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Research Paper

Gender Differences in Participation, Roles, and Attitude towards Mariculture Operation: A Case Study in the Philippines

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Abstract

Mariculture was envisioned to contribute to poverty reduction by increasing employment opportunities and income in the area where it is situated. This paper assesses the participation in mariculture of local men and women in seven mariculture sites in the country, the roles they perform, and their willingness to be involved in mariculture operation. The data used were collected through a household survey, focus group discussion, and key informant interviews conducted in January to August 2015. Results show that only 24 % of the 785 households had members with any participation in mariculture since it was established in the area. By site, household participation ranged between 5 % and 44 %. This was translated to only 228 individuals. Although the men dominated mariculture, the women had demonstrated that they can equally contribute to mariculture as an operator, caretaker or feeder. The majority of the study participants expressed they like having mariculture in their municipalities, particularly men from non-fishing households. The willingness to be involved in mariculture was also high, particularly among men from fishing households. The willingness to become a mariculture operator was higher among women than men. The women or local residents, particularly from households who are interested in mariculture, must be given support to start up small-scale mariculture operations towards increasing local employment and reducing poverty in mariculture areas. To increase women participation in mariculture, women stereotypes need to be overcome and also local legislations that will require a certain percentage of all mariculture

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harvests to be sold directly to local retailers and small processors, mostly dominated by women, are needed.

Introduction

Aquaculture has been practiced in the Philippines for centuries but it was only in the 1960s that fish farming started with common carp cage culture and in the 1970s with milkfish pen culture in Laguna de Bay (Yap 1999). Mariculture is the managed cultivation or production of aquatic (fish and other marine) organisms in brackish and saline water (Troell 2009). Simply put, it is aquaculture in (shallow or deep) coastal waters (Lopez 2006). It usually uses cages or pens for fin fishes, and it can be a monoculture or polyculture system. However, mariculture development in the country has been difficult to monitor and is largely unregulated in terms of stocking and feeding practices. Fish farmers used to install cages of any number and size just about anywhere. The situation inevitably led, in some areas, to mass fish kills in cages and other environmental problems (Escobar et al. 2013; Rosario 2008; San Diego-McGlone et al. 2008; Sumalde et al. 2002).

In the early years of the 2000s, the Philippine government, through the Bureau of Fisheries and Aquatic Resources, introduced the Mariculture Park Program in order to promote food and job security and improve income. As practiced in the country, mariculture parks differ from traditional fish farming. They entail cultivating high-value finfishes (such as milkfish, siganids, groupers, and red snappers) in large enclosures (pens, tanks or cages) in the open sea in municipal waters for food; this also includes seaweeds farming, aqua silviculture, mussel culture, oyster culture, sea ranching of lobsters and seahorses in coral reefs and seagrass areas (BFAR 2009).

Among the aquaculture sectors in recent years, mariculture (fish pens and cages and mariculture of oyster, mussel, and seaweed) contributes to about 80 % of aquaculture production, with seaweed farming sharing about 67 % of aquaculture production (DA-BFAR 2015). At present, fish pens and cages in brackish, fresh, and marine waters contribute 10 % to 12 % to total aquaculture production, but the potential for increase is high. In 2010, for instance, only 0.54 % of the 50, 150 ha of the 62 mariculture parks in the country was developed by 2,199 investors and the BFAR (Bureau of Fisheries and Aquatic Resources) (Salayo et al. 2012).

Mariculture parks aim to ensure food security and contribute to economic growth (Adora 2011). Its objectives are (Adora 2011, BFAR 2014, Rosario 2008): 1) to generate employment and alleviate poverty in the countryside; 2) to promote marine fish culture as an alternative source of livelihood for marginalized and sustenance fisherfolk; 3) to develop an area with appropriate equipment and infrastructure that will allow fishermen-farmers and investors to operate cost effectively and securely; and 4) to promote the use of environment-friendly inputs and farm management practices. Moreover, it was envisioned to develop the technical capacity of a pool of fisherfolks to support mariculture operations.

In line with this, an attempt is made in this paper to assess the case of 7 mariculture sites in the country. 3 questions are posed: What is the participation of men and women? What roles do they perform? What is their attitude towards mariculture? A gender lens was adopted to have a better view of the mariculture operation (Williams 2008). There is a deliberate focus on gender (with the data disaggregated into men and women), participation, roles, responsibilities, and attitude to have a better understanding of the situation towards finding a responsive action. The main purpose is to derive information that can guide in the design of policies that can contribute to increasing the involvement of local men and women in mariculture operation as livelihood opportunities and also in attaining the goal of creating a pool of workers to support mariculture operation.

Methodology

Study Sites and Classification of Mariculture Areas

Based on interviews with BFAR national and regional offices 7 municipalities in the 3 major island groups in the country were selected where there is an active mariculture operation (Fig. 1). 3 are from Luzon - Santo Tomas in La Union Province and Bolinao and Sual in Pangasinan Province (Region 1- Ilocos Region); 2 in the Visayas - Calape and Talibon in Bohol Province (Region 7 - Central Visayas); and 2 in Mindanao - Balingasag in Misamis Oriental Province and Lopez Jaena in Misamis Occidental Province (Region 10 - Northern Mindanao).

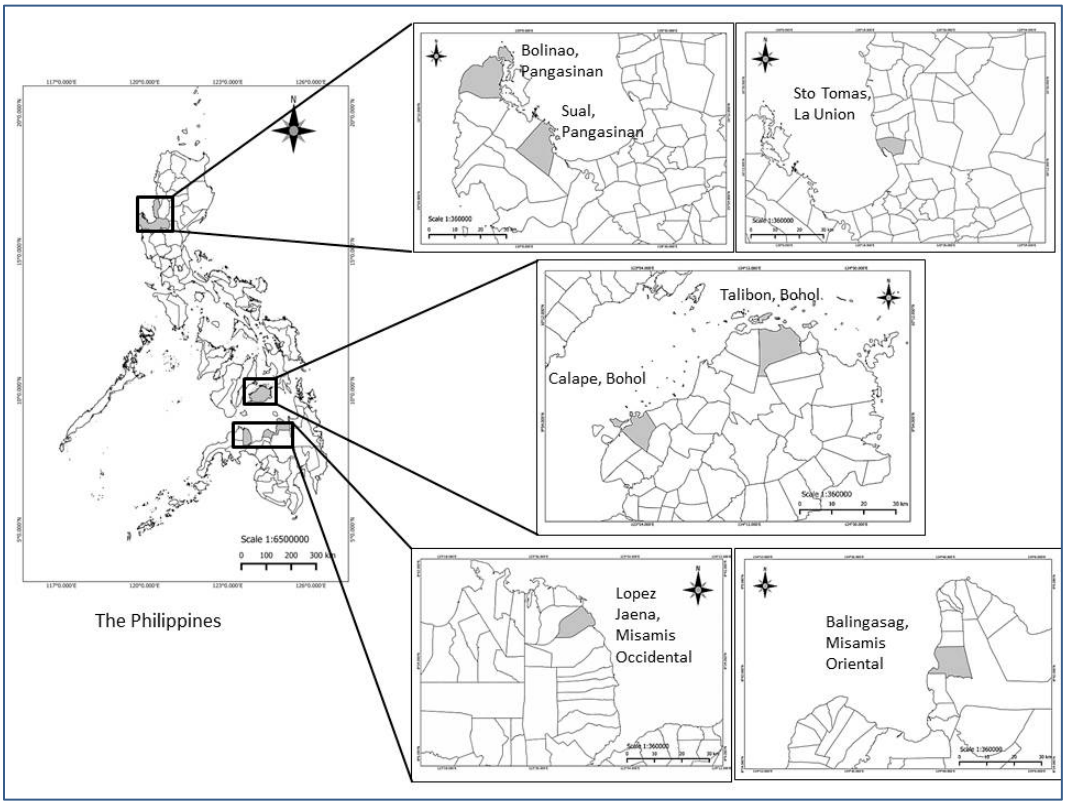

Fig. 1. Location of the Seven Study Sites in the Philippines

Data and Methods of Data Collection

The data for this paper were drawn from a larger data set collected using multiple field data collection methods from January 2015 to August 2015. The data set has data from 48 focus group discussions (FGDs) with 315 participants, household survey with 785 household participants, 138 key informant interviews (KII), secondary data, and observation.

The household survey covered 489 fishing and 296 non-fishing households in the 28 barangays (i.e., village) selected in 7 study sites. The survey participants were randomly selected from a list of fishing and non-fishing households in the selected barangays in the municipality (Table 1). They were in their 40s, the majority were males, reached almost the second year high school education, and were longtime residents of the barangays. Out of the 5 persons in their households, one had a source of income. Two-thirds were from fishing households.

Table 1. Profile of household survey participants

	Balingasag *(N=105)*	Lopez Jaena *(N=105)*	Sual *(N=120)*	Bolinao *(N=105)*	Calape *(N= 105)*	Talibon *(N=105)*	Santo Tomas *(N=140)*
Age (Mean)	47.29	43.88	42.00	44.03	42.41	45.39	46.67
Male (%)	50.48	50.48	50.83	53.33	69.52	60.95	76.43
Number of Years in School (Mean)	8.06	8.64	7.69	8.23	8.08	7.16	9.41
No. of Years in the barangay (Mean)	31.67	32.88	28.79	30.30	30.15	31.86	40.25
Household size (Mean)	5.56	4.88	5.24	5.22	5.25	5.35	5.41
No. of household members with income (Mean)	1.90	1.31	1.35	1.59	1.51	1.74	1.42
From fishing household (%)	62.86	61.90	58.33	61.90	61.90	61.90	66.43
From non-fishing households (%)	37.14	38.09	41.67	38.10	38.09	38.09	33.57

Data from the FGDs supplemented the data collected from the survey. Separate FGDs were held with the men and women in 22 barangays, while a mixed group of men and women were held in 5 barangays. The participants were selected based on criteria that they were residents of the barangay years before the establishment of the mariculture area, and have knowledge of mariculture in the area. Moreover, interviews of key informants who were caretakers, operators, and input suppliers were included in the study. Relevant secondary data were also collected. They were from BFAR Central Office and Regional Offices and their official websites, the local government of the study sites, and from other agencies' official websites.

In this study, the participation in mariculture (i.e., engagement in mariculture as a source of livelihood and income) and the roles performed by the men and women were identified and described in the input, grow out, and marketing segments. Quantitative data on the number of men and women employed was only available, however, for the grow-out segment such as the operator (i.e., owners of the mariculture business), caretaker, watcher, feeder, net mender, and net cleaner. Attitude, a predisposition to respond positively or negatively to a particular object (Bernstein et al. 1994), was focused on the study participants like or dislike of mariculture in their area, their willingness-to-be-involved, and the roles they are willing to perform.

Data Presentation and Analysis

Data are presented by study areas and in tabular and textual form. Data were analysed using descriptive statistics such as mean, frequency, and percentages. Chi-Square Test of Homogeneity was used to see if there is a significant difference in the attitude (e.g., they favor or not the presence of mariculture in their area).

Results

Participation of Men and Women in Mariculture Operation

Results of the household survey show that 24 % of the 785 households had members who were involved in mariculture operation in various capacities over the last few years (Table 2). This is translated to 228 individuals in 187 households. The level of community engagement varies by municipality, with only 5 % in Lopez Jaena to 44 % in Talibon. Of those involved, 92 % were men. In 2 municipalities, Bolinao and Calape, women did not engage in mariculture operation (ie., pen or cage farming) at all.

Table 2. Participation of households and individuals in mariculture operation

Study Sites	Households			Individuals with participation in Mariculture				
	Total Households	With participation	%	Men No.	%	Women No.	%	Total No.
Balingasag	105	31	29.52	55	96.49	2	3.51	57
Lopez Jaena	105	5	4.76	4	80.00	1	20.00	5
Sual	120	40	33.33	34	82.93	7	17.07	41
Bolinao	105	32	30.48	33	100.00	0	0.00	33
Calape	105	14	13.33	14	100.00	0	0.00	14
Talibon	105	46	43.81	47	85.45	8	14.55	55
Santo Tomas	140	19	13.57	22	95.65	1	4.35	23
TOTAL	785	187	23.82	209	91.67	19	8.33	228

Note: Data were from the survey of 785 households

During the KII and FGD, the low participation in mariculture of the local residents, particularly of the women was mentioned. Those local men and women identified to have participation in mariculture were in different stages of mariculture operation like input supply market, grow-out, harvest, and marketing. Men were more identified in the fry or feeds market and in the grow out stage. Records and reports also show that men and women were involved as

operators or owners of fish cages or pen in operation. Table 3 shows that the number of men as cage or pens operators was four times the number of women. Most operators were from outside of the municipality such in Balingasag, Calape and Sual. In Lopez Jaena and Bolinao, most of the operators were local residents.

Table 3. Men and Women as Mariculture Operators

Study Site	Number of Operators	
	Men	Women
Balingasag[1]	30	10
Lopez Jaena[2]	34	18
Calape[3]	4	0
Talibon[4]	2	0
Sual[5]	21	0
Bolinao[6]	43 (cage); 17 (pen)	9 (cage); 7 (pen)
Santo Tomas[7]	2 (inside MP zone)	0 (inside MP zone)
	63 (outside MP zone)	8 (outside MP zone)
TOTAL	216	52

Operators are owners of mariculture operation

[1]From 2014 active list of Balingasag Mariculture Park file provided by Balingasag Mariculture Park Fishery Designate during data gathering in January 2015.

[2]13 operators are not included because they are associations/barangays. Counts reflect the operators of grow-out cages. Conditioning cages are not included because owners also have grow-out cages. Data is based from Mariculture Park of Lopez Jaena List of Investors and Caretakers for 2014 that was provided by the Lopez Jaena Municipal Agriculture Office.

[3]One is owned by corporation and is not included in the count. This is the data as of 2015 and was taken from Calape Mariculture Park Locators Record prepared by the BFAR Aquaculture Technician.

[4]As of March 2015. Based on site visit in the area in Raois, Ubagan, Santo Tomas, La Union.

[5]As of May 2015. Data is based from fish cage area layout provided by the Sual Municipal Agriculture Office.

[6] Data from Bolinao Mariculture Survey/Monitoring/Inventory gathered last November 2014 by the Water Quality Management Team. List was provided by Bolinao Coastal Resource Management Office last July 2015

[7]As of May 2015. Data for "Inside Mariculture Zone" was taken from the records of the Aquaculture Technician of Santo Tomas Regional Mariculture Training and Development Center. Data for "Outside Mariculture Zone" was taken from records of the office of Barangay Narvacan, Santo Tomas.

Roles Performed by Men and Women in Mariculture Operation

The household members in the 7 sites who were identified to have ever participated in mariculture operation performed single or multiple roles in the production phase of mariculture operation. The major roles include as operators, caretakers, watcher, harvester, net cleaner, net mender, and feeder. No woman was identified to have performed the role of a watcher and a net mender, while all roles mentioned were performed by the men (Table 4).

Table 4. Roles Performed by Men and Women in Mariculture Operation*

	With participation	Operator	Caretaker	Watcher	Harvester	Net cleaner	Net mender	Feeder	Others
Balingasag	57	2	17	7	11	9	7	0	4
Men	55	2	17	7	10	8	7	0	4
Women	2	0	0	0	1	1	0	0	0
Lopez Jaena	5	1	2	0	2	0	0	0	0
Men	4	0	2	0	2	0	0	0	0
Women	1	1	0	0	0	0	0	0	0
Sual	41	0	8	3	4	2	0	17	7
Men	34	0	6	3	4	2	0	13	6
Women	7	0	2	0	0	0	0	4	1
Bolinao	33	0	9	1	5	2	1	5	10
Men	33	0	9	1	5	2	1	5	10
Women	0	0	0	0	0	0	0	0	0
Calape	14	1	5	1	3	1	0	1	2
Men	14	1	5	1	3	1	0	1	2
Women	0	0	0	0	0	0	0	0	0
Talibon	55	34	6	1	5	1	1	3	4
Men	47	28	6	1	5	1	1	3	2
Women	8	6	0	0	0	0	0	0	2
Santo Tomas	23	9	4	2	1	1	1	3	2
Men	22	8	4	2	1	1	1	3	2
Women	1	1	0	0	0	0	0	0	0
Total	228	47	51	15	31	16	10	29	29
Men	209	39	49	15	30	15	10	25	26
%	91.67	82.98	96.08	100.00	96.77	93.75	111.11	86.21	89.66
Women	19	8	2	0	1	1	0	4	3
%	9.09	20.51	4.08	0.00	3.33	6.67	0.00	16.00	11.54

*These are individuals from 187 households with participation in mariculture operation from the survey of 785 households in seven mariculture sites.

Roles performed varied by mariculture site. For example, the feeding was a specialized work only in Sual but part of the work of the caretakers in other areas. Moreover, net mending was part of the work of a caretaker in Sual but not in other areas. Roles also varied by scale of operation. For instance, in Sual where the scale of mariculture operation by a single operator (e.g., a corporation) was relatively bigger, there were more roles that require specialization (e.g., feeder, checker, manager, boatman, and helper). In Santo Tomas, the grouper culture operator using cages or pens outside of the designated mariculture zone also performed the roles of a caretaker, watcher, feeder and maintenance worker (for repair of cage/pen and nets).

Table 5. Roles Performed by Men and Women in Mariculture Operation*

Input	Grow-out	Marketing
Men		
Balingasag and Lopez Jeana		
• Cage/net fabricators • Feeds distributors/sales representatives • Seed supply operation/delivery of seed stocks to mariculture area	• Operator • Caretakers responsible for feeding and guarding the fish • Maintenance workers (change net/net mending) • Watcher	• Fish vendors
Sual and Bolinao		
• Cage/Pen/Net fabricators • Seed stock operators	• Feeders • Change net workers • Boat drivers/helpers • Harvesters	• Owners of consignment area
Calape, Talibon, Santo Tomas		
• Cage/pen fabrication • Seed stock supplier • Feeds distributors/sales representatives	• Caretaker • Maintenance (change net/net mending)	
Women		
Balingasag and Lopez Jeana		
	• Operator • Wives participate in the sorting of fish during harvest, • Wives help the husband in feeding the fish, and during stocking	• Members of the fish processing association are also members of the women's association
Sual and Bolinao		
• Feed brand sales representatives	• Feeders • Net menders • Sorters during harvest	• Owners of consignment area
Calape, Talibon, Santo Tomas		
• Feeds distributor/sales lady		• Fish traders/vendors

*Results from FGD and KII

The FGDs and KIIs indicated the involvement of local men and women in the grow-out stage, ancillary industries and marketing stage of mariculture operation (Table 5). Each role requires specific tasks and responsibilities. Skills and knowledge are important in the performance of these tasks. For the development of the manpower pool in mariculture parks, BFAR provides the caretakers training courses, fish cage management seminars, aquaculture

technologies trainings, product development, coastal resource management seminars, and environmental monitoring.

The operators were the owners, financiers, managers and decision-makers of mariculture operation. In big operations like in Sual, a number of operators were corporations and they had managers for the operation. In Santo Tomas, the operators of the grouper farming outside of the mariculture zone performed most of the work needed and hired few workers during harvest or for large repairs of the cage or pen.

The caretaker or watcher of the fish cages were locally hired men. The tasks they performed included guarding the cages during the day, feeding the fish, being in charge of the stocking and cleaning nets. In almost all areas, the wives actually went with their husbands to help in the feeding or in the stocking activities. Sometimes, the wife was left with feeding activity while the husband was fishing nearby or did some other work. While the husband's work was paid, the work of the wife was not. In Sual, there were 7 women who were paid feeders and net menders.

Given that net change/cleaning and net mending are heavy tasks, the men were mostly involved. Harvesting is laborious and risky and usually involved the men. However, the wives or the women helped as sorters of fish.

Men were also cage/net fabricators. This was the result of training on cage fabrication that targets the men as trainees. They were also feeds distributors/sales representatives (also women), or involved in fry supply operation as operators of fingerling nursery in the community.

Attitude towards Mariculture Operation

Knowing the attitudes of the people is important because attitudes can have a powerful influence over behavior. Attitudes are formed directly as a result of experience (direct personal experience or observation), social factors (social roles and norms), and learning (Bernstein et al. 1994). Attitude refers to the emotional or affective component of attitude which is the feeling or evaluation of like or dislike of the object of attitude.

6 in every 10 survey participants indicated that they like having mariculture operation in their municipality (Table 6). Near the majority of the survey participants in Sual (48 %) and Bolinao (43 %) expressed liking in having mariculture operation in their municipality; in other study sites, it ranged between 55 % (Balingasag) and 80 % (Calape and Talibon).

Table 6. Men and Women Who Like Having Mariculture Operation in their Municipality

Sites	Men			Women			Total
	Fishing	Non-Fishing	Total	Fishing	Non-Fishing	Total	
Balingasag	*n*=33	*n*=20	n_m=53	*n*=33	*n*=19	n_w=52	*N*=105
	66.67	50.00	60.38	54.54	42.10	50.00	55.23
Lopez Jaena	*n*=36	*n*=17	n_m=53	*n*=29	*n*=23	n_w =52	*N*=105
	75.00	76.47	75.47	58.62	69.56	63.46	69.52
Sual	*n*=39	*n*=22	n_m=61	*n*=31	*n*=28	n_w =59	*N*=120
	41.02	59.09	47.54	45.16	53.57	49.15	48.33
Bolinao	*n*=40	*n*=16	n_m=56	*n*=25	*n*=24	n_w =49	*N*=105
	42.50	50.00	44.64	28.00	54.17	40.82	42.86
Calape	*n*=53	*n*=20	n_m=73	*n*=12	*n*=20	n_w=32	*N*=105
	79.24	80.00	79.45	83.33	80.00	81.25	80.00
Talibon	*n*=43	*n*=21	n_m=64	*n*=22	*n*=19	n_w=41	*N*=105
	86.05	76.19	82.81	63.64	89.47	75.61	0.00
Santo Tomas	*n*=74	*n*=33	n_m=107	*n*=19	*n*=14	n_w=33	*N*=140
	72.97	84.85	76.64	84.21	78.57	81.82	77.86
TOTAL	*N*=318	*N*=149	*N*=467	*N*=171	*N*=147	*N*=318	*N*=785
	67.61	69.80	68.31	56.14	65.75	60.38	65.09

Note: Values up to hundredths place are % values; the rest are frequencies.

The proportion of men who expressed liking for mariculture operation in their area was higher than the women (68 % vs. 60 %). The difference was significant (χ^2=5.2372, *p*-value=0.022109, p<0.5), which means that the positive attitude towards mariculture operation was significantly associated with gender. By site, no significant difference was found among men and women.

The proportion who likes mariculture operation in their area was lower (but not statistically significant) among men who were from fishing than in the non-fishing households (68 % vs. 70 %). By mariculture site, the proportion who like mariculture operation was higher among men from fishing households in Balingasag (68 % vs. 50 %) and Talibon (86 % vs. 76 %); it was the opposite

in Lopez Jaena (75 % vs. 76 %), Sual (41 % vs. 59 %), Bolinao (42 % vs. 50 %), Calape (79 % vs. 80 %), and Santo Tomas (73 % vs. 85 %).

In general, the proportion who likes mariculture operation was lower (but not statistically significant) among women who were from fishing than in the non-fishing households (68 % vs. 70 %). By mariculture site, the proportion of women who like mariculture operation was higher in fishing households in Balingasag (54 % vs. 42 %), Calape (83 % vs. 80 %), and Santo Tomas (84 % vs. 79 %); it was the opposite in Lopez Jaena (59 % vs. 70 %), Sual (45 % vs. 54 %), Bolinao (28 % vs. 54 %), and Talibon (63 % vs. 89 %).

Willingness to be involved in Mariculture Operation among Men and Women

The information on the willingness-to-be involved in mariculture operation among the local residents is important in designing strategies to increase their participation, in targeting for the kind of role they are willing to be involved in, and in designing training programs to prepare them for the performance of the tasks and responsibilities required in each role.

Table 7. Men and Women Who Were Willing to Be Involved in Mariculture Operation

Sites	Men			Women			Total
	Fishing	Non-Fishing	Total	Fishing	Non-Fishing	Total	
Balingasag	*n*=33	*n*=20	n_m=53	*n*=33	*n*=19	n_w=52	*N*=105
	69.70	50.00	62.26	78.79	42.11	65.38	63.81
Lopez Jaena	*n*=36	*n*=17	n_m 53	*n*=29	*n*=23	n_w =52	*N*=105
	69.44	70.59	69.81	55.17	43.48	50.00	60.00
Sual	*n*=39	*n*=22	n_m 61	*n*=31	*n*=28	n_w =59	*N*=120
	64.10	45.45	57.38	51.61	50.00	50.85	54.17
Bolinao	*n*=40	*n*=16	n_m 56	*n*=25	*n*=24	n_w =49	*N*=105
	65.00	37.50	57.14	52.00	41.67	46.94	52.38
Calape	*n*=53	*n*=20	n_m 73	*n*=12	*n*=20	n_w=32	*N*=105
	75.47	45.00	67.12	50.00	50.00	50.00	61.90
Talibon	*n*=43	*n*=21	n_m 64	*n*=22	*n*=19	n_w=41	*N*=105
	81.40	76.19	79.69	81.82	78.95	80.49	80.00
Santo Tomas	*n*=74	*n*=33	n_m 107	*n*=19	*n*=14	n_w=33	*N*=140
	78.38	60.61	72.90	94.74	64.29	81.81	75.00
TOTAL	*N*=318	*N*=149	*N*=467	*N*=171	*N*=147	*N*=318	*N*=785
	72.96	55.70	67.45	66.47	61.29	59.31	64.20

Note: Values up to hundredths place are % values; the rest are frequencies

Survey results show that 6 in every 10 survey participants indicated willingness to be involved in mariculture operation (Table 7). By mariculture site, data shows that majority of the survey participants were willing-to-be-

involved, with the lowest proportion in Bolinao (52 %) and the highest in Talibon (80 %).

The proportion of men willing-to-be involved in mariculture operation was higher compared to the women (67 % vs 59 %) in all mariculture sites. This difference is significant (χ^2=5.2917, *p*-value=0.021428, *p*<0.5), which means that the willingness to be involved in mariculture operation among the survey participants was significantly associated with gender.

By mariculture sites, those who were willing to be involved in mariculture ranged between 57 % and 80 % among men, and 47 % to 81 % among women. The proportion of women was higher than the men in Balingasag (64 % vs 62 %), Talibon (80 % vs 79.6 %), and Santo Tomas (82 % vs. 73 %). It was the opposite in Lopez Jaena (70 % vs 50 %; significant, χ^2=4.2925, *p*-value=0.038282, *p*<0.5%), Sual (57 % vs. 51 %), Bolinao (57 % vs. 47 %), and Calape (67 % vs. 50 %).

The proportion willing-to-be involved in mariculture operation was higher among men from fishing than in non-fishing households (73 % vs. 56 %). This difference was significant (χ^2=13.7537, *p*-value=0.000208, *p*<0.5). By mariculture site, the proportion of men willing to be involved in mariculture operation was higher in fishing households than in non-fishing households in Balingasag (70 % vs. 50 %), Sual (64 % vs. 45 %), Bolinao (65 % vs. 38 %), Calape (75 % vs. 45 %; significant, χ^2=6.1096, *p*-value=0.013445, *p*<0.5), Talibon (81 % vs. 76 %), and Santo Tomas (78 % vs. 61 %; significant, χ^2=15.534, *p*-value=0.000081, *p*<0.5 %). The opposite was found only in Lopez Jaena (71 % vs. 69 %).

Meanwhile, the proportion willing-to-be involved in mariculture operation was higher among women from fishing than in the non-fishing households (66 % vs 52 %). This was also true by mariculture site, except in Calape where the proportion was found to be equal. Significant differences among women from fishing and non-fishing households were found in Balingasag (χ^2=7.1687, *p*-value=0.007419, *p*<0.5) and Santo Tomas (χ^2=5.0244, *p*-value=0.024992, *p*<0.5).

Roles Willing to be performed by the Men and Women

When classified by type of role they were willing to perform, 38 % of all study participants would like to operate their own mariculture farms (Table 8).

Table 8. Men and women by the role they are willing-to-be-involved in mariculture operation

	Willing to be involved	Operator	Caretaker	Watcher	Harvester	Net mender	Feeder	Others
Balingasag	67	31.34	34.33	13.43	11.94	28.36	0.0	0.0
Men	33	48.48	45.45	18.18	12.12	15.15	0.0	0.0
Women	34	14.71	23.53	8.82	11.76	41.18	0.0	0.0
Lopez Jaena	63	44.44	36.51	4.76	4.76	7.94	0.0	1.59
Men	37	45.95	35.14	8.11	8.11	0.0	0.0	2.70
Women	26	42.31	38.46	0.0	0.0	19.23	0.0	0.00
Sual	65	4.62	30.77	1.54	0.00	6.15	63.08	3.08
Men	35	8.57	45.71	2.86	0.00	2.86	48.57	2.86
Women	30	0.00	13.33	0.00	0.00	10.00	80.00	3.33
Bolinao	55	29.09	36.36	7.27	7.27	7.27	10.91	12.73
Men	32	21.88	31.25	9.38	9.38	12.50	12.5	18.75
Women	23	39.13	43.48	4.35	4.35	0.00	8.70	4.34
Calape	65	35.38	41.54	27.69	26.15	7.69	4.62	9.23
Men	49	26.53	44.90	30.61	32.65	10.20	6.12	10.20
Women	16	62.50	31.25	18.75	6.25	0.00	0.00	6.25
Talibon	84	55.95	11.90	4.76	14.29	2.41	2.41	7.14
Men	51	50.98	11.76	3.92	15.69	3.92	3.92	2.16
Women	33	63.64	12.12	6.06	12.12	0.00	0.00	15.15
Santo Tomas	105	50.48	25.71	16.19	11.43	8.57	0.00	1.09
Men	78	43.59	25.64	20.51	14.10	11.54	0.00	2.56
Women	27	70.37	26.92	3.85	3.85	0.00	0.00	0.00
All	504	37.70	27.78	11.11	11.11	9.52	10.32	6.55
Men	315	36.83	29.21	14.60	14.29	8.25	8.25	8.25
Women	189	39.15	25.40	5.29	5.82	11.64	13.76	3.70

Note: Values up to hundredths place are % values, the rest are frequencies

The proportion of those willing to become an operator differed by mariculture site. For instance, the highest proportion was found in Talibon (56 %), followed by Santo Tomas (51 %), and Lopez Jaena (44 %). The lowest

was in Sual where only 4 % would like to be a mariculture operator. When classified by gender, a higher proportion among women (39 %) than the men (37 %) would like to be an operator. A higher proportion of women than men would like to be an operator in Bolinao (39 % vs. 22 %), Calape (63 % vs. 27 %), Talibon (64 % vs. 51 %), and Santo Tomas (70 % vs. 44 %).

Moreover, one-fourth of the women who would like to be involved in mariculture operation would like to work as a caretaker, while 10 % would like to work as net mender or feeder. Similarly, the men would like to be a caretaker (31 %), net mender (13 %), feeder (13 %) and harvester or watcher (near 10 %).

One-fourth of the survey participants also would like to be a caretaker and the proportion was not significantly different between men (29 %) and women (25 %). For the rest of the roles, about 10 % would like to be a watcher (particularly the men), harvester (particularly the men), net mender (particularly the women), and feeder (particularly the women). The proportion also differed by mariculture site.

Discussion

The mariculture program was launched by the government in early 2000s to contribute to rural development through livelihood enhancement of residents in the coastal barangays where mariculture operations are situated. On the average, only 24 % of the households covered by the survey reported they had household members employed in mariculture at some point in their lives. This low participation of the local residents as fish operators or workers can be attributed to a number of factors. First, the financial requirements are beyond the capacity of the targeted fisherfolks and their families. Even one small bamboo cage (5×5×5 m in size) can cost about PHP 120,000. Even when the cages are free, the high cost of feeds prevents many locals from venturing into mariculture. Second, in small operations, the operator can perform several roles such as that of a caretaker, watcher, and maintenance worker (clean the cage, mend the nets); and only needs hired help during harvest or when changing nets. Third, there is low uptake in mariculture. In 2010, there were only 62 mariculture parks with 2,199 locators/investors, including the first mariculture park in the country established in Samal Island in 2001 (Salayo et al. 2012). In the mariculture areas covered in the study (i.e., Calape, Balingasag and Santo

Tomas), a number of operations have already stopped because of the high cost of operation; some were not able to return to operation after being damaged by a typhoon.

Particularly, among those engaged in mariculture, it is observed that men dominated in all phases of mariculture operation. The dominance of men as mariculture operators may have stemmed from a number of reasons. Fish culture in mariculture parks was perceived as a male activity. Among other things, it was conceptualized, introduced, and promoted as an alternative livelihood for the small-scale fishers, who were mostly men. The local and BFAR technical people were mostly men and thus have more direct contact with men in the community as well. The capacity building (e.g., training fisherfolk involved in mariculture so that they are better skilled in managing mariculture facilities) activities were oriented mainly toward men. In many of the presentations on mariculture, the fish farmer operator is depicted to be a male.

In addition, as mariculture operator, one has to spend time to visit the fish cages or pens, which require special boat trips. These fish cages are into the sea or at a distance from all other major activities of the household. Thus, the time involved in visiting fish cages or pens is more costly for the women (who are heavily burdened by other activities) than for the men. This is particularly true given that many operators were from outside of the mariculture area.

Aside from these, the local men and women who were willing to be involved in mariculture as operator were constrained by the high cost of initial outlay and operations. Despite their low participation, the local men and women like to have mariculture in their area because of employment and income it generates, albeit low.

On the other hand, more men have performed other roles such as caretaker, watcher, feeder, net mender, and net cleaner. This can be gleaned from Table 2 where 181 of the 228 individuals in 785 households who were involved in mariculture have performed different roles aside from being an operator or the owner of the operation. Among the 181 individuals, 170 were men and only 11 were women. Few women were hired because of the prevailing attitude that women are not as strong as the men in carrying out the

heavy tasks in mariculture (e.g., moving the fry for stocking, carrying sacks of feeds from the storage house to the mariculture site, and regular changing and of cleaning nets). During the typhoon season, the seas are dangerous, and more physical strength is required when guarding the cages. During the FGDs and KIIs, it was mentioned that the training for caretakers, which is a requirement in starting mariculture operation, were attended mostly by men.

The women were also perceived to have higher time constraints than men, especially when they have substantial workload and responsibilities in their household such as when having small children. The fish cages are some distance from the house and visits to the cages require taking a boat, which is mostly associated with men. Mariculture activities also require long hours in the open sea. It may also mean being wet for long period of time, which possess more health issues for women than the men.

The women, however, have demonstrated that they can equally perform similar roles as men. There were few women who were operators, feeders, and, as pointed out in the FGD and the KIIs, wives usually help their husbands, hired as caretakers, in feeding activities and in watching over the cages. These contributions of the wives helping their husbands in guarding the cages or feeding the fish, unfortunately, were under acknowledged or unrecognized. Earlier studies show that, in aquaculture in general, and in cage culture in particular, women are heavily involved in fry collection, feed preparation, feeding of stocks, harvest and post-harvest; they also take managerial positions (as an operator or caretaker); and deal with traders on pricing and in credit liaising (DA-BFAR 2004; Sekhar and Ortiz 2007, Guste and del Rosario-Malonzo 2004).

Given the reasons above, it is expected that more men than women would like mariculture in their area and were willing-to-be involved in mariculture operation. When type of household is considered, however, less men and women from fishing households than from non-fishing households like having mariculture in their area. This is likely a reflection of their dissatisfaction in their actual participation in mariculture operation. This is reinforced by the finding that more of men and women from fishing households would like to be involved in mariculture. The fishers were willing to be involved in mariculture operation, yet their actual participation is low. The

mariculture program was promoted in the early 2000s as a way to reduce poverty in coastal communities, particularly targeting the marginal fisherfolks. However, its take up has been slow and local people have not been involved to the degree that was hoped when the program was first launched.

Conclusions

The men were commonly identified with mariculture. The main reason for this is the perception that mariculture is a male activity with tasks requiring physical strength, it being time consuming, and exposure to danger associated with work in open sea. However, the women have demonstrated that they can equally perform similar roles as men.

Among the goals of mariculture are to reduce employment problems in communities where they are situated and to produce a pool of manpower for mariculture operation in the area. In the case of the 7 mariculture sites in the study, the goals were poorly attained given the low participation of local residents in mariculture operation.

The favorable attitude of the women on mariculture operation and their willingness to be involved in mariculture operation as operators are good inputs for program design to respond to the low impact of mariculture on local employment. Engaging women to become mariculture operators and also be hired for other work in the operation can be one of the opportunities to explore to increase the participation of the local residents toward achieving the goals set for mariculture, i.e., of higher employment and poverty reduction. The women or local residents, particularly from fishing households, who are interested in mariculture must be given support to start up small-scale mariculture operations and to market farmed fish. To increase womens' participation in mariculture, they have to overcome stereo-typing. Also, local legislations that will require a certain percentage of all mariculture harvests to be sold directly to local retailers and small processors, mostly dominated by women, are needed. If more mariculture operators are local residents, then it is likely that more residents will be hired to work on their operations. Non-local mariculture operators should be encouraged to prioritize local hiring. Moves should therefore be made to make this connection.

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