Labor characteristic on brackish water aquaculture in Aceh Tamiang Regency

N. Shafitri*, A. Zulham, C. Yuliaty, Mira, N Kurniasari

Research Center for Marine and Fisheries Socio Economics-Ministry of Marine Affairs and Fisheries, Pasir Putih 1, Ancol Timur, Jakarta

*Corresponding author: nensyana@gmail.com

Abstract. Farmer and labor have a working relationship in shrimp aquaculture. These relationships are affected by the social status, economic motive, and competence of the workers/laborers. This research aims to (1) analyze the characteristics of labor in Aceh Tamiang Regency and (2) analyze the work relationships existing in each technology used. The research was conducted in April – May 2021. Primary data were collected from interviews with the purposive respondents using a structured questionnaire. Meanwhile, literature reviews are secondary data obtained from literature reviews and information provided by related institutions. The research findings showed that 89% of the respondents use traditional technology, 5% semi-intensive methods, and 6% apply intensive technology. Conventional technology is commonly self-employed and involves family members. In contrast, the semi-intensive and intensive technologies employ skilled laborers with monthly salaries and the yield sharing system (bagi hasil). Consequently, the capacity of the traditional fish pond farmers needs to improve to achieve the skillful need. Employee relationships in semi-intensive and intensive brackish water business ponds are mainly hired skilled labor from other places by legal binding. Both neglected to employ local people to maintain a social relationship.

1. Introduction

One of the prioritized programs from the Ministry of Marine Affairs and Fisheries (MMAF) until 2024 is the development of aquaculture in order to support the 250% of shrimp export. Shrimps are highly valued and can contribute to the country's foreign exchange, increase income, and create employment and job opportunities [1]. Therefore, MMFA has set the target for the increase in shrimp exportation until 2024 as much as 250% [2].

Indonesia is the fourth largest shrimp exporting country, together with India, Ecuador and Vietnam. In 2018, the shrimp export volume reached 6.23% of the total global export volume, worth USD 1.741.086.000,00 [3]. One of the areas contributing to this shrimp production is Aceh Tamiang Regency. Based on the statistical data [4], the proportion of shrimp production to the total production of brackish water ponds was 69%. The rest, 27% as contributed by fish aquaculture, and another 4% were from crab production. The ponds mainly supplying the Vaname Shrimp were located in 4 districts, Seruway, Bendahara, Banda Mulia, and Manyak Payed.

On those four districts to support the export target, the shrimp production activities run by labor connection between the owner of the pond and the skilled and unskilled employee. In brackish water activities, there is a shortage of supply for skilled and unskilled labor [5,6]; segmentation of demand for labor [7,8]; reluctance to guarantee the basic labor needs [9]. Those problems in the brackish water labor market primarily influenced social status, economic motive, work competence, and technology. The
type of technology used affects aquaculture management and the use of workforce or labor in this industry. Three different types of technology are utilized in this business. They can be grouped into traditional, semi-intensive, and intensive technologies. This classification is based on the stocking density, the use of commercial fish foods, and the utilization of a scoop wheel to add oxygen to the water [10]. This research aims to analyze labor characteristics in Aceh Tamiang Regency and analyze the work relationships existing in each technology used.

2. Data and Methods
The research was done from the fourth week of April to early May 2021 in Seruway, Bendahara, Banda Mulia, and Manyak Payed districts in Aceh Tamiang Regency. Those four districts are the centers for shrimp aquaculture. The data collected include primary and secondary data. The primary data cover the data about the working system and work relationship in the shrimp aquaculture industry. In contrast, the secondary data include the potential of fish aquaculture, information related to other activities concerning the fishery sector, and previous research supporting this analysis. Data were obtained through interviews, focus group discussions, and literature studies. Key informants who understand the shrimp farming business were interviewed in-depth. In addition, interviews with shrimp farming were also conducted using a semi-structured questionnaire. Respondents of vannamei farmers amounted to 152 people and were selected proportionally based on the technology used. The purposive sampling technique determined samples, and 152 respondents were selected based on the type of technology they used. Data were analyzed using descriptive qualitative analysis by reducing, displaying, and drawing conclusions [11]. Data analysis begins with identifying the workforce's characteristics and answering work relations in the shrimp farming business. It elaboration was made in order to investigate how and why a phenomenon or reality occurred.

3. Results and Discussions
3.1. Overview of the potential of fish aquaculture
One of the most potential economic sectors in Aceh Tamiang Regency is aquaculture in the brackish water pond areas. It can be seen from the size of the areas utilized for the productive aquaculture industry, especially the area used for brackish water ponds, which are 5,751.68 ha, and the area used for fresh water ponds 31,101 hectares [4]. The data [12] shows that as much as 3,300 ha are used for traditional brackish water ponds, 74.3 hectares are semi-intensive, and 250.2 hectares are for intensive brackish water ponds. Meanwhile, out of the farmers households, about 91% use traditional technology, 3% implement semi-intensive one, and 6% apply intensive technology (Figure 1). The primary product of brackishwater ponds is vanammei shrimps, tiger prawns, nile tilapia, milkfish, and crabs. The yield harvested from brackish water ponds in 2020 reached 1.737 tons, 1.190 tons of which were shrimps, 476 tons were fish, and 71 tons were crabs [13].

![Figure 1. Distribution of farmers households and the size of aquaculture ponds based on technology](image-url)
3.2. Labor characteristics in brackish water pond industry

The labor characteristics used in this business depend on the type of technology used by the farmers. There are three types of technology, traditional, semi-intensive, and intensive. In this research, 89% of the respondents use traditional technology, 5% of them use semi-intensive, and 6% of the respondents use intensive technology. Table 1 shows the characteristics of employment in this industry which is based on the technology used. Workers or laborers are involved in the preparatory, maintenance, or cultivation and the shrimp harvesting stages.

Laborers who work in the brackish water ponds consist of permanent and temporary workers, including family members and non-family members, male and female, skilled and unskilled laborers. In this fishery industry, there are some players taking part in this business. They include farmers, technicians, and assistants or laborers. A farmer makes his living from a fishery business, a technician is a skilled person who owns technical skills to manage the brackish water ponds, and an assistant is a worker or laborer who has no skills or specific knowledge [8].

Preparing the ponds requires several days; the number of days needed depends on the technology used. The traditional technology needs 14 days, while the semi-intensive technology requires 17 days, and the intensive one needs 22 days. Although the days differ as in the semi-intensive and intensive technologies, more time is needed to install the water scoop. In addition, a waste management installation also needs to be fitted in those two methods. The activities in the preparatory stage include drying the land using the sunshine, which may take 7-14 days, then giving ground limestone and fertilizer, and the last arranging and installing the equipment [14,15]. The payment system for each type of technology is daily-based and ranges from Rp 100.000 to Rp. 150.000/day. The number of laborers needed varies; traditional technology needs 1-2 persons, semi-intensive and intensive require 2-4 and 4-6 persons, respectively. During the preparatory stage, the laborers hired are local people. While in the semi-intensive and intensive technology, the laborers are from within the regency and outside. The outside laborers are usually from Gebang Subdistrict Langkat Regency. According to the respondent, laborers from Gebang have specific skills in the cleansing process. They are good at cleaning the remains of the fish food and waste.

During the cultivation process, each laborer works for 90 days on average. In the traditional system, it is quite common to use unpaid laborers. These laborers are usually family members because traditional shrimp farming does not require maintenance. Feeding is done up to 35 days, and for the rest of the cultivation period, shrimps feed on natural food from the fertilizing process. In contrast, the semi-intensive and intensive methods require skilled laborers and technicians. Technicians receive monthly pay, ranging from Rp. 1.000.000 to Rp. 4.000.000 and a part of the harvest (yield sharing system), depending on the size of the area that they manage. As a result, skilled laborers commonly become permanent workers. These permanent positions are usually filled by technicians and pond operators [16]. The average length of shrimp rearing in Aceh Tamiang Regency is 3-4 months/cycle. Likewise, in Bangladesh, the production cycle of shrimp culture is also for three months [17]. According to [18], the shrimp harvest cycle with intensive technology is three times/year. Farmers will harvest earlier when disease occurs in their farms [19,20].

To harvest the shrimps, farmers usually employ workers who are traders collecting all the harvest (pengepul). These traders may come from the regency or outside. They are such as from the city of Medan and its surrounding areas. This shrimp harvesting takes about 1-2 days and is done at once and partially. Different types of technology need different numbers of persons to harvest the shrimps. In the traditional method, it is needed between 3 and 5 persons, while semi-intensive and intensive methods 4-10 and 7-15 people are required each. If the labor comes from collecting traders, the farmer does not incur harvest costs. While if the farmers do the harvest, then the laborers are paid daily by the farmers. The amount ranges from Rp. 100.000-Rp. 200.000. However, in the semi-intensive method, payment can be made daily or as a whole (in bulk), which can reach Rp. 2.500.000. The harvest system in the intensive technology uses the wholesale system or the yield sharing system, the amount of which ranges between Rp. 2.000.000-Rp. 4.000.000. In each stage of shrimp aquaculture activities, unskilled laborers are generally employed [9].
## Tabel 1. The characteristics of labor in brackish water pond area in aceh tamiang per hectare, 2021

| Labor                          | Type of Brackish Water Ponds | Traditional | Semi Intensive | Intensive |
|--------------------------------|-----------------------------|-------------|----------------|-----------|
| Preparatory Stage              |                             |             |                |           |
| Number of days (Days)          |                             | 14          | 17             | 22        |
| Payment system                 |                             | Daily       | Daily          | Daily     |
| Amount (Rp)                    |                             | 100.000 – 150.000 | 100.000 – 150.000 | 100.000 – 150.000 |
| Number of labor (person)       |                             | 1-2         | 2-4            | 4-6       |
| Place of origin                |                             | Within the regency | Within and outside the regency | Within and outside the regency |
| Maintenance/Cultivation        |                             |             |                |           |
| Number of days (Days)          |                             | 60 - 90     | 80 - 100       | 80 -100   |
| Payment system                 |                             | Unpaid      | Monthly and yield sharing system | Monthly and yield sharing system |
| Amount (Rp)                    |                             | -           | 1,500.000 and 100.000 – 200.000 | 1,000.000 – 4,000.000 |
| Number of labor (person)       |                             | 1           | 1-3            | 2-4       |
| Place of origin                |                             | Family and within the regency | within the regency | within the regency |
| Harvest Period                 |                             |             |                |           |
| Number of days (Days)          |                             | 1           | 1-2            | 1-2       |
| Payment system                 |                             | Daily       | Daily and in bulk | In bulk and yield sharing system |
| Amount (Rp)                    |                             | 100.000 – 200.000 | 100.000 – 200.000 and 2,500.000 | 2,000.000 – 4,000.000 |
| Number of labor (person)       |                             | 3-5         | 4-10           | 7 – 15    |
| Place of origin                |                             | Within and outside the regency | Within and outside the regency | Within and outside the regency |

### 3.3. Works relationships in brackish water pond business

The shrimp cultivation or aquaculture business involves many parties, including the owners, managers of the sites, technicians, and assistants or anak tambak. The cooperation that exists among those people builds work relationships that can affect production. Work relationships are represented by the types of laborers used - full-time laborers and part-time ones - and the types of pay. Some are paid monthly, others are daily, and others are based on agreement or borongan. There is also a yield sharing system. Work relationships can vary, depending on the type of ponds. The working relationship in traditional brackish water ponds is straightforward. That is the working relationship with the laborers that exists during the preparatory and harvest stages. This relationship is temporary-based, and the laborers are paid daily and not involved in the cultivation stage. According to [21], fish farmers with a small land are likely to hire part-time laborers paid daily. Farmers using traditional, semi-intensive, and intensive methods in Aceh Tamiang Regency have no relationship or attachment (patron) with laborers preparing the land of fish ponds. The majority of the traditional shrimp farmers do not employ paid laborers during the cultivation stage. Instead, this stage is taken care of by owners of the ponds and their family members. Likewise, in Vietnam, small-scale shrimp farmers also use labor from family members [22].

It is because traditional farmers use limited production inputs [23]. Family members used for pond operations which is to save labor costs [24]. Laborers other than family members are hired during the harvest season. Harvest laborers can be paid by farmers or by collectors if the harvest reaches a particular production.

Unlike traditional farmers, farmers using semi-intensive and intensive methods employ skilled workers or laborers. Skilled labor is needed to increase production and production quality [25]. Di Bangladesh, larger farms tend to have skilled and permanent labor. The use of skilled laborers is to reduce the risks during the cultivation period. Because intensive technology has a high risk [22], these skilled laborers or technicians have specific knowledge and skills related to fisheries, and they usually
have an educational background in fisheries. This action is taken as shrimp cultivation with semi-intensive and intensive methods is costly. It requires a huge amount of money as investment and operations costs. The investment needed to start cultivating shrimps using a semi-intensive method reaches Rp 192,715,000 for every 4 hectares while using an intensive method requires as much as Rp 1,000,235,000/hectare/year [26,27].

Each laborer on the site has a clear job description. The pond manager is in charge of managing the management of the pond business, supervising technicians and pond workers. Technicians are assigned to control the composition of the foods and feeding times, vitamins, drugs, diseases, and brackish water conditions. They also calculate the number of foods needed, as well as the drugs. In addition, they test the salinity and the pH of the water and the mineral contents contained in the water [13]. While the assistants feed the shrimps, do the maintenance of the ponds, and harvest. These assistants also help spread the spawns and are responsible for the storage room [13]. Owners usually provide lodging on the location where the technicians and assistants can live. They can also secure the location against intruders.

Technicians and assistants are full-time workers and are paid monthly. A full-time worker works for a particular production cycle or longer and receives a wage [9]. In addition, laborers can also get additional income from the harvest. Technicians working for an aquaculture business commonly have experience working with fish feed factories; therefore, they have some knowledge and hands-on experience. In factories, the task of skilled employees is to market the product, fish feed. Farmers using fish feed from a specific factory will be accompanied and supervised by a technician from that factory. If a technician from a particular factory assists farmers, they are not charged as that technician receives a monthly salary. Yet, this kind of supervision, which a factory provides, is only available for a certain period.

One technician can work for several pond owners. The salary received is then a collective amount paid by the owners. The salary earned by a technician who manages an area of 10 hectares of ponds is around Rp. 3,000,000/month. In addition, a technician also gets as much as 3% of the net income of the owners. In contrast, an assistant can only work for one owner, and he receives a monthly pay Rp. 1,500,000. During the harvest period, farmers using semi-intensive and intensive methods hire part-time or temporary laborers. Most harvest of the ponds using these two methods is done by the traders collecting all the harvest. These traders have already had a connection with the farmers as they usually provide them with business capital. Traders are informal lenders who provide loans to farmers who cannot access formal loans [7]. There has been a system in which farmers employ laborers to lift the fishing net and the shrimps, and these laborers get paid daily. Meanwhile, traders collecting the harvests hire laborers to sort the shrimps. The amount of pay that these laborers receive is based on mutual agreement or in bulk. There is also the assistant of the boss or tauke, who is also paid based on agreement. In general, the partnership with skilled laborers is not stated in a written form. A contract

Figure 2. Relations among fish pond owner, manager, technician and assistant in shrimp production in brackish water ponds using semi intensive and intensive methods, 2021
shows transparency between pond owners and their laborers. Whereas employment contracts provide guarantees for workers, one of them is to avoid irregular salary payments [28]. Figure 1, 2, and 3 are a summary of the working relationship between semi-intensive and intensive technology farmers.

**Figure 3.** Relations among fish pond owner/manager, technician and assistant in shrimp production in brackish water ponds using semi intensive and intensive methods, 2021

**Figure 4.** Relations among fish pond owner/manager/technician and assistant in shrimp production in brackish water ponds using semi intensive and intensive methods, 2021 (Note : = Command Line; - - - - : Coordination Line)

4. Conclusion
Technology affects the use of laborers in the cultivation of shrimps in brackish water ponds. During the preparatory stage, which is the phase to prepare the water pond areas, fish farmers employ part-time laborers who are paid daily. Then, family members are involved during the cultivation period, while fish farmers applying semi-intensive and intensive methods prefer to hire skilled and unskilled laborers with monthly payment plus a bonus. Skilled laborers are used to minimizing the risks of failure to harvest the shrimps. Part-time laborers are employed to harvest the shrimps. These laborers may come from traders collecting all the harvests (pengepul), and the harvest is sold in bulk. Otherwise, part-time laborers with daily pay are hired. Therefore, it is necessary to improve the knowledge, skills, and abilities of traditional fish farmers to compete with those using other technologies. Partnership with skilled laborers can be made formal with a written agreement. Hiring local laborers still needs to be done in order to maintain social relationship.

Acknowledgement
The authors would like to express their utmost gratitude towards the Research Center for Marine and Fisheries Socio Economics for its full support and funding.

References
[1] R Iskandar et al 2018 *IOP Conf. Ser.: Earth Environ. Sci.* 207 012011
[2] Kementerian Kelautan dan Perikanan 2020 Program Percepatan Tambak Udang Nasional *kkp*
[3] Soetjipto W, et al 2019 *Peluang dan Investasi Udang Vaname* ed Sjarif I N (Jakarta: Ditjen...
Penguatan Daya Saing Produk Kelautan Dan Perikanan

[4] Badan Pusat Statistik 2020 *Aceh Tamiang Dalam Angka 2020* (Aceh Tamiang: BPS Kabupaten Aceh Tamiang)

[5] Tobey J, Clay J and Vergne 1998 *Maintaining A Balance : The Economic, Enviromental and Social Impat of Shrimp Farming in Latin America* [https://www.crc.uri.edu](https://www.crc.uri.edu)

[6] Liu Y, Barret C B, Pham T, and Violette W 2020 *Food Policy* 94 1-14

[7] Pokrant B and Reeves P 2003 *South Asia : Journal of South Asian Studies* 26 359-389

[8] Tiller R G, Hansen L, Richards R and Strand H 2015 *Marine Policy* 51 563-572

[9] Aquaculture Stewardship Council 2019S Standar Udang ASC Versi 1.1 *asc-aqua*

[10] Ula M and Kusnadi N 2017 *Forum Agribisnis* 7 49-66

[11] Mile M B and Huberman A M 1994 *Qualitative Data Analysis: An Expanded Sourcebook* (USA: Sage Publications)

[12] Dinas Pangan, Kelautan dan Perikanan Kabupaten Aceh Tamiang 2020 Statistik Perikanan Kabupaten Aceh Tamiang 2020 (Aceh Tamiang: Dinas Pangan, Kelautan dan Perikanan Kabupaten Aceh Tamiang)

[13] Nurhajarini D R, Wahyono T T, Listiana D *Perkembangan Budidaya Tambak Udang Di Pesisir Tuban 1980 – 2015* (Yogyakarta : Balai Pelestarian Nilai Budaya (BPNB) Yogyakarta)

[14] Andriyanto F, Efani A, Riniwati H 2013 *Jurnal ECSOFiM* 11 82-96

[15] Tim Perikanan WWF Indonesia 2014 Better Managemen Practices Seri Panduan Perikanan Skala Kecil Budidaya Udang Vannamei Tambak Semi Intensif dengan Instalasi Pengolahan Air Limbah (Jakarta : WWF Indonesia)

[16] Febrina L, Handaka A A, and Riyantini I 2016 *Jurnal Perikanan Kelautan* 5 128-139

[17] Abdullah A N’ Myers B, Stacey N, Zander K K, and Garnet S 2017 *Environment,Development and Sustainability* 19 2093-2114

[18] Suadi, Saksono, and Triyatmo B 2019 *Jurnal Perikanan Universitas Gadjah Mada* 21 53-64

[19] Shakir C, Manilal A, Jayakumari M, Sujith S, and Selvin J 2010 *Iranica Journal of Energy and Environment* 1 287-292

[20] Ninh L K 2019 *Journal of Economics and Development* 21 270-284

[21] Astuti W A 1993 *Jurnal Forum Geografi* 12 1993

[22] Lan N T P 2013 *LanSpringerPlus* 2:675

[23] Gordon D V, Bjorndal T 2009 *Aquaculture Economics & Management*, 13176–190

[24] Sano A 2000 *Social Actors In The Global Market: Socio-Economic Impacts Of Shrimp Aquaculture In South Sulawesi* working paper

[25] Pokrant B anf Reeves P. 2003 *South Asia : Journal of South Asian Studies* 26 359-389

[26] Lutfiana F, Arsyad A, Yoesdiarti A 2019 *Studi Kelayakan Finansial Usaha Petambak Udang Vaname (Litopenaeus vannamei) Semi Intensif Jurnal AgribiSains* 5 2 1-42

[27] Nainggolan A I S, Lesmana I, Utomo I L, Usman S and Suryanti S *Jurnal MarIsland* 1 13-23

[28] Nakamura K, Bishop L, Ward T, Pramod G, Thomson D K, Tungpuchayakul P and Srakaew S 2018 *Science Advances* 4 1-10