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Labour Resource Challenges in Fisheries-Based Communities in Quang Ngai Province, Vietnam

越南广义省渔业依赖型社区劳动力资源面临的挑战

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Abstract:
The study evaluates the current status of direct labour resources in Vietnam's coastal fisheries sector, with a focus on both workforce quantity and quality, and identifies key challenges constraining labour supply. Empirically, it examines workers engaged in aquaculture and marine capture activities in coastal communities of Quang Ngai province, a major economic hub in the country's central coastal region. The results reveal substantial labour market pressures in coastal fisheries. Although fisheries workers account for an average of 6.5% of the local labour force, demand for labour remains under-satisfied, hindering stable production and productivity gains. A pronounced labour shortage is particularly evident in Quang Ngai. Among 91 surveyed aquaculture households, 77 (84.62%) reported difficulties in recruiting workers. The situation is even more severe in fishing households, where 108 out of 138 (78.26%) reported labour shortages. These findings underscore the need for targeted policy measures and support mechanisms to mitigate labour constraints in coastal fisheries. The study provides an evidence base for

Keywords: labour resources; coastal fisheries; fisheries industry; Quang Ngai; Vietnam

关键词：劳动力资源；沿海渔业；渔业产业；广义省；越南

designing and implementing sustainable human-resource strategies in Vietnam's coastal fisheries and tourism sectors, in line with the national development vision to 2030 and outlook to 2040.

摘要：本研究评估了越南沿海渔业部门直接劳动力资源的现状，重点关注劳动力数量与质量两个方面，并识别制约劳动力供给的主要瓶颈因素。基于实证调查，研究对象为广义省沿海社区从事水产养殖与海洋捕捞活动的劳动者。广义省是越南中部沿海地区重要的经济区域。研究结果表明，沿海渔业劳动力市场正面临较大压力。尽管渔业从业人员平均占当地劳动力总量的6.5%，**但**现有劳动力供给仍难以满足生产需求，从而制约了生产稳定性和生产率提升。广义省的劳动力短缺问题尤为突出：在接受调查的91户水产养殖家庭中，有77户（84.62%）**反映在招工方面存在困**难；在138户渔业捕捞家庭中，则有108户（78.26%）报告出现劳动力短缺。上述发现凸显了制定有针对性的政策工具与支持机制以缓解沿海渔业劳动力约束的紧迫性。本研究为越南沿海渔业及旅游产业的人力资源可持续发展战略设计与实施提供了实证依据，与国家面向2030**年的**发展愿景及展望至2040**年的**长远规划相契合

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1. Introduction

Aquaculture and capture fisheries constitute critical components of the global food system, providing livelihoods and employment for millions of people worldwide. According to the Food and Agriculture Organization (FAO, 2022), an estimated 58.5 million individuals were engaged in fisheries and aquaculture in 2020, including full-time, part-time, casual and unspecified forms of employment. Asia accounted for more than 84% of this workforce, with approximately 61% employed in capture fisheries and 29% in aquaculture (FAO, 2022). The sector encompasses a wide spectrum of occupations ranging from fish farmers, aquaculture technicians, fish processors and fisheries managers to marine biologists, fishers, vessel operators, and sales and marketing specialists underscoring its socio-economic significance and occupational diversity.

The existing literature on fisheries and aquaculture has predominantly concentrated on food security and the impacts of climate change (IPCC, 2018; Istudor et al., 2019), as well as on the role of information and communication technologies in supporting sectoral transformation (Alsaleh & Yang, 2023). A substantial body of work also addresses traditional aspects of agricultural production, including farming practices and key input factors such as natural resources, capital and raw material costs, both in general agriculture and in fisheries-specific contexts. At the same time, rapid advances in science and technology, coupled with exogenous shocks economic crises, extreme weather events, pandemics and limits to adaptive capacity have triggered profound structural changes in fisheries systems. These dynamics are reflected in shifting employment patterns: FAO (2022) reports a decline in the global fisheries and aquaculture workforce from nearly 61 million workers in 2015 to about 58.5 million in 2020, partly due to the impacts of COVID-19. Yet, despite these trends, the quantity and quality of the fisheries workforce, and the specific labour-market challenges faced by workers, remain relatively underexplored in both academic research and policy debates.

In response to sectoral transformations, many developed and developing countries have introduced skills-development initiatives and vocational education programs tailored to fisheries and aquaculture. These range from short-term training courses to comprehensive undergraduate and postgraduate programs (EU, 2009; Jensen et al., 2015; Curtotti et al., 2012; Pita et al., 2015). Alongside these initiatives, attractive benefit packages and competitive wages are used to retain and attract workers. Nevertheless, severe constraints persist, including labour shortages, a scarcity of skilled workers, occupational health and safety concerns, rising labour costs for enterprises, and intensified competition for labour from other sectors. Such challenges have become particularly salient in the United States (Engle et al., 2017; van Senten et al., 2020), Europe (Pita et al., 2015), Australia (Curtotti et al., 2012) and Japan (OECD, 2019), and they increasingly shape the prospects for sustainable fisheries development.

Vietnam's fisheries sector occupies a central position in the national economy, contributing approximately 4–5% of GDP (Nguyen et al., 2017). With 28 out of 63 provinces having a coastline and an extensive shore stretching from North to South, Vietnam has leveraged its marine and coastal advantages to become the world's third-largest exporter of aquatic products and the seventh-largest producer in capture fisheries by 2019 (FAO, 2021). The Vietnamese government has adopted a series of policies and strategies to promote offshore fishing and export-oriented aquaculture, aiming to reduce pressure on nearshore fisheries (Ehlert & Faltmann, 2018; Le, 2016), mitigate tensions associated with maritime disputes (Roszko, 2020) and address historical legacies (Butcher, 2004; Hayton, 2014). The sector has emerged as an important engine of economic growth (Pomeroy et al., 2009), providing employment for around 4 million workers, of whom approximately 1.89 million are directly involved in fisheries. At the same time,

rapid expansion has contributed to resource depletion and a range of environmental challenges (Myers & Worm, 2003; Salayo et al., 2008). Sectoral characteristics have also reinforced a pronounced gendered division of labour, with men predominantly engaged in offshore and capture activities, while women are concentrated in onshore logistics, processing, marketing and household provisioning roles. This gendered segmentation further shapes the structure and resilience of the fisheries labour force.

In line with Resolution No. 36-NQ/TW (2018), Vietnam has set an ambitious goal of transforming its fisheries from traditional small-scale farming and exploitation toward industrialized, high-technology production. Achieving this transformation requires the integration of advanced science and technology in aquaculture, capture fisheries, post-harvest handling, preservation and processing of aquatic products. These objectives, however, are contingent on the availability of a sufficiently large and skilled workforce that meets both quantitative and qualitative requirements.

Against this backdrop, the main objective of this paper is to identify labour-related challenges in the fisheries sector and to assess the current status of direct labour resources both in terms of quantity and quality with a particular focus on capture fisheries and aquaculture workers in coastal communities. Empirically, the study adopts Quang Ngai province, a key coastal region, as a case study. The findings are intended to provide an evidence base for the effective implementation of Vietnam's Strategy for the sustainable development of the marine economy and coastal fisheries sector to 2030, with a vision extending to 2040.

2. Research sites and methodologies

2.1. Research sites

The study was conducted in coastal communities engaged in aquaculture and marine capture fisheries in Quang Ngai province. Located in Vietnam's Central region, Quang Ngai is a key economic province with a natural land area of 5,153 km². The province has a coastline of approximately 129 km, together with an extensive territorial sea, creating favourable conditions for the development of coastal aquaculture and marine resource exploitation.

Geographically, Quang Ngai lies between 14°32'–15°25' North latitude and 108°06'–109°04' East longitude, along the Truong Son range and facing the East Sea. It borders Quang Nam province to the north, Binh Dinh province to the south, Kon Tum province to the west, and the East Sea to the east. Administratively, Quang Ngai consists of Quang Ngai City and 13 districts, including Ly Son island district, six lowland (delta) districts, and six mountainous districts. The delta region is characterized by extensive alluvial plains formed by the sedimentation of five major rivers and is marked by relatively high sand content. However, these areas are prone to erosion and land degradation, driven by adverse weather and hydrometeorological conditions.

Fieldwork for this study was carried out in 11 coastal communes across five cities/districts and one island district within Quang Ngai province. The selected sites include: Quang Ngai City (Nghia An and Tinh Khe); Duc Pho (Pho Thanh and Pho Quang); Mo Duc (Duc Minh and Duc Loi); Son Tinh (Binh Hai and Binh Chau); and Ly Son island district (An Vinh, An Hai and Binh An). These locations represent core aquaculture and fishing communities and capture the diversity of coastal socio-ecological settings in the province.

2.2. Data and analytical methodologies

The analysis is based on both secondary and primary data. Primary data were collected using a structured household questionnaire administered in 11 coastal communes of Quang Ngai province. In total, 229 households participated in the survey, comprising 91 aquaculture households and 138 fishing households. The questionnaire and in-depth interview components elicited detailed information on household labour dynamics, including the number of workers, household size, age structure, gender composition, educational attainment, occupational experience, and other relevant socio-economic characteristics.

The study primarily employs descriptive and comparative statistical methods. Descriptive statistics are used to characterise the structure and attributes of the fisheries labour force, while statistical comparison is applied to contrast labour characteristics between aquaculture and fishing households and across localities. Data visualisation techniques (e.g., charts and graphs) are used to support comparative analysis and to highlight key patterns in the data. All quantitative analyses were implemented using Microsoft Excel, which was used for data entry, processing, tabulation, and the generation of graphical outputs, thereby ensuring consistency and accuracy in the interpretation of results.

3. Results and Discussion

3.1. Characteristics of the labour force in the coastal fisheries sector of Quang Ngai province

Quang Ngai province comprises 14 administrative units, including districts, cities, and an island district. As illustrated in Fig. 2, population distribution is highly uneven: while mountainous districts account for a substantial share of the land area, population density is much higher in the coastal districts. Quang Ngai City is the most densely populated locality, with approximately 250,000 residents. Coastal districts such as Binh Son, Mo Duc, and Duc Pho also exhibit relatively high population densities compared with inland areas, reflecting the concentration of economic activities along the coast.

Within the five key coastal districts/cities, Quang Ngai City has the largest number of aquaculture households, with 436 farming households. Binh Son ranks second, with 298 households, followed by Duc Pho and Mo Duc districts, which have 240 and 90 aquaculture households, respectively. Notably, more than 80% of these households operate on aquaculture areas of less than 0.5 hectares, according to the 2019 report of the Quang Ngai Provincial Office of Fishery (QNPOF, 2019). This pattern indicates a predominance of small-scale, household-based aquaculture production systems.

Fishing capacity is similarly concentrated in coastal localities. Quang Ngai City records the highest number of fishing vessels, with 741 nearshore boats and 615 offshore boats. Duc Pho district ranks second, with 393 nearshore and 584 offshore vessels, followed by Binh Son district, which has 547 nearshore and 377 offshore boats. Mo Duc district operates 218 nearshore fishing vessels, whereas Ly Son island district has 219 nearshore and 140 offshore boats, according to QNPOF (2019). A salient feature of the provincial fleet structure is the relatively high proportion of vessels with engine capacities exceeding 400 CV, which are predominantly concentrated in Quang Ngai City, Duc Pho district, and Binh Son district (QNPSO, 2019).

Overall, these figures reveal a coastal fisheries sector characterised by high population density, a large number of small-scale aquaculture households, and a sizeable motorised fishing fleet with a growing share of higher-capacity vessels. This configuration has direct implications for labour demand, labour organisation on vessels and farms, and the vulnerability and resilience of fisheries-based livelihoods in Quang Ngai province.

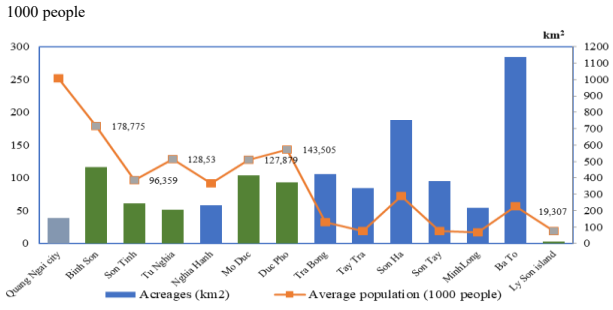

Figure 1. Average area and population of districts/cities/island districts of Quang Ngai province. Source: QNPSO, 2019

QNPOF (2019), as of the year 2016, Quang Ngai province has a total aquaculture area of 1,121 hectares, with saltwater and brackish water areas constituting more than 50% of this area. Coastal aquaculture areas in the surveyed communes are significantly concentrated in Tinh Khe, Nghia An, and Pho Quang, as detailed in Table 1. At the same time, the distribution of fishing vessels is mainly concentrated in Nghia An, Tinh Khe, Pho Thanh and An Vinh, indicative of a significant presence of maritime activities in these specific regions.

Table 1. Land use in aquaculture and the number of fishing boats in studied communes
Source: QNPSO, 2019

Communes	Natural area (km^2)	Agricult ural area (km^2)	Aquacultur al area (km^2)	Coastal aquacul ture area (km^2)	The No. of fishing boats (boats)
1. Duc Loi	4.6	1.58	0.31	0.1	147
2. Duc Minh	16.26	7.49	0.65	0.214	113
3. Pho Thanh	30.24	23.48	0.2	0.11	780
4. Pho Quang	11.05	3.29	1.5	0.5703	192
5. Nghia An	3.16	1.08	0.84	0.84	1547
6. Tinh Khe	15.62	2.68	1.01	1.01	1304
7. Binh Hai	13.09	10.36	0.41	0.11	362
8. Binh Chau	19.43	12.62	0.78	0.07	483
9. An Hai	0.52	422	-	-	115
10. An Vinh	4.19		-	-	409
11. An Binh	0.69		-	-	92

The demographic distribution within the surveyed districts and cities shows an even dispersion. However, the main concentration of the workforce of the coastal fisheries industry is in Quang Ngai City, Binh Son District, and Duc Pho District, with rates ranging from 9% to 11% (Fig. 2). The survey findings indicate a notable concentration of fisheries labor in Nghia An, Tinh Khe, and Pho Quang. These regions are characterized by robust advancements in offshore fishing activities, accompanied by a substantial demand for labor.

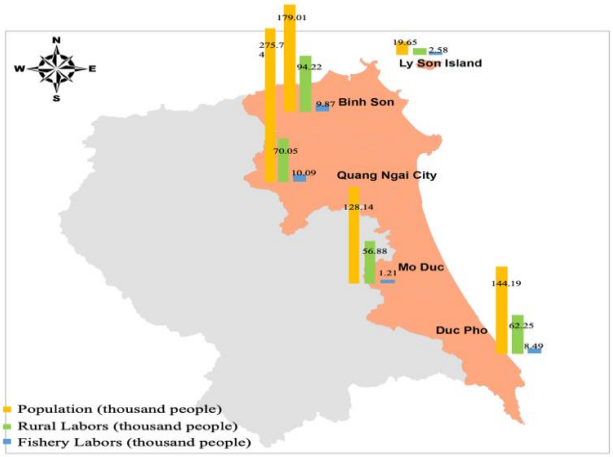

Figure 2. Population, labor and aquatic workers in the study sites. Source: QNPSO, 2019

3.2. Current Situation and Challenges for Fisheries Workers in Quang Ngai

The economic structure of Vietnam is gradually shifting away from agriculture, with a growing

emphasis on industry and services. This transition has resulted in a reduction in the proportion of agricultural workers, including those in the fisheries sector, which encompasses both aquaculture and fishing. Within the fisheries labour force, workers are categorized into different roles: owner-workers (owners of ponds, farms, enterprises, offshore fishing boats, or nearshore fishing boats), farm managers (aquaculture) or captains (fishing), full-time hired workers, and part-time workers.

This transformation is evident across various aspects of the fisheries sector, driven by changes such as the digital revolution, adaptation to climate change, and evolving economic, social, and political dynamics. These shifts place significant pressure on the sector's most critical resource its labour force.

The age of workers is a crucial factor in aquaculture, leading to divergent perspectives on its impact (Deressa et al., 2009; Hassan & Nhemachena, 2008). On one hand, age is viewed as a reflection of valuable experience, with older fishers often possessing extensive practical knowledge and skills in aquaculture. This experience enables them to navigate production challenges and associated risks more effectively (Hassan & Nhemachena, 2008). On the other hand, advancing age is associated with decreased ability to access and absorb new knowledge, which may limit farmers' capacity to adopt and implement new technologies (Shiferaw & Holden, 1998). Consequently, age plays a significant role in decision-making processes, particularly concerning investments in technology, equipment, and the diversification of fish farming methods and breeds.

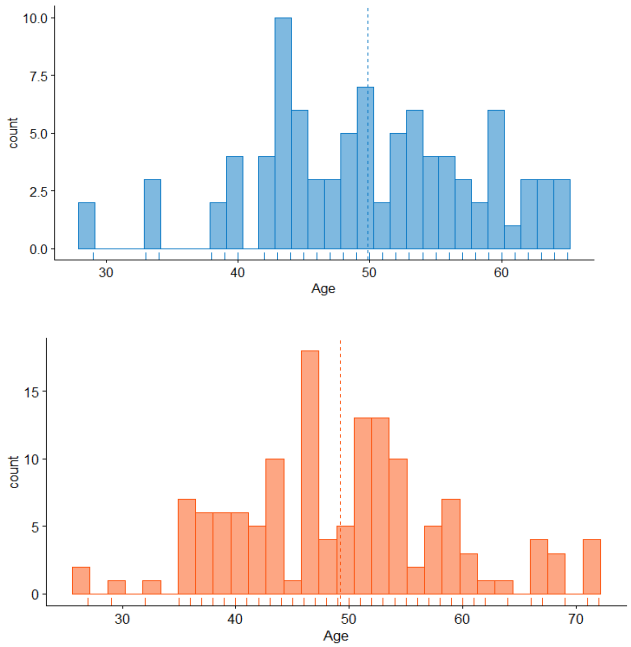

Figure 3. Age distribution of coastal fishers according to farming and fishing methods. Source: Author's Synthesis

The age distribution of coastal fishers in Quang Ngai reveals that those involved in aquaculture are typically aged between 40 and 65, while those in fishing range from 35 to 60 years old (Fig. 3). The age pyramid illustrates a particularly low proportion of younger workers, which poses a significant challenge for the future labour supply. This issue is especially pronounced in the offshore fishing industry, where it takes considerable time for workers to acquire the necessary skills and experience. Consequently, in the next 10 to 15 years, as the labour force aged 50 and above retires, there will be a limited influx of workers aged 20 to 30. This trend is consistent with findings in other countries experiencing population aging, including Japan (OECD, 2019a), US (OECD, 2016), Australia (Curtotti et al., 2012), Latvia (OECD, 2019b), Netherland (OECD, 2015), Canada (OECD, 2015b), Korea (OECD, 2018a), and Estonia (OECD1, 2018). For instance, the average age of farmers in the UK was 60 in 2016, and it is projected that by 2025, 25% of Canadian farmers will be over 65 years old (Curtotti et al., 2012; OECD, 2019).

While the OECD suggests that population aging is not a major issue in ASEAN countries, including Vietnam, migration pressures within and outside the country are a significant concern. Research findings in Quang Ngai highlight that the remote nature of fishing areas and competitive employment opportunities elsewhere, particularly with higher wages, are drawing labour away from the aquaculture and seafood industries. Offshore fishing, in particular, is perceived as dangerous and requires workers to endure harsh conditions, which discourages many young people from pursuing the profession. Moreover, wages in Vietnam's fishing and aquaculture industries are relatively low, and the working conditions are neither safe nor stable, making it difficult to attract and retain workers.

The deteriorating marine environment, coupled with the depletion of fish resources, has further complicated fishing operations, making them less effective and driving workers to abandon the profession. Additionally, the allure of urban areas and lucrative labour markets in countries such as South Korea and Japan has increasingly drawn young workers away from the seafood and agricultural sectors.

Vietnamese labour laws clearly stipulate that individuals under the age of 18 are not permitted to work in fishing. However, interviews with fishing households in Quang Ngai reveal that due to labour shortages, the perceived need for early training, and the tradition of father-to-son transmission of fishing skills, children as young as 14 sometimes participate in fishing activities, assisting and gaining experience. This phenomenon has also been documented in the study by (Ha & Nguyen, 2014), which noted that underage boys often leave school early to accompany their fathers and grandfathers on fishing trips. Mastery of fishing skills and knowledge takes a long time, and becoming a

proficient fisherman or captain is viewed as part of a cultural and livelihood tradition passed down through generations.

Gender inequality remains a critical issue within the fisheries workforce, with global data indicating that women constituted approximately 21% of the sector's labour force in 2020, primarily engaged in post-harvest activities (FAO, 2022). However, in the specific context of Quang Ngai, the representation of women in the fisheries sector is notably lower, comprising only 7.1% of the workforce in 2017 (QN - PDARD, 2019). The majority of workers in this sector are hired laborers, accounting for over 50%, with the provincial average reaching 61%. In contrast, the ownership rate among workers averages 39%, with the highest rates observed in Ly Son Island district, where over 79% of the workforce holds ownership, and in Binh Son district, where the rate exceeds 46% (Table 2).

Table 2. Fisheries labors in rural areas based on gender and work characteristics in regions
Source: (QN - PDARD, 2019)

Cities/Districts	Male		Female		Employers		Employees	
	No. of people	(%)	No. of people	(%)	No. of people	(%)	No. of people	(%)
QN province	**30,405**	**92.9**	**2,338**	**7.1**	**12.769**	**39,0**	**19.974**	**61,0**
1. QN city	9,369	92.9	721	7.1	3.34	33,1	6.75	66,9
2. Binh Son	8,858	89.8	1,009	10.2	4.576	46,4	5.291	53,6
3. Mo Duc	1,177	97.1	35	2.9	374	30,9	838	69,1
4. Duc Pho	8,122	95.7	368	4.3	2.019	23,8	6.471	76,2
5. Ly Son island	2,515	97.3	69	2.7	2.047	79,2	537	20,8

A survey of 229 fishers in coastal communities reveals that all men in these households actively participate in fishing and aquaculture activities. In contrast, while women play an essential role in household fishing and aquaculture tasks, their participation rate is less than 30%, primarily focusing on post-harvest activities such as fish sales, processing, and logistical support for production. In Quang Ngai, men predominantly undertake the core responsibilities of fishing and fish farming. The existing literature, including findings by (Asfaw & Admassie, 2005), suggests that men are more inclined to take risks, adopt new technologies, and engage in adaptation strategies than women. Cultural beliefs, which view women as unsuited for physically demanding and dangerous work, reinforce the notion of men's inherent strength and capability. This perspective is also supported by studies such as those by (Waitt & Hartig, 2005), which examined similar gender dynamics in Australia and Japan.

Education, particularly formal education, plays a crucial role in determining the quality of the fisheries workforce. A clear correlation exists between educational attainment and the ability to access relevant information or adopt new technologies, as demonstrated in various studies conducted in Virginia (Norris & Batie, 1987), Nigeria (Igodan et al., 1988), and China (Lin, 1991). Among coastal fishers in Quang Ngai, a significant proportion have completed primary and secondary education, with 33% holding primary school qualifications and 52% having completed secondary school. Additionally, 15% of fishers have attained higher secondary education (Fig. 4).

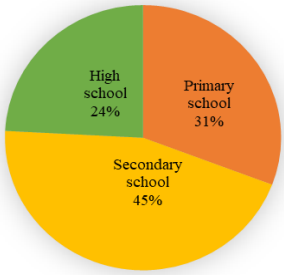

Figure 4. The education qualification level of fishers in Quang Ngai. Source: Author's Synthesis

The education level of fishers in Quang Ngai province, as depicted in Fig. 6, reveals some notable trends. A significant majority of both aquaculture and fishing workers are untrained, with over 83% of aquaculture fishers and 85.5% of fishing fishers falling into this category. Approximately 11% of fishing fishers have received short-term training, while only 3.3% of coastal aquaculture fishers have undergone similar training. In terms of long-term training, 3.62% of fishing fishers have participated, compared to just 1.1% of aquaculture fishers.

Remarkably, a considerable portion of aquaculture fishers possess higher education qualifications. Specifically, 7.69% hold university degrees, and an additional 4.4% have attained postgraduate degrees, underscoring the notable presence of advanced education within this demographic group.

The advancement of science and technology is significantly transforming the labour structure in the aquaculture industry, shifting it from a labour-intensive model to one that is highly mechanized and reliant on

skilled and qualified workers (Li & Li, 2020). However, in Quang Ngai, the current workforce remains predominantly untrained or low-skilled. The increasing automation in aquaculture and fishing is reshaping labour demand, requiring fewer but more specialized workers (Kumar et al., 2020).

Aquaculture and fishing also necessitate substantial initial investment, and both developed and developing countries are trending towards large-scale farms and enterprises in these sectors. Vertical integration and expansion drive the need to enhance labour efficiency. Research by (Nettle & Vera-Toscano, 2021) and (Rose & Creak, 2021) highlights that major structural changes in the agri-food sector over the past two decades have resulted in shifts in labour and skill requirements. Factors such as larger farm sizes, diversification of farm ownership, and increased reliance on non-family employment reflect a move away from traditional farming models towards more modern, multi-sector, and technologically sophisticated operations.

The increasing adoption of technology in aquaculture demands workers with technological expertise, fundamentally altering the type of labour required. Larger farms necessitate not only a higher number of workers but also workers with advanced management skills suited to large-scale operations. Moreover, new forms of farm ownership are changing the operational dynamics of farms, requiring diverse types of labour to accommodate these evolving business models.

Maintaining traditional skills and knowledge in biology, nutrition, and water quality remains essential in the evolving aquaculture industry. Simultaneously, new skills are increasingly required, such as the ability to input and manage data from automated systems, make data-driven decisions, and oversee remote monitoring and control of production facilities, especially in intensive pond production operations. The use of robotics and "big data" is also becoming more prevalent in the industry (Engle et al., 2017).

One of the main challenges is the training and capacity-building needed to develop a skilled workforce. There is a growing demand for cross-training to ensure employees can fill in for one another, particularly during periods of absence, as demonstrated during the COVID-19 pandemic (van Senten et al., 2020). Such training helps farms maintain efficient and cost-effective operations. To stay competitive and promote the sustainable development of the aquaculture industry, upgrading the skills of the workforce is essential, especially in light of the declining availability of traditional labour resources and rising labour costs. This pressure pushes businesses to improve productivity and labour efficiency, thereby reducing production costs.

As the aquaculture sector transitions from traditional models to more performance-oriented systems, the need for a more educated and skilled workforce becomes apparent, replacing the reliance on unskilled labour. Research is increasingly necessary to tackle labour-related issues, such as improving productivity and efficiency, and to identify effective workforce development programs. This trend is not unique to Vietnam; in the EU, concerns have arisen regarding the mismatch between training programs and the needs of the labour market (Pita et al., 2015).

Experience in the fishing industry is critical for acquiring the necessary knowledge and skills to succeed. It helps fishers develop an in-depth understanding of the ecological zones, fishing areas, species targeted, and the ability to differentiate fish sizes. Given the physically demanding nature of fishing, experience, along with good health and endurance, is vital. Many fishers begin their careers in their teenage years. This is reflected in the number of years of experience reported by Quang Ngai fishers in the survey (Fig. 5, 6). Specifically, 42 fishers had accumulated between 27 and 34 years of experience, 23 had between 34 and 41 years, and 11 had more than 41 years of experience. In contrast, a smaller proportion of respondents (11 out of 138) had between 7 and 14 years of experience, representing younger individuals or those relatively new to the profession. The largest group (51 out of 138) reported having between 15 and 27 years of fishing experience.

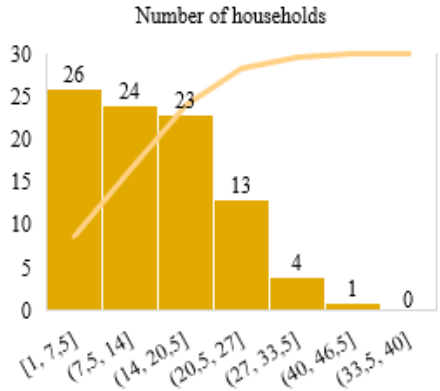

Figure 5. Number of years of fisher's fishing experience. Source: Author's Synthesis

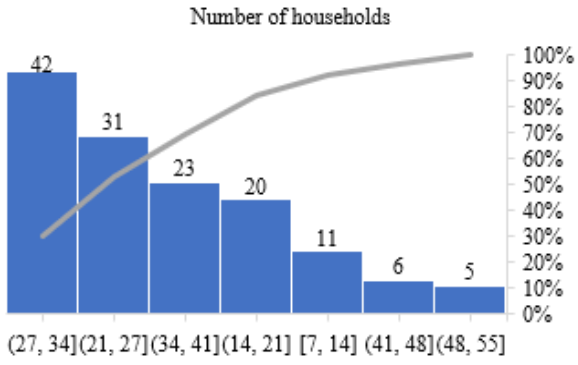

Figure 6. Number of years of fisher's aquaculture experience. Source: Author's Synthesis

In aquaculture, accumulated experience plays a crucial role in enhancing fishers' understanding of environmental dynamics, such as changes in seawater conditions, weather patterns, ocean currents, and coastal ecosystems. This knowledge is particularly valuable in fish farming, as it supports decision-making processes related to management, care, and environmental protection. Experienced aquaculture workers are better equipped to address challenges, mitigate risks, and apply the skills and knowledge needed for effective operations. This, in turn, fosters environmental stewardship and sustainable economic outcomes.

However, compared to the extensive experience typical of traditional fishing, the years of experience among aquaculture workers are relatively low. More than 92% of those in aquaculture have five years or less of experience, with nearly 44% having just two to three years. Only 5.5% of the respondents reported having more than six years of experience in aquaculture.

Aquaculture is a seasonal activity, with a heightened demand for labour during harvest and production periods. Household size can significantly influence the availability of labour for these labour-intensive agricultural tasks. Larger households provide a potential solution to labour shortages during peak seasons by utilizing family members, rather than relying on external labour sources, as noted by Croppenstedt et al. (2003).

The impact of family size and the number of working members in each household in Quang Ngai is illustrated in Table 3, which highlights their potential influence on labour availability. On average, 86% of the surveyed households consist of two to five members, while 11% have more than six members. Labour distribution within households is largely concentrated between one and four workers, representing 98% of households. A significant portion of fishing households, about 98%, consist of two to five members. Notably, 81% of these households have one to two working members, with 47% having only one worker.

A trend observed in many fishing families is that when the husband works offshore, he often assumes the role of the primary breadwinner. Meanwhile, the wife typically remains at home, focusing on household responsibilities such as childcare. This gendered division of labour reflects the traditional roles within fishing communities, where men engage in physically demanding and high-risk work, while women manage domestic and supportive roles.

Table 3. Household size and number of workers in households. Source: Author's Synthesis

HHs Size (people)	Number of HHs	% of HHs	Average number of labor in each family	Number of HHs	% of HHs
Aquaculture (91 HHs)					
2	19	20.88	1	14	15.38
3	15	16.48	2	37	40.66
4	32	35.16	3	20	21.98
5	11	12.09	4	17	18.68
6	3	3.30	5	2	2.20
> 6	11	12.09	> 5	1	1.10
Fishing (138 HHs)					
2	24	17.39	1	66	47.83
3	25	18.12	2	48	34.78
4	59	42.75	3	21	15.22
5	27	19.57	4	1	0.72
6	1	0.72	> =5	2	1.45
> 6	2	1.45			

Human resources are critical to both farming and fishing, particularly in offshore fishing, where boat owners depend heavily on available labour. Decisions regarding the diversification of fishing methods and targets, investments in facilities, gear, and technology, and the willingness of fishers to temporarily halt production are all closely tied to labour availability. Moreover, labour constraints significantly hinder career transitions within the sector. Among the 91 fishing households surveyed, 77 (84.62%) reported labour shortages, while the overall figure for all fishing households surveyed stood at 108 (78.26%). This issue is prevalent throughout Quang Ngai, affecting a total of 138 households interviewed (Table 4).

The challenge of labour shortages is not unique to Quang Ngai but is also observed in other coastal fishing regions, such as Hai Phong, where fishers are often reluctant to commit to long-term employment arrangements. As a result, ship owners must invest considerable time and effort in recruiting enough workers for each fishing expedition, which ultimately impacts the efficiency and success of the fishing process.

Table 4. Current status of fishery labor resources in Quang Ngai. Source: Author's Synthesis

	Aquaculture	Fishing
Enough labour (HHs/% of HHs)	14 (18.18%)	30 (21.74%)
Labour shortage (HHs/% of HHs)	77 (84.62%)	108 (78.26%)

The fishing industry currently faces a significant challenge in finding workers, particularly experienced ones. The nature of the industry requires years of training to cultivate a skilled workforce, which is currently in short supply. This shortage is further aggravated by the fact that many individuals, after receiving training and gaining experience, choose to transition to other occupations, opting not to continue working at sea. The departure of experienced workers from the sector poses a critical threat to the sustainability of the local fishing industry.

Labour shortages in the seafood industry are not confined to specific regions but represent a global problem, affecting both developed and developing countries. In developed nations such as the United States, Canada, and those within the European Union (EC, 2019; FOC, 2021; NMFS, 2022), key causes of the shortage include aging populations, the demanding

nature of fishing work, and strict regulations, particularly concerning fishing quotas. In contrast, in developing countries like Vietnam, Thailand, and India (ILO, 2020; VMARD, 2021), labour shortages are primarily driven by the migration of young people to urban areas, leaving rural fishing communities with insufficient staffing.

Both developed and developing regions face difficulties in attracting and retaining workers, especially given the harsh working conditions and ongoing human rights concerns within the industry (FAO, 2021). These challenges highlight the need for both structural reforms and improved labour conditions to ensure the long-term viability of the fishing sector worldwide.

4. Conclusion

To ensure stability and enhance productivity in the seafood production industry, labor plays a crucial role, both in terms of quantity and quality. In terms of quantity, the workforce must meet the industry's needs in alignment with market demands, maintaining a stable supply to address growing consumption. However, quality labor is equally important and is evaluated based on factors such as age, gender, education, expertise, physical endurance, and the ability to absorb and apply technological innovations in production. Achieving these goals requires investment in workforce training and skill development.

The current labor situation in the seafood industry in Quang Ngai province faces several challenges, including a shortage of skilled workers and a pronounced gender division in the workforce. The hospitality sector accounts for an average of only 6.5% of the province's total labor force, which is insufficient to meet the growing demand for stability and increased productivity. Furthermore, the majority of the workforce is male, aged between 40 and 65, with most having completed only primary or secondary education. Around 85% of workers have not received formal professional training, highlighting the critical need for increased investment in labor training, particularly in skill-intensive areas such as offshore fishing. Practical experience is another essential factor, with offshore fishers often having 14 to 40 years of experience, while those engaged in aquaculture typically have less than five years of experience.

The labor shortage in Quang Ngai's hostel sector has become a pressing issue. According to the survey, approximately 84.62% of the 91 aquaculture households and 78.26% of the 138 fishing households reported difficulties in finding labor. This shortage has significantly impacted production and poses a significant challenge to maintaining operations and meeting growing market demands. To address this situation, it is essential to develop a stable and high-quality workforce through targeted training programs that improve workers' skills and qualifications.

Based on the research findings, several policy recommendations have been proposed to develop the labor force in Quang Ngai's coastal sector:

Enhance Worker Skills and Knowledge: Implement training programs focused on fishing techniques, safety at sea, and business management to improve workforce competencies.

Promote Sustainable Fishing Practices: Educate fishers on marine ecosystem conservation and encourage the adoption of alternative livelihood options, such as aquaculture or ecotourism, to ensure environmental sustainability.

Improve Access to Financial Support: Provide small-scale fishers with access to loans or grants through microfinance programs to facilitate investments in their operations.

Strengthen Regulatory Enforcement: Reinforce compliance with fishing regulations to prevent violations and promote sustainable practices within the industry.

Moreover, particular attention should be given to increasing the participation of women and youth in the sector, as well as addressing issues related to migration and labor exploitation. This can be achieved by implementing measures to protect migrant workers' rights and providing necessary support services. Collaboration with international organizations will be key in promoting ethical labor practices in the seafood industry and ensuring a sustainable future for the sector.

5. Limitations and Further Study

While this study offers important insights into Quảng Ngãi's seafood industry labor force, several limitations remain. The analysis relies mainly on survey data from aquaculture and fishing households, which may not reflect perspectives from processors, training institutions, or government agencies. The sample size and geographic scope are limited, and the study focuses on workforce characteristics rather than quantifying labor's impact on productivity or industry growth.

Future research should track labor trends over time, compare Quảng Ngãi with other coastal provinces, and examine how automation, technology, and socio-cultural factors such as gender and migration influence workforce participation. A deeper economic analysis of labor investments, including training, financial support, and regulatory measures, would further strengthen policies toward building a skilled, sustainable, and inclusive seafood workforce.

Author Contributions

Conceptualization, Phong. N T, Giang. T H. and Lam. P T.; methodology, Linh N H.; software, Linh N H., Phong N T.; validation, Phong. N T, Giang. T H. and Lam. P T.; formal analysis, Phong. N T, Giang. T H. and Lam. P T.; investigation, Nguyet T M.;

resources, Nguyet T M. and Linh N H. ; data curation, Linh N H.; writing—original draft preparation, Phong. N T and Giang. T H.; writing—review and editing, Phong. N T, Giang. T H. and Lam. P T.. All authors have read and agreed to the published version of the manuscript.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The original contributions presented in this study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author(s).

Dataset available on request from the authors. The raw data supporting the conclusions of this article will be made available by the authors on request.

Conflicts of Interest

The authors declare no conflicts of interest.

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