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Hotate (*Patinopecten yessoensis*) Seeding Technique using *Zabutonkago* and *Marukago* Tools with Hanging Method in Funka Bay Hokkaido, Japan.

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Abstract

This research focuses on cultivation techniques for Hotate shellfish (*Patinopecten yessoensis*) during the hatchery phase in Funka Bay, Hokkaido, Japan. Hotate scallops are also called giant ezo scallops, these scallops are cultivated in Japan because they have relatively high productivity. This research aims to determine the best seeding technique for mussels (*Patinopecten yessoensis*) using the hanging zabuton-kago and maru-kago media. The research method uses observation and interviews with company owners. The results show that the technique for seeding Hotate shellfish (*Patinopecten yessoensis*) using pearl nets and lantern nets from May to September was carried out in 3 processes, namely chigai, kari-bunsan, and hon-bunsan. The method used is to sort the shells repeatedly until they reach a size of 50 mm – 70 mm during the mimizuri process in March. The hatchery process for cultivating Hotate shellfish can provide the basis for valuable information for sustainable management and maintenance in the future.

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Introduction

Shellfish (*Patinopecten yessoensis*) are a group of molluscs that have soft bodies and are protected by two cupped shells. Mussels are large bivalve species, have a brown color on the top and white on the bottom, grow quickly, and have a high selling price (Li et al., 2007). Generally live in mud and are able to adapt to brackish or sea waters with certain salinity levels (Yuliana et al., 2020). These mussels consume phytoplankton or submerged particles in natural habitats with high efficiency depending on particle concentration, quality

and size of food particles, and shell size (Aya et al., 2014).

The Zabuton kago or pearl net is a net with dimensions of 35 cm x 35 cm on each side, shaped like a pyramid. Zabuton-kago has 12 - 15 levels (compartments) and is tied together with a rope up to 4 m long. Zabuton - kago is divided into three mesh sections, namely section one has a small mesh mesh measuring 2 mm, section two has a medium mesh mesh measuring 4 mm and section three has a large mesh mesh measuring 6 mm with a surface area of 0.3 m^2 each. (Walker et al., 1991).

Maru-kago or lantern net is a net that has a round shape like an andon with a length of 4 m, a diameter of 50 cm and a radius of 25 cm. Maru-kago has 1 rope containing 20 levels (compartments) with a mesh size of 15 mm and a surface area of 0.5 m^2. Zabuton-kago and maru-kago have the function of developing hotate seeds so that they do not scatter in the sea, avoiding predators (Kinoshita, 1935). Each net rope or per unit weighs 1 kg or 100 grams and is used for vertically holding the net in the water of Funka Bay.

Funka Bay in Hokaido, Japan, is an important area for the development of shellfish cultivation. Shellfish cultivation is economically important for coastal communities around the bay. The area of shellfish cultivation in this bay increased approximately 1.6 times from 1982 (12% of cultivation area) to 2003 (19% of cultivation area) (Miyazono, 2006). However, with the rapid development of shellfish farming, concepts such as carrying capacity and ecological footprint need to be considered in relation to sustainable farming activities. The majority of research conducted in Funka Bay focuses on environmental aspects such as shellfish and seaweed, which are widely cultivated by individuals.

Funka Bay is a semi-enclosed bay in southwest Hokkaido. The longitudinal axis of the bay is aligned northwest-southeast. It lies between 42°00–42°35 kan North and 140°18–141°00 kan East, with mean and maximum depths of 38 m and 107 m respectively. The bay has 2,315 km^2 of surface area, and a coastline of 195 km, and is connected to the northwestern Pacific Ocean via a 30 km wide shallow sill in the eastern part of the bay (Radiarta et al., 2008).

This research aims to determine the best seeding technique for Hotate shellfish using zabuton-kago and maru-kago media using the earhanging method.

Materials and methods

Time and Place

This research conducted from 15 May

to 15 September 2022 at the Iriyama Gyogyo company, Funka Bay. Kunnui, Oshamambe-cho, Hokkaido Japan. The process carried out in this research is the Hotate (*Patinopecten yessoensis*) seeding process.

Research Methods

The object used is Hotate spat (*Patinopecten yessoensis*) with a body size from 1 mm to 40 mm. The method used in this research uses the earhanging method with zabuton - kago and maru - kago tools as a means of storing shells so that they do not scatter in the sea. The method used includes 2 approaches, namely: (1) Observation of hatchery activities and the useful function of zabuton-kago and maru-kago in Hotate and (2) Interviews regarding hatchery activities. The seeding activities carried out are as follows: Taking seeds from nature; Use of zabuton-kago and maru-kago in the seeding process; Sorting and grading in hatcheries; The quality of the water used in the seeding process.

Results and Discussion

Hotate or Chigai Shellfish Seed Process

The seeding of Hotate seeds takes place in May using straight net fishing equipment, called main rupe or bo-ami, namely a straight net attached to a rope (keta) and planted in the sea and then cultivated for 40 days. The straight net planting treatment attaches the Hotate seeds directly to the straight net. This net planting process is carried out once a year at a sea depth of around 10 m to 15 m as shown in **Figure 1**.

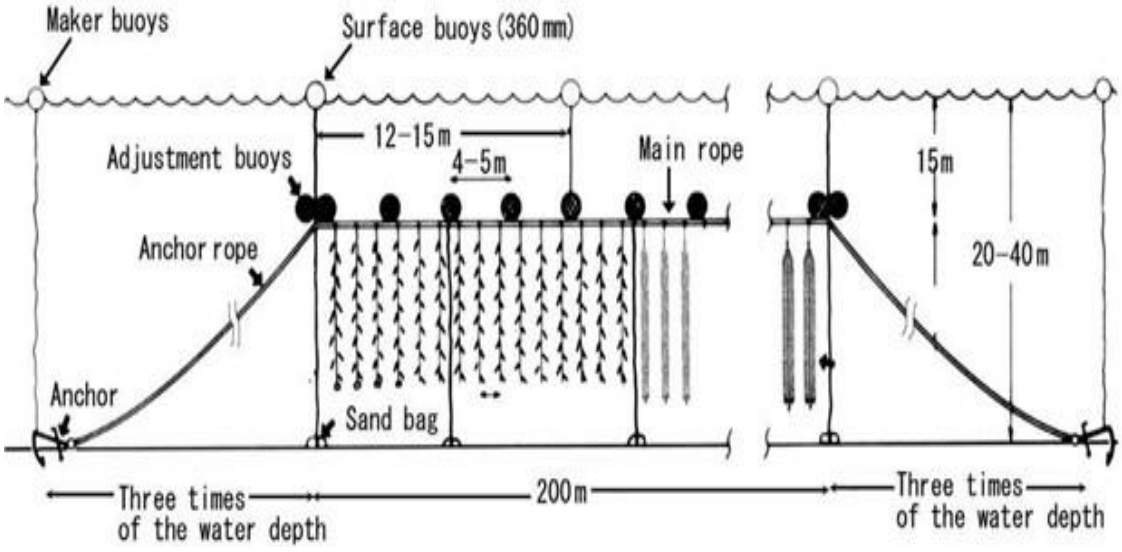

Figure 1. The seeding process uses a straight net (bo-ami)

Before being harvested, hotate seeds are cultivated in the sea for one month. In June, the seeds have been attached to a straight net with a diameter of about 3 -4 mm, before being lifted onto a ship using a crane. The hotate seeds that have been harvested are temporarily transferred into a bucket containing sea water. Afterwards, superior seeds are sorted or selected for cultivation with a sandbag net hanging system, after which the seeds are cultivated.

Sorting functions to separate Hotate seeds from dirt and attached pests. Then put the Hotate seeds into a large bucket with a net and sift them again until they are separated from any rubbish or pests attached to the Hotate seeds. Hotate clam spats are sorted at the initial stage based on size, namely 2.0 mm – 3.3 mm. The shells that have been sorted are then spread into nets or containers based on the specified number and size, around 500 spats are spread in pearl nets per sheet and 1200 spats in sand bags per net. This process is called the curry – bunsan process (Grecian et al., 2000).

Sorting Process for Hotate Clam Seeds (Kari-bunsan)

The curry - bunsan process or temporary sorting process is the second process where Hotate seeds are sorted from the best or superior seeds. The temporary sifting or sorting process is done manually using a tool such as a round tray with 1-2mm wire mesh which will then be inserted into the zabuton - kago (small mesh measuring 2mm) as in **Figure 2**.

Figure 2. Temporary sorting or grading process

Once the sorting process is complete, the size of the shells is adjusted and placed in different buckets and put into a 4 mm zabuton - kago by opening the mouth of the pearl net and taking the Hotate seeds using a plastic spoon. Pearl nets contain around 1,000 - 1200 Hotate seeds, each of which contains 85 - 100 seeds. Then the seeds are placed into the sea and cultivated again for 2 months. The placement method is by using a large rope (keta) 350 m long filled with 100 zabuton - kago ropes. According to Kosaka (2016), this was done because the seeds were still relatively small when this process was performed. Hotate seeds are inserted into medium-eyed zabuton - kago with a mesh size of 4mm. Hotate was placed back in the sea for approximately 2 months. According to Maguire and Burnell (2001), a smaller mesh size increases the number of parasitic organisms attached to the net and reduces the speed of the current. The main parasites on Hotate are caused by tube worms (*Triqueter pomatoceros*) and starfish (Asteroidea sp.).

After 2 months the Hotate seedlings were lifted back from the sea in August using a crane. The size of the Hotate seeds which have reached 10 mm – 20 mm are removed from the zabuton-kago and then placed in a bucket filled with sea water. Seeds are cleaned again by sifting and sorting them using a sieve or bin with a bigger wire measuring 3 - 7mm and adjusted to match the shell size and returned to the pearl net. The method was similar to that used by Cliche et al. (1997), in which spat shells from "Kari-Bunsan" were lifted from the sea. Then the shells are sorted to find the best shells. After that, put it back into the pearl net in the amount determined based on its intended use. *Hotate Clam Seed Sorting Process (Hon-bunsan)*.

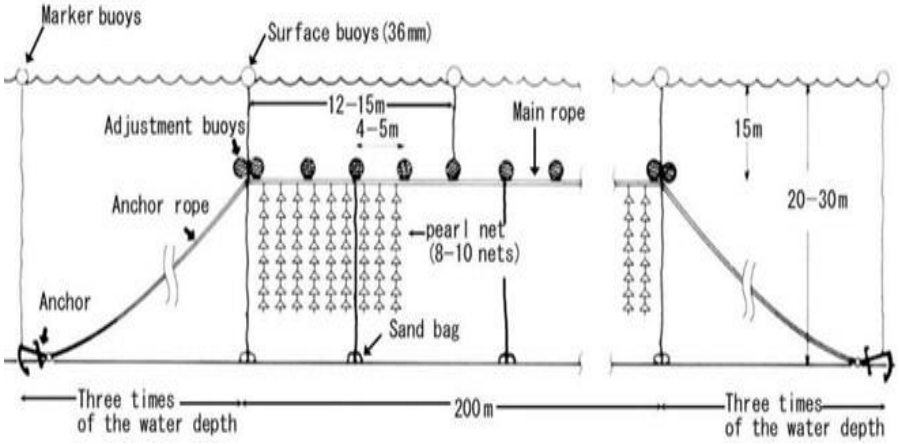

Figure 3. The pearl net process (Zabuton-kago) using the earhanging

Hon – bunsan is the third or final sorting process in selecting superior seeds whose results will be used as a mimizuri process. Hotate shells measuring 20 – 40 mm were lifted from the seabed using a crane at the end of September. After that, the hotate is removed again from the zabuton - kago and then shredded or sorted using a Senbetsuki machine (sifting machine). Then the results of the shredding are sorted again into grouped sizes and sick or disabled hotate are not included in the sorting process, because they result in poor quality.

The selected hotate is put back into the zabuton - kago with a larger mesh size of 6 mm, then the hotate is put into the zabutonkago as many as 35 grains and the marukago as many as 60 grains. The results of the Hon-bunsan process are placed back into the sea with a sea depth of around ± 40 m, cultivated for 5 months until the mimizuri process. This process is carried out at the end of the 9th month.

This is in accordance with (Cliche et al., 1997) that this process is called "Hon-Bunsan" and begins around the end of September. In the cultivation facility, mussel spats are sorted by size, tipped into pearl nets by size and rehung in predetermined quantities. During each sorting process, the pearl net is also replaced so that the mesh is larger to suit the growth of the shellfish. The number of shellfish seeds introduced must also be adjusted appropriately, so that shellfish growth is not disturbed.

Shellfish with good yields are obtained from spat collectors or hatcheries and placed into various types of breeding and rearing systems. Seed can be placed directly on the seabed in suspended aquaculture or in closed systems with recirculating seawater. For nursery systems, pearl nets are generally used until the mussels reach a shell height of 40mm. For final rearing to commercial size, mussels are generally transferred to lantern nets and stocking densities are reduced. The process continues until the final stage, where Hotate shellfish are hung vertically with small monofilament threads using the Japanese method known as "ear hanging" or mimizuri (Narvarte, 2003).

Conclusion

Based on the results and discussion, it can be concluded that the Hotate clam (*Patinopecten yessoensis*) seeding technique was carried out 3 times in several months. In the first process, not chigai, the net is planted on the seafloor in May to make the shells stick together, and after about a month, the straight net is lifted and sorted to produce superior seeds, which are then placed into the pearl net. In the kari-bunsan stage, bins are

manually sorted using bins and then placed back on the pearl net repeatedly for two months, depending on the size and number of pearls. The final process is Hon-bunsan, where shells measuring 20-40mm are sorted again using a senbetsuki machine, then the shells are put into pearl nets and lantern nets, placed back on the seabed and cultivated for ± 6 months until the mimizuri process.

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References

Aya, F. A., Hidaka, Y., & Kudo, I. (2014). Clearance rates and ingestion efficiency of the Japanese scallop (*Patinopecten yessoensis*). *Plankton and Benthos Research*, 8(3): 134–140.

Cliche, G., Vigneau, S., & Giguère, M. 1997. Status of a commercial sea scallop enhancement project in Îles-de-la-Madeleine (Québec, Canada). *Aquaculure International,* 5(3): 259 – 266.

Grecian, L. A., Parsons, G. J., Dabinett, P., & Couturier, C. 2000. Influence of season, initial size, depth, gear type and stocking density on the growth rates and recovery of sea scallop, Placopecten magellancius, on a farm-based nursery. *Aquaculture International,* 8(2–3): 183–206.

Kinoshita, T., 1935 b. Hokkaido san hotate-gai no kara no hosharoku-su no chihoteki heni (Local variations in radiating rib number of Japanese scallop shells from Hokkaido). *Venus,* 5(4): 223 - 229.

Kosaka, Y. (2016). Scallop Fisheries and Aquaculture in Japan. In *Developments in Aquaculture and Fisheries Science* (Vol. 40).

Li, Q., Xu, K., & Yu, R. 2007. Genetic variation in Chinese hatchery populations of the Japanese scallop (*Patinopecten yessoensis*) inferred from microsatellite data *Aquaculture*, 269(1–4): 211–219.

Maguire, J. A., & Burnell, G. M. 2001. The effect of stocking density in suspended culture on growth and carbohydrate content of the adductor muscle in two population of the scallop (*Pecten maximus L.*) in Bantry Bay, Ireland. *Aquaculture,* 198(1–2): 95 - 108.

Miyazono, A., 2006. The current situation of mariculture of scallops and

problems in estimating their carrying capacity in Funka Bay. Japan. *J. Benth*. 61: 45–52.

Narvarte, M. A. (2003). Growth and survival of the tehuelche scallop Aequipecten tehuelchus in culture. *Aquaculture*, 216(1–4): 127–142.

Radiarta, I. N., & Saitoh, S. I. (2009). Biophysical models for Japanese scallop, Mizuhopecten yessoensis, aquaculture site selection in Funka Bay, Hokkaido, Japan, using remotely sensed data and geographic information system. *Aquaculture International*, 17(5): 403–419.

Radiarta, I. N., Saitoh, S. I., & Miyazono, A. (2008). GIS-based multi-criteria evaluation models for identifying suitable sites for Japanese scallop (*Mizuhopecten yessoensis*) aquaculture in Funka Bay, southwestern Hokkaido, Japan. *Aquaculture*, 284(1–4): 127–135.

Walker, R.L., Heffernan, P.B., Crenshaw, J.W. Jr. and Hoats, J. (1991) Effects of mesh size, stocking density and depth on the growth and survival of pearl net cultured bay scallops, Argopecten irradians concentricus, in shrimp ponds in South Carolina, U.S.A. *Journal of Shellfish Research*, 10: 465–469.

Yuliana EY, Afiati N, Muskananfola MR. 2020. Analisis Kelimpahan Bivalvia di Pantai Prawean Bandengan, Jepara berdasarkan Tekstur Sedimen dan Bahan Organik. *Management of Aquatic Resources Journal (MAQUARES)*, 9(1) : 47-56.