

MARINE PRODUCTION AND DISTRIBUTION SYSTEM AND DISPERSED / INTEGRATED CONSTRUCTION OF FISHING PORTS

Akira NAGANO, Future University-Hakodate Department of Media Architecture,
nagano@fun.ac.jp
Atsumi FURUYA, Sadayuki OKA, Minoru SHIBAI

ABSTRACT

There are approximately 3000 fishing ports in Japan and there have been strong criticisms against the dispersed construction of fishing ports. The dispersed construction of the fishing ports is inevitable and historical consequence of the style of the production and life of fishing operators. In recent years, with the fishing production and distribution patterns becoming wide spread, and with the advancement of motorization and information technology, the criticism against the investment in dispersed construction of fishing ports is growing furthermore. This paper shows that daily production and living hours of inshore fisheries determine the most of production patterns of the year and so that the dispersed construction of fishing ports is inevitable. Also, this clarifies that some functions of fishing port, considered to be easier for integration than others, such as the function of joint seedlings production, market distribution and direct sales to urban consumers, have been in progress of integrations accompanying function-sharing. Also, this paper shows that these dispersed constructions of fishing port are advancing with the merger of the fishery cooperative, which was considered it would push the integration of constructions.

Keywords: Marine production and distribution system, Fishing Ports, Dispersed construction, Integrated construction

INTRODUCTION

When it comes to the fishery industry, production is an inseparable part of daily life.

In harvest seasons, fishery operators manage their full schedule of daily tasks between their home, fishing port and fishing ground. The distance from the fishing house to the fishing port has a great impact, especially on the workloads of women in fishery communities. Through the case study on the fishing families, which has been diversified in terms of the distance from the ports, this research shows how the position of the port influences the living patterns and production styles of fishing families, and also the lives of women in these fishery communities. Furthermore, this shows the importance of reform in distribution and sales of fishery products through the actual examples in the fishing ports.

FISHERY OPERATORS' LIVES AND THE CONSTRUCTION OF FISHING PORTS AND GROUNDS

Fishery industry in Minamikayabe town

I have clarified in my recent paper, "Is the integration of the fishing port construction efficient or not?"¹⁾, the need and efficiency of eight fishing ports located in Minamikayabe town in Hokkaido, from the aspects of production, living, and cost performance. The following is an excerpt from the paper pertaining to the interrelations between fishing port construction and living

A general overview of the fisheries in Minamikayabe town (1994, 1999) is shown below (Table I) and despite the all-round decrease in town population, catch volume and number of association members by 20%, only landed price has increased by more than 10%.

Table I: Fishery in Minamikayabe town

year	1993	1998	'93/'98
Town population	8,921	7,510	0.81
Catch volume (tons)	68,549	50,384	0.74
Value(million yen)	11,166	12,760	1.14
Numbers of association members	1,711	1,476	0.86

There are eight fishing ports and communities along the 34.8km coastline and other than those fishing ports, slanting tracks are scattered along the coast. It takes less than an hour to drive all the way down the coast of the National highway. The coast is filled with fishery rights, including common fishery rights, division fishery rights for sea tangle farming and large and small fixed net fishery rights. (Fig.1)

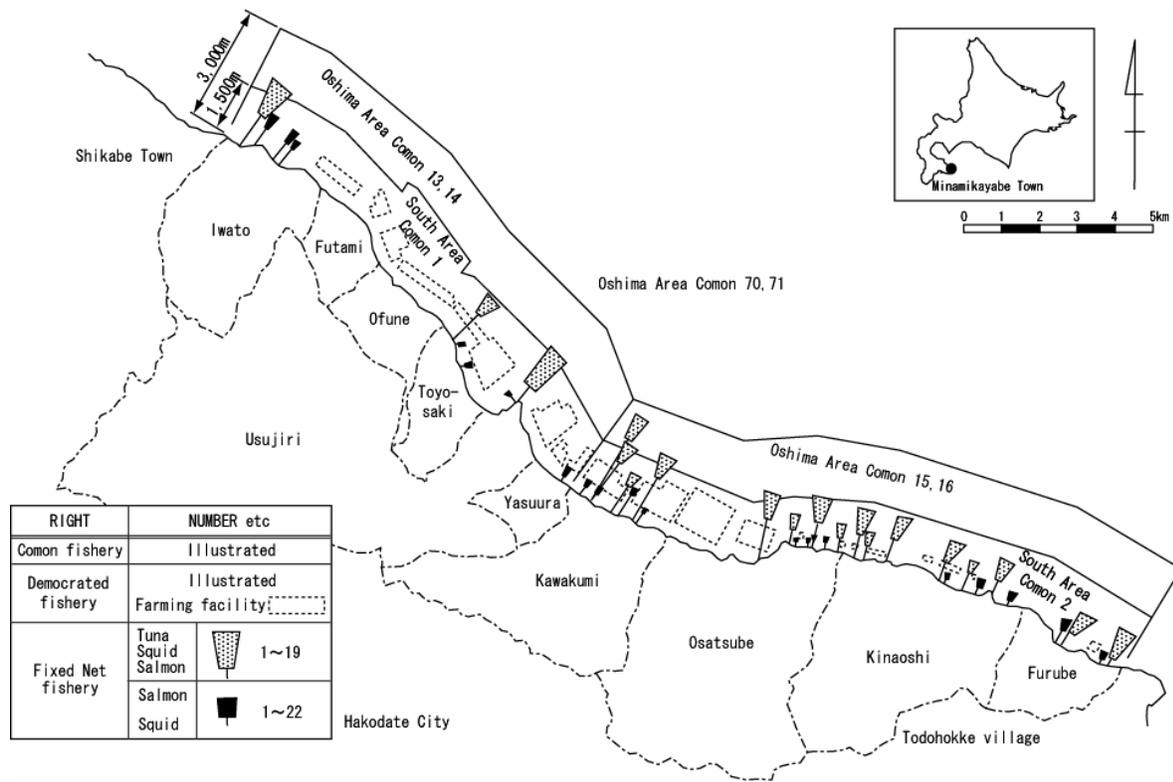


Figure 1. Coastline of Minamikayabe town

Table II: Living hours of sea tangle fishing

Fishery Family	Living Hours
Mr. A	
A's Family (parents, wife, part-time worker)	
Mr. B	
B's Family (mother, wife, part-time worker)	
Mr. C	
C's Family (wife, daughter, part-time worker)	
Mr. D	
D's Family (wife, part-time worker)	

The standard living hours in the harvest season of natural sea tangles are as follows:

Fishing operators wake up at 3 o'clock in the morning, sail out at 4:30 and harvest the natural sea tangles for two hours. For the most part, it is a couple consisting of a man and woman who go on board. When the man gathers sea tangles with a sickle or fishing apparatus called "nejiri-makka", the woman steers the ship and piles the sea tangles on board. Back in the fishing port, they hang up the sea tangles in drying spaces with the help of their children and/or grandparents. The sea tangles will be dried by four o'clock in the evening and are ready to be put away in the processing cabin. It is about nine or ten at night when they get through all the tasks. As for the women's living schedule, including awakening and bedtime, the time spent aboard the ship is equal to that of her male partner, but additionally she must spend her spare time on the primary processing of the sea tangles, as well as the domestic tasks such as preparing lunch and dinner, washing clothes, and grocery shopping. So not to waste even a minute of time on the preparation of a cup of tea, they usually carry canned drinks. (Table II)

Various living patterns in the same fishing port

I have clarified ¹⁾ that dispersed construction of fishing ports is an inevitable result led by living and production patterns. I have experienced sea tangle farming with four families for several years. The standard living hours in the harvest season of sea tangle farming are as follows:

Fishing operators wake up at 3 o'clock in the morning, sail out at 3:30, harvest cultivated sea tangles and return to the port. Then they unload and wash them at the port, bring them home and hang them in their private drying room. The sea tangles will be dried by 4 o'clock p.m. to be removed and kept in storage. After several days, stored sea tangles have to be smoothed down. Since sea tangles are humidified during the smoothing process, they have to be dried again for storage. This reap work lasts from July to August, and then fishing operators are exclusively engaged in processing. The price of the sea tangles is graded through several quality tests from September to December.

The distance from the fishing port and their family structure determines the work procedures of sea tangle processing, and the number and work style of part time employees. During the processing season, the living pattern of each fishing family varies until November, when the finished sea tangles are graded and shipped.

The maximum distance from the port to each fishing house is about 500m. Every 50m makes a difference in the living and production pattern, depending on the use of a car to carry the sea tangles. With more than 500m apart, they have to use the facilities on the coast or seawall and it is hard to continue sea tangle fishing itself ¹⁾. Since it is not only sea tangle fishing which the fishing operators deal with throughout the year, the distance leads to the decline of productivity and also to a substantially different lifestyle from those fishing operators close to the fishing port.

Table III shows a comparison of the procedures of four fishing families that vary in the distance from the port. The distance from the fishing port, differing by a few score meters, determines the work procedures after the unloading, the processing sequence, and the number of part-time job employees for demanded labor. These processing patterns are considered by each family in order to gain the maximum harvest with minimum labor throughout the harvest to processing season.

A's house is located at a 50m distance, but they use the dry riverbeds, which are located at a 500m distant from the port, as their work area. During the harvest season, they unload and dry the sea tangles, store them in a warehouse, and after the harvest season, they start the smoothing process. Located apart from the fishing port, they can keep enough space for a large drying room and warehouse. Many part-time employees are hired for the washing and drying processes. For that reason, A puts the sea tangles in a storage tank in the fishing port to prepare them for the washing and drying procedures of the next day. Since dried sea tangles are large in quantity, relocating them to the warehouse is the first thing to be done in the morning. Even in poor weather conditions, these preparations have to be made for the many part-time employees who are ready from four o'clock in the morning. Though A is relatively young and works straight through the harvest season, he does not carry out the multiple procedures in one day. Washing, drying and smoothing procedures are divided horizontally and allowed four months to finish up. It is possible to take time off with prior notice. In fact, it is common to take a day off for their children's school events.

Table III: Comparisons of living and production patterns of four fishery families

Name	Family structure	Distance from the port	Procedures	Number of part-time workers
A	Young couple (in their 40's)	50m (house) 300m (work area)	Putting away sea tangles in drying room at 3:00 a.m., sailing out, transporting them from the port to work area, washing, drying, sailing out in the afternoon	6 for washing 5 for drying
B	Elderly couple	50m	Sailing out at 4:00 a.m., washing, transporting, drying, smoothing	2 for washing Help of their relatives
C	Middle age couple	150m	Sailing out at 4:00 a.m., washing, transporting, drying, smoothing	5 for washing 3 for drying 2 for smoothing
D	Young couple (In their 20's) and their parents	25m	Putting away sea tangles in drying room at 3:00, sailing out, washing, transporting, drying, smoothing, sailing out in the afternoon	4 for washing 4 for drying

A's living and processing patterns are deeply related to the positional relation of the fishing port and the size of the work area, drying room and storage house.

B wakes up at three and sails out around four, harvests the sea tangles and unloads them utilizing the quay wall of the fishing port. With the help of relatives, who live next door and of two part-time employees, washing and drying procedures are finished by eight in the morning. Thereafter B and his wife carry out the smoothing procedures until late at night. By the end of the day, they remove the sea tangles from the drying room to the warehouse in order to secure space for drying the next morning. Since work procedures are carried out on a day-to-day basis, both of them take on part-time jobs either in construction work or at the fishery-processing factory. For those living close to the fishing port and where the size of the work area and warehouse is small, living hours are divided hourly to carry out all of the processing tasks of the day. Since most of smoothing procedures are completed day by day, this living pattern allows them to rest after the harvest season.

C lives at a 150m distance from the fishing port and carries out the drying, storage and smoothing procedures in the space adjacent to their house in the community. The sea tangles are to be washed in the port and transported by shuttle minivan to the drying room. Since the warehouse is within the community and is not big enough to store the large amount of dried sea tangles, smoothing procedures have to be done each day. For these reasons, C hires several part-time employees to carry out each procedure. Depending on the weather conditions, there may be a case whereby the gathering of the sea tangles is done a day in advance and stored in the fishing port. The smoothing process is completed each day. C is in his 50's, and his living pattern is to stay relaxed after the harvest season.

D's work area and house are 25m from the fishing port. D is in his 20's and lives with a large family. Since the house is close to the port, living patterns are flexible depending on the distribution of the work force into each procedure: transport from the port, washing and drying. However, since the work area and storage is close to the port and relatively small, dried sea tangles are to be smoothed down as soon as possible in order to secure the storage for the completed sea tangles. D's living and processing patterns are set to carry out these tasks.

Consideration of the various living patterns in the fishery community

Even in this small fishery community, the living hours of these four fishery families vary because of the difference in distance from the port and their family structure. What can be done to level the living patterns, and to enable these families to interact with one another and thereby have a better opportunity to form a natural community setting?

The first possibility is to improve the sufficient number of fishing ports. However, it is impossible to construct fishing ports close to all fishery families' work areas. The second possibility is to set up a cooperative, which needs some appropriate facilities. There is a recorded case whereby the living patterns were leveled through the establishment of a cooperative in a scallop farming community. In this case, too, there was a common work area right behind the quay to enable them to cooperativize.

As for sea tangle farming, the cultivation and smoothing procedures require lengthy periods and the quality of these procedures is examined through the grading of the sea tangles. This production system itself has been the main obstacle to setting up a cooperative. However, at a time when the fishery population is rapidly decreasing in step with aging, a cooperative of intensive sea tangle culture, which produces rather low-quality products, will be set up before long.

CHALLENGES BEFORE THE FISHERY COMMUNITY AND COUNTERMEASURES

Issues related to women in fishery communities

There are many issues in the sea tangle fishery oriented town of Minamikayabe. The roles of development in the fishery infrastructure in resolving these issues are examined in this chapter.

Looking closely at the women's lifestyle, which shows not only the aspect of fishery activity itself, but also the many-sided life in the fishery community, clarifies the roles that should be played by the fishery infrastructure.

Women in fishery communities play multiple roles in production, housework, child rearing, and socializing within the community. They break down their daily schedules to play these roles.

Problems in the fishery community of Mianamikayabe are interrelated, and they require multifaceted countermeasures. For example, even if some facilities are developed as a solution to one particular problem, without the remediation of the social environment and the public's attitude where the facility is utilized, it will not serve as a fundamental solution.

The Items (problem) column in Table IV shows 20 problems faced by women in fishery communities, based on the result of a questionnaire survey. The improvement of the fishing port and community is one part of the solution to women's issues in fishery communities. Problems in the community should not be solved separately. Multiple solutions that act on any part of the problems will be required.

Table IV: Problems of women in fishery community and countermeasures

Items (Problems)	Problem index			Comprehensive problem index			
	*Significance degree	effect degree	centrality degree	initiative	conventions	Facility	Total
	(a_i)	(r_i)		(B_{i1})	(B_{i2})	(B_{i3})	(A_i)
1. There is no time limit in the tasks during the harvest season	2.90	40.5	82.3	41.78	33.75	41.78	117.31
2. Heavy labor at sea	2.40	44.1	87.2	39.32	30.25	36.30	105.87
3. Relationships in the community are difficult	2.20	28.1	55.1	23.58	21.33	16.84	61.75
4. There are no regular holidays	2.60	35.0	74.4	42.16	32.04	16.86	91.06
5. Climate conditions (heat and cold) are harsh	2.30	39.0	79.5	34.53	20.72	34.53	89.78
6. Unable to find a sense of fulfillment	1.70	37.4	73.7	28.26	18.55	16.70	63.51
7. Facilities related to living environment (e.g. parks, roads) are insufficient	2.30	28.8	52.9	19.25	21.39	25.67	66.31
8. There is no long leave	1.90	38.8	72.0	32.26	29.18	12.29	73.73
9. There are no women in the fisheries cooperative association	1.90	23.8	51.8	15.53	17.27	12.23	45.03
10. Have to juggle the housework and fishery tasks	2.30	39.6	76.9	35.87	32.88	22.42	91.17
11. Insufficiency in basic facilities	2.00	24.3	50.3	16.21	14.30	18.11	48.62
12. Have to wake up very early in the morning in order to wait for signal for starting operation and stake out the spot	1.80	33.1	61.2	20.47	21.40	17.68	59.55
13. Heavy labor on the land	2.20	38.5	79.5	27.44	27.44	29.83	84.71
14. There are few chances to voice their own opinion	2.30	28.1	56.9	28.41	24.53	11.62	64.56
15. There are few facilities for the work due to the harsh wind or snow etc.	1.25	29.4	59.6	12.43	11.35	12.97	36.75
16. No bathroom on fishing boat	2.10	28.7	58.8	18.57	19.50	22.28	60.35
17. There are few chances to interact with people in other communities besides fishery related people	1.20	19.1	41.8	10.29	7.02	5.62	22.93
18. Not paid for the labor	1.50	24.6	47.4	13.71	17.93	5.27	36.91
19. Anxious about the safety of family members at sea	2.50	33.2	65.7	30.64	26.81	25.53	82.98
20. Unable to take off when physical condition is poor	2.90	40.9	83.0	47.44	40.66	30.50	118.60

* Significance degree (a_i): the direct valuation of the results of questionnaire into three steps: (3) the problem is very severe (2) severe (1) a little serious

As shown in Table IV, the problems faced by women in fishery community include: “Having to wake up very early in the morning is burdensome” “juggling the housework and fishery is hard” “There are few chances to voice their own opinion” and so on. Each problem can be given multiple countermeasures.

When generalizing about these countermeasures, there are two solutions to the problems: the first is to change the convention, and the next is to improve facilities. Both of these solutions can be paraphrased by the allocation of the labor quantity. Productive activities in the fishery community and housework are given quantity of labor. More specifically, the solution is to allocate the labor to someone else and / or reduce the quantity of labor through mechanization or by the setting up of facilities.

Allocation of labor on women’s shoulders means having all the members of the community be aware of shared responsibility and to establish a consensus about the changes. In short, women will join the decision-making of the labor allocation and establish their individual initiative.

Consequently, countermeasures against the problems faced by women in fishery communities can be grouped into three categories: the establishment of women's individual initiatives, the amelioration of conventions and the improvement of facilities. In the case of the women in Minamikayabe, countermeasures for 20 problems can be grouped into the three categories mentioned above. Through the analysis of the problems and their countermeasures, desirable ways for the development of fishery infrastructure will be clarified.

Analysis of the problems and countermeasures

In order to analyze the 20 problems and their countermeasures, a pair-comparison questionnaire survey related to 5 phases of significance degree and interrelationship between 20 items was conducted, targeting ten women in Minamikayabe town.

A positioning of the problems is analyzed through a pair-comparison survey conducted by DEMATEL (Decision-Making Trial and Evaluation Laboratory) method. The interrelationships of the items are indicated as 20 by 20 normalized direct effect matrices (X). Then 20 by 20 total effect matrices (T), which include the indirect effect between the items, are found through the formula below.

$$T = X(I - X)^{-1} \quad (\text{Eq.1})$$

I : unit matrix

The row of total effect matrix indicates the degree of effect that one item gives the others. The sum of the rows is called effect degree (r_i), which indicates the power of the effect that one item has in the problem structure. The total of the sum of the rows and that of the columns is called centrality degree, which indicates how one item presides in the problem structure. The difference of the sum of the rows and that of the columns is called causality degree, which indicates the position of one item as causal factors in the problem structure.

The result of the calculation is shown in Table IV. The items that are high in effect degree are related to the work hours and conditions: 1. There is no time limit in the number of tasks during the harvest season. 2. heavy labor at sea. 5. Climate conditions (cold or heat) are harsh. 10. Have to juggle the housework and fishery work. 20. Unable to take off when physical condition is poor.

These items are also high in centrality degree, meaning they preside in the problems of the women in the fishery communities.

Contributory degree of the three countermeasures

Through the questionnaire survey, to what extent do the three countermeasures i.e. the establishment of a women's initiative, the amelioration of conventions and the improvement of facilities, contribute to each problem item? The degree of contribution is rated on a scale of one to four. For calculation of the comprehensive problem index Total (A_i), indirect effect degree (r_i) is taken into consideration and then it is corrected by significance degree (a_i). The contributory degree of the three countermeasures (B_{i1} , B_{i2} , B_{i3}) is calculated.

The total effect coefficient of the 20 items can be indicated by the sum of rows per item. Consequently, the result of significance degree (a_i), which the respondents to the questionnaire are aware of, times the total effect coefficient of each item (r_i) indicates the comprehensive problem index.

Indicating the total effect coefficient of the 20 items as r_i , establishing women's initiative as B_{i1} , the amelioration of conventions as B_{i2} , and improvement of facilities as B_{i3} , the total efficiency of these three countermeasures, including the total effect degree, is calculated through the formula (Eq.2):

$$A_i = r_i \cdot a_i = B_{i1} + B_{i2} + B_{i3} \quad (\text{Eq.2})$$

The result of the calculation is shown in Table IV. For every item, the efficiency of each countermeasure has its own ratio, and none of them works as an all-round solution by itself. Generally, establishing a women's initiative and the amelioration of conventions are called measures for system development, as contrasted to infrastructure development. As shown in Table IV, when both the development of the system and infrastructure work hand in hand, it is most effective as a countermeasure.

When looking at the ratio of three countermeasures in the comprehensive problem index, the items that have high proportion of infrastructure are as follows: 7. Facilities related to the living environment (e.g. parks, roads) are insufficient, 11. Insufficiency in basic facilities, 13. Heavy labor on the land, 15. There are few facilities for the work under the harsh wind or snow, 16. There is no bathroom on the fishing boat.

Needless to say, improving the specific facility is the most effective solution to these problems.

The conclusion here is the combination of three measures (establishing women's initiative, the amelioration of conventions and development of facilities) will work most efficiently as a countermeasure to the various problems of women in fishery communities. It is not to overestimate or underestimate the development of facilities as fishery infrastructure, but to emphasize the importance of a so-called development system to solve the various problems.

DEVELOPMENT

The current conditions and the role of fishery infrastructure are clarified above. Here the future of a fishery and its community, and the development of fishery infrastructure are examined.

In Minamikayabe town, 6 independent cooperatives were merged into the Minamikayabe fishery cooperative association in April 2003. At the same time, Hakodate city and the adjacent four fishery communities are due to merge by December 2004. The influence of a cooperative merger on the development and utilization of the fishery infrastructure, and on life in fishery communities has to be considered. Alternatively, a merger on a municipality or cooperative level may be carried out and the development and utilization of the fishery infrastructure considered in order to provide a clear vision for the living conditions in such fishery communities.

The fishery cooperative association is an economic organization, and deservedly should pursue economic efficiency. Production and distribution facilities not mentioned above will be reorganized and integrated for efficient operation. Additionally, as a cooperative with a turnout of 10 billion yen it should develop its own strategies for sales and distribution. What is the prospect of the changes in fishery community life with these trends? Or again, alternatively, in a trend of fishery communities aiming for ideal work conditions, living hours and lifestyles, which are not substantially different from those of urban areas, the cooperative's new strategies might be provided.

Since I clarified ¹⁾ that dispersed construction of fishing ports is efficient, two more fishing ports have been constructed: Osatsube fishing port (Kurowashi district) and Yasuura fishing port. The way of utilizing these two ports is relevant to the promotion of efficiency and integration in production and distribution, which is in step with the cooperative merger. Three trends relating to infrastructure development are introduced below:

The first movement is the reorganization and integration of seedling production facilities for sea tangle farming. It is a plan for integrating dispersed facilities in four fishing ports, namely Osatsube fishing port, Kakkumi fishing port, Usujiri fishing port and Ofune fishing port, into two places. The reasons for integrating them into two places at most are that securing adequate sites for the facility is difficult and that

there is a risk of annihilation of seedlings caused by disease etc. Though this is the reverse trend of dispersed construction of fishing ports, the facilities are being constructed in the newest ports.

Since the seedling production of sea tangles requires full-time experts, the integration of facilities are efficient. Also, this integration was not possible without the cooperative merger.



Photo 1. Seedling production facility in Osatsube Fishing Port (Kurowashi district)

The second movement is the distribution system called “Dispersed (production) and integrated distribution” in newly developed Yasuura fishing port. Before the cooperative merger, six cooperatives had been distributing the fresh fish individually. Business used to be conducted on the phone when the amount of trading was small. High priced fish of small catch, for example: barfin flounder, black fox jacopever, live spotty belly greenling, halibut etc. was negotiated in price by individual cooperatives, and therefore the price was not reasonable. At the same time, the fish of large catch, such as walleye pollack, was also priced between each cooperative and specific brokers. Under these conditions, individual cooperatives did not fulfill their primary function as a fresh market for the producers.

Then the “Dispersed production and integrated distribution” system was imported as a new method to gather fish by type from the former six individual cooperatives into one fishing port, and to place tenders there. In the first place, walleye pollack is gathered from all towns into Yasuura fishing port, and its price is set by bidding. This has achieved a sufficient effect, and prices have been modified. Secondly the fish of small catch are also gathered to one port and priced through bidding. This distribution system was made possible under the condition of a cooperative merger. These examples show the possibility of the dispersed production of sea tangles and the integrated distribution proceedings at the same time.



Photo 2. Consolidating of Walleye Pollack in Yasuura Fishing Port

The third movement is the owner system of sea tangles conducted by a youth group of the fishery cooperative in Ofune fishing port. They recruited farmed sea tangle owners by sending out direct mail to 2000 people who purchased sea tangles at a local traditional center of the third sector. The intensive culture of sea tangles takes nine months from autumn to the following summer, and then it is processed into products.

The unit of sea tangle farming is a farming rope, from which they can gather approximately 44 sea tangles. The price of being an owner of a farming rope was 27,000 yen, and they have succeeded in collecting 80 owners (at present). The thinning procedure is carried out from winter to spring, and these thinned out sea tangles are soft and very tasty. They are sent to owners in the thinning seasons, so that they may learn the process.

Even though in Minamikayabe town they produce sea tangles that make up about 20 % of the national output, there is no brand awareness of these products. In the foreseeable future, Minamikayabe sea tangles will become a well-known brand owing to the merger of organizations and the efforts of the youth part of the cooperative. It is inevitable that these efforts will change the production style in fishing ports and also the life of fishery communities.

CONCLUSION

Fishery production and life in fishery communities and their surrounding environment is interrelated. Under the interrelationships, fishery operators are aiming for the most efficient way to perform their constant and productive operations and to make their living utilizing the facilities in the fishing port. Before making a cost-benefit analysis of the construction of fishery infrastructure, there needs to be an evaluation system for the living patterns of fishery operators, in which they find their maximum productive efficiency.

This means that improvement of the minimum fishery facilities for either the maintenance or the betterment of the living patterns of fishery operators and women in fishery communities should come before the cost-benefit analysis. The integration of fishing ports should also be discussed in terms of the fishery activities, rather than in terms of their size or location.

There are dispersed fishery communities and fishing ports in Mianamikayabe town. Further observations will be made about the effect on life in fishery communities from the cooperative merger and municipality merger, and from the integration of fishery activities or other activities (not facilities), I would like to make further reports in the next several years.

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