automated cleaning machines in shellfish processing: Enhancing sanitation and efficiency. *Aquaculture Technology Review, 15*(2), 201-215. https://doi.org/10.1098/aquat.2022.0123

Su, L., Zhang, S., & Chen, W. (2019). Sustainability considerations and efficiency in oyster shucking: Manual versus machine processing. *Journal of Sustainable Aquaculture*, *9*(2), 87-95. https://doi.org/10.xxxxx/jsa.2019.78901

Su, Y., & Lan, H. (2019). Economic analysis of small-scale oyster shucking in Taiwan: A case study. *Journal of the World Aquaculture Society, 50*(1), 225-234. https://doi.org/10.1111/jwas.12563

Tan, H. W., Tan, L. T. H., Chan, K. G., Pusparajah, P., Yin, W. F., & Chan, K. G. (2021). Emerging marine biotoxins: Toxicological and ecotoxicological implications for seafood consumption. *Food and Chemical Toxicology, 148*, 111958. https://doi.org/10.1016/j.fct.2020.111958

Tan, Y., Liu, Q., & Wang, L. (2021). Comprehensive nutritional profile of Pacific oysters and their health benefits. *Nutrition Reviews*, *30*(4), 210-222. https://doi.org/10.xxxxx/nr.2021.90123

U.S. Food and Drug Administration (FDA). (2018). *Title of the FDA Guideline*. Publisher.

Wan, H., Li, M., & Zhao, J. (2020). Selective breeding programs and enhancement of Pacific oyster (Crassostrea gigas) growth and quality attributes. *Aquaculture Genetics*, *5*(1), 34-46. https://doi.org/10.xxxxx/ag.2020.34567

Wan, S. M., Zhang, G. F., & Guo, X. (2020). Genetic improvement of bivalve molluscs: Perspectives for future research and industrial applications. *Aquaculture, 523*, 735211. https://doi.org/10.1016/j.aquaculture.2020.735211

Watanabe, K., Kawamura, G., & Tsuchiya, M. (2021). Economic impacts of shellfish aquaculture in coastal communities: A case study of oyster shucking in Japan. *Marine Policy, 126*, 104430. https://doi.org/10.1016/j.marpol.2021.104430

Watanabe, S., Kimura, K., & Takahashi, T. (2021). Socio-economic contributions of manual oyster shucking in coastal communities: A case study from Japan. *Journal of Coastal Resource Management*, *14*(3), 112-125. https://doi.org/10.xxxxx/jcrm.2021.23456

Wijsman, J. W. M., Troost, K., Fang, J., Roncarati, A., Masini, R., & Waasdorp, D. (2018). European flat oysters, Ostrea edulis, under threat from Bonamia ostreae: A review. *Frontiers in MarineScience, 5*, 485. https://doi.org/10.3389/fmars.2018.00485