OCCUPATIONAL FRAMEWORK

A03 - Fishing And Aquaculture

Jabatan Pembangunan Kemahiran
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OCCUPATIONAL FRAMEWORK

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ABSTRACT

The Occupational Framework (OF) is a foundational document crucial for shaping occupational standards. This OF was constructed particularly for the fishing and aquaculture division in reference to MSIC A03. Its significance lies in enhancing the overall efficiency of the labour market in this industry. The OF establishes a well-defined hierarchical structure, organising industry-specific job titles and tasks based on expertise, complexity, knowledge, and autonomy levels. This framework proves to be an asset for stakeholders in the fishing and aquaculture sector, assisting in recognising available job positions and streamlining organisational structures within companies. It also plays a crucial part in developing National Occupational Skills Standards (NOSS). Constructed with a thorough opinion by experts and professionals with extensive experience in the fishing and aquaculture sector, this OF addresses a pressing concern in both sectors: heavy dependence on foreign labour. The work's physically demanding and often inadequately compensated nature discourages local youth and recent graduates from pursuing careers in this domain. The development of this OF involved a comprehensive data collection process, spanning document analysis, focus group discussions with industry experts, surveys, and data triangulation. These endeavours led to the identification of four fishing areas and six aquaculture areas. In achieving its objectives, 62 job titles relevant to the industry were recognised together with the detailed explanation of occupational description, with 24 being marked as critical and 39 aligning with the requirements of the Industrial Revolution (IR). The OF introduces three categories of competencies in the fishing and aquaculture sector: general skills, fishing skills, and aquaculture skills. Additionally, it maps the impact of the eight technology pillars of the IR on each job area, recognising the need for technological adaptation within the industry. Moreover, the OF highlights 11 critical issues within the fishing and aquaculture sector. Ultimately, the OF recommends nine (9) existing NOSS for review and proposes three (3) new NOSS to be developed. OF becomes a pragmatic and cost-effective approach in assisting the industry’s stakeholders to adapt to the ever-changing requirements and challenges. This OF is a valuable fishing and aquaculture document supporting talent management, skills development, and strategic planning. It offers a structured approach to employment, contributing to the fishing and aquaculture sector's long-term financial and ecological sustainability.

ABSTRAK

Kerangka Pekerjaan (OF) adalah dokumen asas yang penting untuk membentuk piawaian pekerjaan. OF ini dibina khususnya untuk sektor perikanan dan akuakultur. Kepentingannya terletak pada peranannya dalam meningkatkan kecekapan pasaran buruh secara keseluruhan dalam industri ini. OF menetapkan struktur hierarki yang jelas, mengatur tajuk pekerjaan dan tugas yang spesifik industri berdasarkan kepakaran, kerumitan, pengetahuan, dan tahap autonomi. OF ini terbukti menjadi aset bagi pihak berkepentingan dalam sektor perikanan dan akuakultur, membantu dalam pengenalan kedudukan kerja yang tersedia dan penyusunan struktur organisasi dalam syarikat. Selain itu, ia juga memainkan peranan penting dalam pembangunan Standard Kemahiran Pekerjaan Kebangsaan (NOSS). Ia dibina berdasarkan pendapat yang teliti oleh pakar dan ahli profesional yang mempunyai pengalaman luas dalam sektor perikanan dan akuakultur. OF dapat menangani kebimbangan dalam sektor ini yang banyak bergantung pada tenaga kerja asing. Sifat kerja yang memerlukan tenaga fizikal dan seringkali tidak setimpal dengan ganjaran membuatkan belia tempatan dan graduan baru enggan menceburi dalam sektor ini. Pembangunan OF ini melibatkan proses pengumpulan data yang komprehensif, meliputi analisis dokumen, perbincangan kumpulan fokus dengan pakar industri, tinjauan, dan triangulasi data. Usaha ini membawa kepada pengkelasan empat bidang perikanan tangkapan dan enam bidang akuakultur. Dalam mencapai objektifnya, 62 tajuk pekerjaan yang relevan dengan industri telah dikenali, dengan 24 daripadanya ditandakan sebagai kritikal dan 39 selaras dengan keperluan Revolusi Industri (IR). OF memperkenalkan tiga kategori kecekapan dalam perikanan dan akuakultur yang dikelaskan sebagai kemahiran umum, kemahiran perikanan, dan kemahiran akuakultur. Selain itu, ia memetakan impak lapan teras teknologi IR pada setiap jenis kerja, mengakui keperluan untuk adaptasi teknologi dalam industri. Kerangka pekerjaan ini telah mengenal pasti sebelas isu kritikal dalam sektor perikanan dan akuakultur. Di akhir OF ini, sejumlah sembilan (9) NOSS sedia ada dicadangkan untuk dikaji semula dan tiga (3) NOSS baharu dicadangkan untuk dibangunkan. OF menjadi suatu pendekatan yang pragmatik dan kos-efektif dalam membantu semua pemegang taruh dalam industri ini bersedia dengan keperluan dan cabaran yang sering berubah. Kesimpulannya, OF adalah sangat penting bagi sektor perikanan dan akuakultur, menyokong pengurusan bakat, pembangunan kemahiran, dan perancangan strategik. Ia menawarkan pendekatan berstruktur kepada pekerjaan, menyumbang kepada kelestarian kewangan dan ekologi jangka panjang untuk sektor perikanan dan akuakultur.

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ABBREVIATIONS

3D	Three dimensional
RMK12	Twelfth Malaysia Plan
ASC	Aquaculture Stewardship Council
BPKLP	*Bahagian Pembangunan Kapasiti dan Latihan Pertanian*
CAGR	Compound Annual Growth Rate
CAPEX	Capital expenditure
CU	Competency Unit
DID	*Jabatan Pengairan dan Saliran* / Department of Irrigation and Drainage
DOE	Department of Environment
DOF	Department of Fisheries
DOSH	Department of Occupational Safety & Health
DOSM	Department of Statistics Malaysia
DSD	Department of Skills Development
DSMN Action Plan	National Food Security Policy Action Plan
DVS	Department of Veterinary Services
EEZ	Exclusive Economic Zone
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization
LKIM	*Lembaga Kemajuan Ikan Malaysia* / Fisheries Development Authority of Malaysia
FDPM	Department of Forestry Peninsular Malaysia
FGD	Focus Group Discussion
FRI	Fisheries Research Institute
GDP	Gross Domestic Product
GIS	Geographic Information System
HOB	Hygiene On Board
iGROW	*Institut Agro Usahawan JSN*
KIMIA	Department of Chemistry

ILO	International Labour Organization
IMP3	Third Industrial Master Plan
IoT	Internet of Things
IOTC	Indian Ocean Tuna Commission
IR	Industrial Revolution
IUU	Illegal, Unreported, and Unregulated
JIM	*Jabatan Imigresen Malaysia* / Department of Immigration Malaysia
JSM	*Jabatan Standard Malaysia* / Department of Standard Malaysia
JTKSM	Department of Labour Peninsular Malaysia
KKP	*Keluk Kemungkinan Pengeluaran*
KPI	Key Performance Indicator
MADA	Malaysia Aquaculture Development Association
MAED	Mandatory Area for Exclusion Devices
KPKM	Ministry of Agriculture and Food Security
MAQIS	Malaysian Quarantine and Inspection Services
MASCO	Malaysia Standard Classification of Occupations
MFFAM	Marine Fish Farmers Association of Malaysia
MFS	Malaysian Fisheries Society
MKN	*Majlis Keselamatan Negara* / National Security Council
APMM	*Agensi Penguatkuasaan Maritim Malaysia* / Malaysian Maritime Enforcement Agency
MOH	Ministry of Health
MOHR	Ministry of Human Resources
MOSQF	Malaysian Occupational Skill Qualification Framework
MPPI	*Menunggu Peranti Pengumpul Ikan*
MSC	Marine Stewardship Council
MSCS (*SPKM*)	Malaysian Skills Certification System
MSIC 2008	Malaysia Standard Industrial Classification 2008
MySPIKE	Malaysian Skills Integration Management System
NADMA	National Disaster Management Agency
NAP	National Agrofood Policy

NEKMAT	*Persatuan Nelayan Kebangsaan*
PNN	*Persatuan Nelayan Negeri*
PNK	*Persatuan Nelayan Kawasan*
NJT	No Job Title
NOSS	National Occupational Skills Standards
NPOA-IUU	Malaysia's National Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing
NRECC	Ministry of Natural Resources, Environment and Climate Change
OA	Occupational Analysis
OD	Occupational Descriptions
OF	Occupational Framework
OPEX	Operational Expenditure
OR	Occupational Responsibilities
OS	Occupational Structure
OSHA	Occupational Safety and Health Administration
PLKPK	*Program Latihan Kemahiran Pertanian Kebangsaan*
PNK	*Persatuan Nelayan Kawasan*
RFMO	Regional Fisheries Management Organization
SDGs	Sustainable Development Goals
SEAFDEC	Southeast Asian Fisheries Development Center
SIRIM	Standards and Industrial Research Institute of Malaysia
SKM	*Sijil Kemahiran Malaysia*
SOP	Standard Operating Procedure
SSM	*Suruhanjaya Syarikat Malaysia* / Companies Commission of Malaysia
TED	Turtle Excluder Device
UN	United Nations
VMS	Vessel Monitoring System
WIM	Written Instructional Materials
WKB 2030	*Wawasan Kemakmuran Bersama* 2030

GLOSSARY

Aquaculture	The breeding, rearing, and harvesting of fish, shellfish, algae, and other organisms in all types of water environments (Referred to definition by Fisheries Act 1985 and MSIC).
Agrarian economy	Also known as agricultural society, agrarian community is any community whose economy is based on producing and maintaining crops and farmland.
Benthic communities	Benthic communities are biological communities that live in or on the seabed.
Biofouling	Biofouling, or biological fouling, is the accumulation of microorganisms, plants, algae, or small animals on wet surfaces that have a mechanical function, causing structural or other functional deficiencies.
Broodstock management	Measures that are taken by the aquaculturist to enable a captive group of fish to undergo reproductive maturation and spawning and produce fertilized eggs.
Capture fisheries	The activity involves the harvesting, capturing, or collecting of fish and other aquatic organisms from natural bodies of water, such as rivers, lakes, seas, and oceans. This may include methods such as fishing, netting, trapping, and any other techniques used to extract aquatic resources for commercial or subsistence purposes (Referred to definition by Fisheries Act 1985 and MSIC).
Cascading effects	An inevitable and sometimes unforeseen chain of events due to an act affecting a system.
Coastal fisheries	Fishing in a coastal fishing zone, by vessels not exceeding 12 metres and using passive fishing gear or fishing gear operated from the shore.
Deep-sea fisheries	Deep-sea fisheries occur at great depths (200-2000 meters), on continental slopes, oceanic seamounts, ridge systems and banks, many in waters beyond national jurisdiction.
Detrimental effects	Contamination of the waters of the state or making the same injurious to public health, harmful for commercial or agricultural use, or deleterious to animal or plant life.
Emerging skills	Skills predicted to be imperative to the industry in the near future, based on recent developments, trends or studies.
Fish aggregating device	An artificial object used to attract ocean-going pelagic fish such as marlin, tuna and mahi-mahi (dolphin fish).
Fish landings	Catches of marine fish landed in foreign or domestic ports. Marine capture fisheries landings are subject to changes in market demand and prices and

	the need to rebuild stocks to maximum sustainable yield levels to achieve long-term sustainable use of marine resources.
Fishing	The catching, taking, or killing of fish by any method, the attempted catching, taking, or killing of fish, engaging in any activity which can reasonably be expected to result in the catching, taking, or killing of fish, or any operation in support of, or in preparation for, any activity (Referred to definition by Fisheries Act 1985).
Fry rearing	A process that nurtures 3 to 4-day-old post larvae, which have begun to eat food, into fingerlings for pond stocking.
Geographic information system	A computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface.
Grey literature	Materials and research produced by organisations outside of the traditional commercial or academic publishing and distribution channels.
High-sea or open-sea fisheries	High-sea fisheries or deep-sea fisheries in the high seas refer to fishing activities operated beyond EEZ, owner or non-owner-operated, using longlines or purse seines, usually regulated by Regional Fisheries Management Organization (RFMO) such as the Indian Ocean Tuna Commission (IOTC), target species, mainly oceanic tuna and tuna-like species.
Inland fisheries	Fisheries in riverine waters (Referred to definition by Fisheries Act 1985)
Malaysian Occupational Skills Qualification Framework	Definitions developed by the Department of Skills Development (DSD) classify occupational skills into eight levels, each defined by a certain set of abilities and responsibilities.
Malaysian Skills Certification System (SPKM/MSCS)	The system which regulates skills training programmes that lead to the Sijil Kemahiran Malaysia (SKM), Diploma Kemahiran Malaysia (DKM), and Diploma Lanjutan Kemahiran Malaysia (DLKM) awards. The skill and work-based certification system in Malaysia is achieved through assessment and training.
Micro-Credentials	Recognised short-duration, competency-based learning or training programmes that align with labour market or community needs and can be assessed and recognized for employment or further learning opportunities.
Monoculture	The practice of cultivating one species at a time.
National Occupational	A document that outlines the minimum competencies required by a skilled worker working in Malaysia for a certain field and job level as well as the

Skills Standard (NOSS)	path to achieve these competencies.
Ornamental fish	Any species of aquatic animals that are reared or marketed for their beauty or exotic characteristics, rather than for consumptive or recreational use.
Polyculture	Practice of cultivating more than one species in the same space, at the same time. In doing this, polyculture attempts to mimic the diversity of natural ecosystems.
Seagrass meadows	Seagrass meadows or seagrass bed is an underwater ecosystem formed by seagrasses. Seagrasses are marine plants found in shallow coastal waters and in the brackish waters of estuaries.

CHAPTER I

INTRODUCTION

1.1. Research Background

Fishing is vital in meeting the world's growing seafood demand while supporting livelihoods and sustaining marine ecosystems. Aquaculture, also known as fish farming, involves cultivating fish, shellfish, and aquatic plants in controlled environments such as ponds, tanks, or open-water enclosures (Ahmed et al., 2021). It has emerged as a crucial solution to supplement wild-caught fish and alleviate pressure on dwindling wild fish stocks. Captured fisheries capture fish and other aquatic organisms from natural water bodies such as oceans, rivers, and lakes (Funge-Smith & Bennett, 2019). This age-old practice has been a cornerstone of human sustenance and economic activity, providing employment opportunities and contributing to global food security. Together, fishing and aquaculture contribute to the world's seafood production, offering diverse and sustainable means of meeting the nutritional needs of a growing global population.

Fishing (captured fisheries in this OF document) and the aquaculture sector are essential for Malaysia’s economy and food security by creating job opportunities and being a vital source of animal protein. The increasing production trend in aquaculture over the years proves the importance of this industry and its contribution to the Malaysian economy. Observing the economic performance in the country, Malaysia's real gross domestic product registered a growth of 8.7 % year-on-year in 2022 as compared to 3.3 % in the preceding year, recording a value of RM1,510.9 billion. During the reference period, agriculture accounted for 6.6 % of overall gross domestic product with a value of RM99.1 billion. Further disaggregating fishing activities, this sector grew marginally at 0.1 % with a value-added of RM11.5 billion.

Marine fishing contributed 62.8 % to the value-added value of fishing activities, while the remaining 37.2 % were in aquaculture activities. The Department of Fisheries (DOF) under the Ministry of Agriculture and Food Security (KPKM) plays a significant role in developing, regulating and managing both industries in Malaysia.

In terms of employment, there are 15.4 million persons engaged in 2022, as published by the Department of Statistics, Malaysia (DOSM). Among these, 1.5 million persons were employed in the agriculture sector, which comprises 10.0 % of overall employment. According to the Department of Fisheries (DOF) 2021 statistics reports, the total number of culturists in 2021 reached 37,855 individuals, with 16,164 individuals engaged in freshwater culture and 21,241 individuals in marine culture. In addition, the number of fishers recorded working on board was 114,979 on 48,493 vessels. These figures highlight the evolving landscape of Malaysia's fishing and aquaculture sector, reflecting both challenges and opportunities for the industry.

The Malaysian fishing industry is regulated by the Fisheries Act 1985 (Act 317) and its provided regulations. While inland fisheries and inland aquaculture fall under State jurisdiction, marine fisheries and marine aquaculture fall under Federal jurisdiction. At the Federal level, the Ministry of Agriculture and Food Security (KPKM) through the Department of Fisheries (DOF) is responsible for promoting the management and development of fishing and aquaculture in marine and inland areas with authorisation from the relevant State Government. This includes supporting inland aquaculture through initiatives such as establishing experimental aquaculture stations, fish-breeding facilities, and training centres for demonstration purposes.

Malaysia has launched two policies, The National Agrofood Policy 2021-2030 (NAP 2.0) and the National Food Security Policy Action Plan (DSMN Action Plan) 2021-2025, to address the need for a comprehensive food security policy. NAP 2.0 consists of critical strategies that focus on enhancing competitiveness and innovation in the agrofood sector, including fishing and aquaculture, promoting well-being among individuals, and fostering a shift towards a sustainable food system to adapt to climate change. One distinguishing feature of NAP 2.0 compared to its predecessor, NAP 1.0, is its recognition and integration

of components from the Fourth Industrial Revolution (4IR). Hence, NAP 2.0 aligns with related sectorial policies, such as the (IR 4.0) Policy and the Malaysian Digital Economy Blueprint, to improve efficiency and productivity in the agrofood sector from production to retail and distribution. These policies were introduced in late October 2021. They are in line with other national development policies, including the Vision for Shared Prosperity 2030 (WKB 2030) and 12th Malaysia Plan (RMK 12), which focus on achieving sustainable economic growth while ensuring fair, equal, and inclusive economic distribution across all income groups, ethnicities, regions, and supply chains.

The aims are to strengthen the management of resources and development, cultivate an organization with high integrity and performance, enhance services through digitization, and empower the department's image. The plan targets to increase the number of deep-sea fishing vessels and tuna operations in Malaysia's Exclusive Economic Zone (EEZ) and high seas, increase tuna landings in Malaysia to 150,000 metric tons, develop modern deep-sea fishing vessels and tuna in an integrated manner, comply with domestic and international resolutions by at least 85%, and increase the market for high-value tuna-based products domestically and internationally. The plan also aims to develop a sustainable aquaculture industry, increase fishery products' production, improve fishery products' quality, promote technology in fishing management, and enhance human capital development.

The agrofood sector is expected to grow at a rate of 4.5 % per year during the implementation of the RMK 12. It is projected to become one of the main contributors to the country's Gross Domestic Product (GDP). Minister of Agriculture and Food Security stated that the agricultural sector is anticipated to grow by 3.8 % annually during the RMK-12 period, contributing 7 % to the country's GDP by 2025. While implementing the 12th Malaysia Plan (RMK-12), the agricultural sector will be accelerated by leveraging intelligent technologies to enhance productivity and strengthen national food security across all agrofood subsectors.

The fishing and aquaculture sector will significantly attain multiple UN Sustainable Development Goals (SDGs) by 2030. These 17 goals are designed to eradicate poverty, tackle inequality, and combat climate change (Goal 14). Fishing and aquaculture are directly connected to several key Sustainable Development Goals (SDGs). SDG 2 (Zero Hunger)

emphasises achieving food security and promoting sustainable agriculture, with aquaculture and sustainable fishing playing a crucial role in providing nutritious food and eliminating hunger. SDG 14 (Life Below Water) focuses on the sustainable management and conservation of marine resources, including fishing, while promoting the responsible use of aquaculture to protect marine ecosystems. SDG 8 (Decent Work and Economic Growth) recognises the fishing and aquaculture sectors' employment opportunities and economic contributions, particularly in coastal communities. SDG 12 (Responsible Consumption and Production) encourages sustainable practices in fishing and aquaculture to ensure resource efficiency and minimise environmental impacts. Lastly, SDG 17 (Partnerships for the Goals) emphasises the importance of global collaboration and cooperation to achieve sustainable management of fishing and aquaculture. By aligning with these SDGs, fishing and aquaculture can support food security, poverty reduction, environmental conservation, and economic growth efforts.

The total fishing and aquaculture of the Southeast Asian region in 2019 reached a record of 46.77 million metric tonnes, with an average increase of 6.08 % annually over the past 15 years. Indonesia reported the highest fishing production in 2019 in terms of volume at 22.6 million metric tonnes or nearly 48.3 % of the region’s total fishing production, followed by Vietnam [8.2 million metric tonnes (17.7 %)], Myanmar [5.9 million metric tonnes (12.7 %)], Philippines [4.4 million metric tonnes (9.4 %)], and Thailand [2.5 million metric tonnes (5.3 %)]. The increased fishing production in Indonesia could have been due to many reasons, including an increased abundance of fish in several locations of the country, good weather with waves and wind that support fishing activities, an increase in the number of fishing vessels, as well as government support for fishing facilities, e.g., distribution of fishing gears in 2018 (KKP, 2019). In contrast, the fishery statistics of Thailand showed declining trends, particularly from 2006 until 2019, at an average rate of 3.4 % annually, mainly because of the yearly decrease in the production of marine capture fisheries (SEAFDEC, 2022).

In 2020, DOF recorded that fishing production was 1,383,299 metric tonnes, while aquaculture production was 400,017.59 metric tonnes. Compared with 2021, the production of the fishing and aquaculture sectors has increased to 417,187.68 metric tonnes and

1,328,041 metric tonnes, respectively, underscoring these industries' significant contribution to the country's economy and food security. Fishing and aquaculture contribute to the food supply by providing protein-rich seafood. They diversify the range of food options available, reducing reliance on traditional food sources and thus enhancing food security.

Among the top cultured species in Malaysia are seaweed, freshwater catfish, river catfish, red tilapia, seabass, tiger shrimp and white shrimp. The increasing trend of ornamental fish production in 2020-2021 was recorded from 227,944,067 pieces (worth RM 495 million) to 242,498,244 pieces (worth RM 534 million).

The Occupational Framework (OF) document is the basis for developing occupational standards, especially in the fishing and aquaculture sectors. The importance of the labour market in the fishing industry is crucial, and a clearly defined occupational structure outlined in OF can help improve the industry's effectiveness. The OF categorises industry-specific job titles and tasks into a hierarchy, with each level corresponding to the required level of expertise, complexity, knowledge, and autonomy. The OF is a valuable reference for fishing industry participants to identify available job positions and develop appropriate organisational structures in their respective companies. Additionally, the OF is a fundamental resource for creating National Occupational Skills Standards (NOSS).

This Occupational Framework (OF) was developed by individuals with extensive experience and knowledge in the fishing and aquaculture sector, including industry experts and professionals (Annex 2). These individuals likely contributed their knowledge and expertise to defining industry-specific job titles and tasks and identifying the corresponding levels of competency required for each. The intended outcome is to develop a comprehensive framework that accurately reflects the skills and knowledge needed to succeed in the fishing and aquaculture sector. Furthermore, the OF places significant emphasis on the Occupational Structure by highlighting industry-specific tasks and job titles tailored to meet the specific needs of the fishing and aquaculture sector. This comprehensive framework serves as a valuable reference for academic institutions, providing them with valuable insights and guidance in designing and offering relevant courses that align with the requirements of these industries. By utilising the OF as a reference, academic institutions can ensure that their

educational programs equip future workers with the necessary knowledge and skills demanded by the fishing and aquaculture sectors, fostering a skilled workforce prepared to contribute effectively to the fishing industry's growth and sustainability.

This chapter discusses the problem statement related to the OF in the fishing and aquaculture sector. It outlines the study's objectives, provides an overview of the scope and structure of the upcoming chapters, and explores the application of the OF for training purposes, including skills and curriculum development within academic organisations. The chapter aims to provide a clear understanding of the issues surrounding the OF, the goals of the research, and the potential benefits of incorporating the OF into training programs in the fishing and aquaculture sectors.

1.2. Problem Statement

An Occupational Framework (OF) is a complete record of a particular Occupational Structure (OS) that describes tier-based position areas and job/position titles inside the industry in Malaysia. Malaysia Standard Industrial Classification 2008 (MSIC) 2008 Version 1.0, produced by DOSM, is a boundary reference in developing this OF.

The fishing and aquaculture sector has many foreign workers, highlighting the industry's reliance on foreign labour instead of local workers. These industries can be characterised as hard work involving dirty, dangerous, and often difficult tasks, colloquially called “3D”. These challenges are precisely why the industry heavily relies on foreign labour. Youngsters or fresh graduates in Malaysia show little interest in pursuing careers in this field due to the physically demanding nature of the work and the insufficient salary it offers. To address this issue, efforts should be made to reduce the number of foreign workers and encourage more locals to work in the industry. The development of the OF can help in this regard by serving as a foundation for local training programs. Given the lack of a clear and specific job description and job title in the industry, the OF can provide a comprehensive framework for identifying the required competencies and skillsets necessary for success in the field. With a well-defined OF, training programs that target the specific competencies identified in the framework can be developed, enabling locals to gain the necessary skills and knowledge to

fill job vacancies in the industry. Encouraging more locals to work in the industry can reduce the dependence on foreign labour, ultimately leading to a more sustainable and locally driven fishing and aquaculture sector.

The OF articulates the work scope of a job area in terms of capabilities requirements and in-call for competency for the industry. The OF is the early process before developing the associated National Occupational Skills Standards (NOSS), the record that highlights labour capabilities. No OF has been documented for the fishing and aquaculture sector. Hence, the development of this OF is crucial because it serves as an essential reference for revising the existing NOSS and developing additional NOSS.

Prior to the OF development, the NOSS lacked specificity in the fishing and aquaculture sectors. The development of the OF indicates a need for a more comprehensive and industry-specific framework that can serve as a reference for training and skills development initiatives in the field. By providing a detailed and comprehensive framework, the OF can be used as a foundation for developing future NOSS in the fishing and aquaculture sector, ultimately contributing to a more skilled and capable workforce in the industry. This is crucial due to the current demand trends and supply of labour, which calls for identifying crucial jobs, required capabilities, and jobs relevant to the advancement of technology. These elements may also impact the occupational landscape. Hence, the OF for the fishing and aquaculture sector needs to be developed for future industrial and academic references.

1.3. Objectives of the Study

Five (5) study objectives have been underlined for this Occupational Framework (OF) development, as shown in the following Figure 1.1:

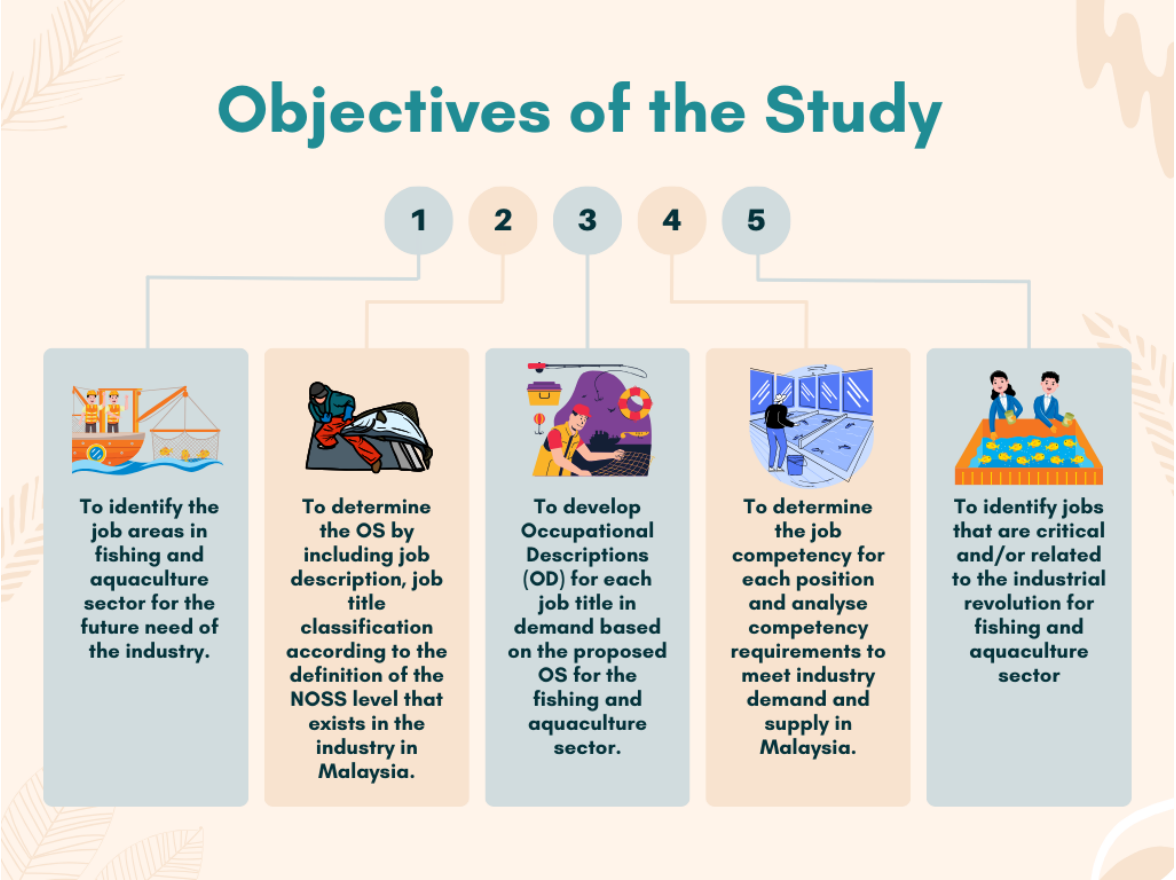

Figure 1.1: Objective of the Study

1.4. Scope of the Study

This study aims to analyse and identify the various occupational areas, job titles, competency levels, critical jobs, occupational responsibilities, and occupational descriptions within the agriculture, forestry, and fishing industry under Division A03 of the MSIC 2008 document. The study focuses explicitly on Group 031 Fishing and Group 032 Aquaculture (Table 1.1). By examining these groups, the study aims to provide a comprehensive understanding of the roles and responsibilities within this industry and the necessary competencies for each job title. This will ultimately contribute to developing a more competent and skilled workforce,

benefiting the industry. The scope of this Occupational Framework is developed for the Malaysia context. For representation and scope of data of this OF, please refer to Chapter 3.

The current landscape of skills standards in the fishing and aquaculture sector reveals that there are six available NOSS specifically tailored to the fishing domain, while 28 NOSS are available for the aquaculture domain. However, these NOSS currently do not have an OF in place to provide a structured framework for organising and aligning the industry's various job titles, competencies, and responsibilities. Developing an OF would benefit the fishing and aquaculture sector by providing a cohesive and standardised approach to training, skills development, and career progression.

Table 1.1: Summary of Scope Based on MSIC Section, Division and Group (Source: MSIC 2008)

Classification	Code	Title
Section	A	Agriculture, forestry and fishing
Division	03	Fishing and Aquaculture
Group	031	Fishing
	032	Aquaculture

For more details on the scope of this Occupation Framework (inclusion and exclusion of the areas in this OF based on MSIC), please refer to Table 2.1.

1.5. Significance of the Study

The OF will benefit the fishing and aquaculture sectors because it provides a standardised approach to identifying the different job titles, competencies, critical jobs, occupational responsibilities, and occupational descriptions within the industry. This will facilitate the development of a proper occupational structure, improving the industry's effectiveness and efficiency.

With the development of an OF, industry participants can identify the available jobs within the occupation industry and create the appropriate organisational chart in their respective companies. The OF will also serve as a fundamental reference for developing and revising existing NOSS, providing a basis for training and certifying workers in the industry.

In summary, while fishing and aquaculture sectors are related to the aquatic environment, they have distinct differences. An OF will apply to both industries by providing a standardised approach to identify the different job titles, competencies, critical jobs, occupational responsibilities, and occupational descriptions, ultimately improving the industry's effectiveness and efficiency.

1.6. The Occupational Framework (OF) Outline

This introduction concludes with a brief overview of the overall Occupational Framework (OF), visually outlined in Figure 1.2 as follows:

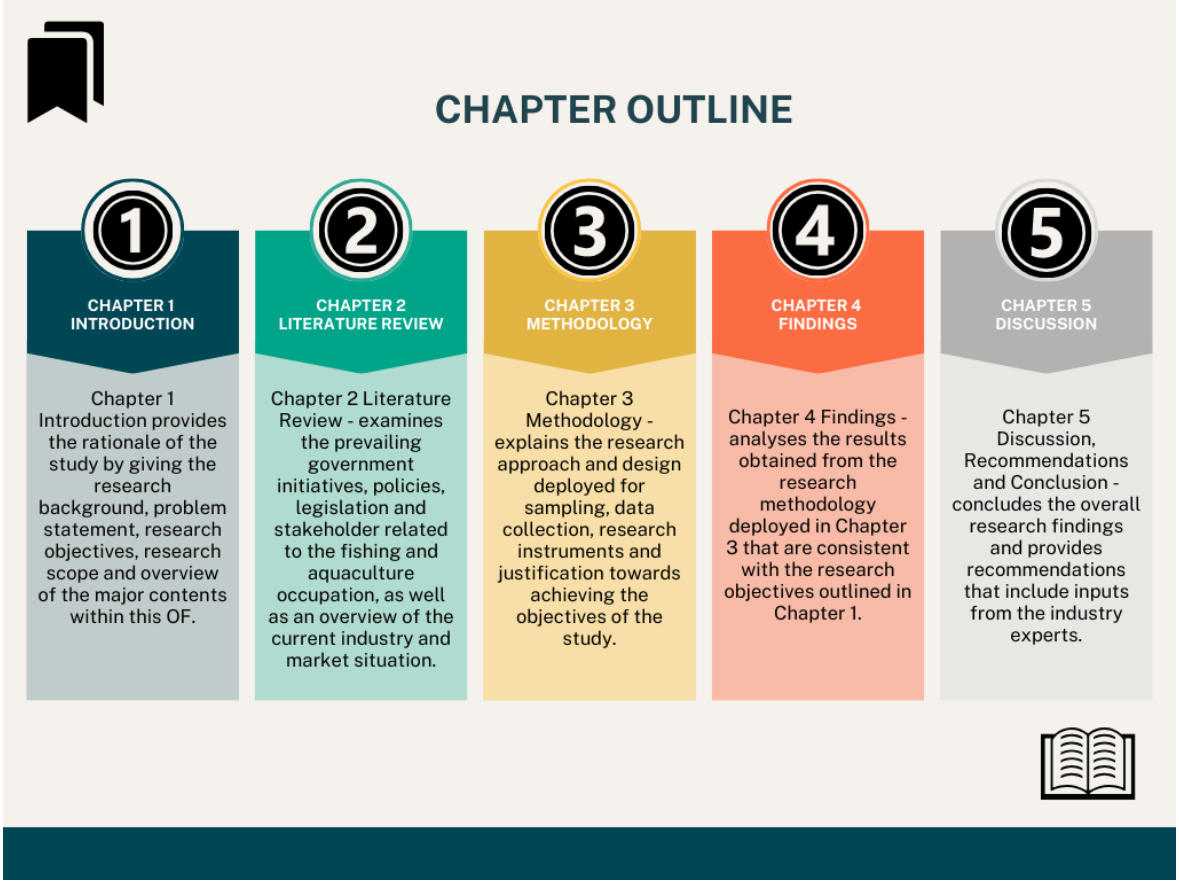

Figure 1.2: Chapters overview

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter highlights the industry's overview for the fishing and aquaculture sectors. It initially briefly explains the fishing and aquaculture sector, followed by Job Potential in the industry. This chapter also includes the Malaysian Skills Certification System and the Occupational Framework (OF) scope based on Malaysia Standard Industrial Classification 2008 (MSIC) Version 1.0. A list of key stakeholders and major industry participants (such as government agencies and regulatory bodies; government legislation, industry associations and professional bodies; and training centres) are also included. The examination of the market and the industries followed, along with comparisons between Malaysia and other ASEAN countries with advanced countries such as the United Kingdom and United States and a few others. The Industrial Revolution and its effects on fishing and aquaculture are also discussed.

2.2 Overview of Fishing and Aquaculture Sector

Fishing and aquaculture are both considered significant industries in Malaysia. Fishing refers to capturing or harvesting fish and other seafood from natural water bodies, while aquaculture refers to cultivating aquatic plants and animals.

2.2.1 Aquaculture

Aquaculture was first introduced in Malaysia during the 1920s through the extensive polyculture of Chinese carp, such as bighead carp, silver carp, and grass carp, in ex-mining pools. Blood cockles began in the early 1940s, followed by freshwater fish culture in earthen ponds in the mid-1950s. In the 1970s, the semi-intensive shrimp culture, characterised by low stocking density and pond fertilisation, was developed in Johor. During the same period, the floating net cage culture of marine fish, mainly green grouper, and the raft culture of green mussels also began to occur. In the early 1990s, intensive commercial aquaculture further enhanced aquaculture activities through high stocking density and complete dependence on supplementary feeding. This was made possible by establishing government and privately owned fish and shrimp hatcheries in the 1980s. Additionally, the establishment of private feed mills in the same period contributed to the commercialisation of aquaculture. As a result, aquaculture has become a lucrative and sustainable industry associated with the culture of high-value species, including shrimp, marine fish, and high-value freshwater fish.

Aquaculture systems encompass a wide range of operations, which can be intricate and overwhelming for beginners due to their diversity. Typically, these systems are classified based on three main criteria. First is the type of culture structure. The classification of aquaculture systems based on culture structure revolves around what encloses or supports the aquaculture organisms. For instance, aquaculture structures can include ponds, tanks, raceways, cages, and pens, depending on the specific requirements and characteristics of the operation. Secondly is water exchange. Water exchange refers to the degree of water movement or control within the aquaculture system. It describes the amount of water that is exchanged with the environment. The levels of water exchange can vary from static (limited exchange) to open (continuous exchange with the surrounding water body), semi-closed (controlled exchange), or recirculating (closed system with minimal water exchange). Third is the intensity of culture: The intensity of culture reflects two aspects: the stocking density of aquaculture organisms per unit area or water volume and the ability of the natural environment to support the crop. The intensity of culture can be categorised broadly as intensive (high stocking density and significant reliance on external feed inputs), semi-intensive (moderate stocking density with partial dependence on natural productivity), or extensive (low stocking density utilising the natural productivity of the environment). Lastly,

are the fish farming methods. This criterion relates to rearing different fish species within the same aquaculture system. Depending on the specific objectives and requirements, various fish farming methods can be employed, such as monoculture (cultivating a single fish species), polyculture (cultivating multiple compatible fish species together), or integrated multi-trophic aquaculture (combining fish with other organisms to create a symbiotic system).

2.2.2 Fishing

The fishing industry has been vital in supplying animal protein sources for decades in Malaysia. As for fishing, different types of practices are used in Malaysia, including coastal fisheries, deep sea fisheries, high sea fisheries and inland fisheries. Coastal fisheries involve fishing in waters within 12 nautical miles from the shore. Coastal fisheries refer to catching fish and other marine resources in shallow waters or coastal areas. It involves fishers using simple and traditional equipment or gear such as nets, fishing rods, and small boats. Other standard fishing methods in coastal fisheries include trawling, gillnetting, and purse seining. Coastal fishing activities are often carried out by traditional fishermen and play a crucial role in the economy and livelihoods of coastal communities.

On the other hand, deep-sea fisheries involve fishing in waters beyond 30 nautical miles from the coast. Deep-sea fisheries involve catching fish and marine resources in deeper waters far from the coastline. It requires larger vessels and advanced fishing technologies such as longlines, deep-sea trawls and purse seines. Deep-sea fishing typically targets species that inhabit greater depths, such as neritic and oceanic tuna. Due to the deeper waters, deep-sea fisheries present different technical and economic challenges compared to coastal fisheries.

High-sea fisheries or deep-sea fisheries in the high seas encompass fishing activities conducted in open waters beyond the Exclusive Economic Zone (EEZ), which is usually regulated by the Regional Fisheries Management Organization (RFMO). It involves using large vessels and sophisticated fishing technologies, such as large-scale purse seiners or longliners. High-sea fisheries typically target species that inhabit open waters and undertake migratory movements, such as tuna and other pelagic fish. High-sea fisheries often operate

at an industrial scale and can involve international operations.

Inland fisheries refer to fisheries in riverine waters, which include rivers, lakes, reservoirs, and other freshwater bodies. Inland fisheries may involve various fishing methods, such as nets, traps, and angling. It significantly provides food and livelihoods for communities near freshwater bodies, including recreational fishing and aquaculture activities.

Each type of fishery has its unique characteristics and challenges, but it is vital to manage and regulate fishing activities holistically to ensure the sustainability of fishery resources.

2.3 Job Opportunities in Fishing and Aquaculture

Malaysia's fishing and aquaculture sectors offer substantial employment opportunities, encompassing diverse roles throughout the value chain, including production, processing, and marketing. According to the Department of Fisheries (DOF), these industries collectively employ over 300,000 individuals in the country. This highlights the significant job potential within the fishing and aquaculture sector, contributing to local livelihoods and the economy.

The fishing industry relies on the expertise of fishers, fish processors, and traders to handle the capture. Recently, there has been an increasing demand for skilled workers in the fishing and aquaculture sector, particularly in breeding, genetics, nutrition and fish health management. Similarly, aquaculture farms necessitate the involvement of various workers, such as farm managers, technicians, hatchery workers, feed mill operators, and harvesters, to operate and manage the facilities effectively. The government has initiated diverse training programmes to address this demand, including vocational training and university courses specialising in fishing and aquaculture-related fields. These programs aim to equip individuals with the necessary knowledge and skills to meet the evolving needs of the industry and foster the development of a skilled workforce.

Malaysia's fishing and aquaculture sector offers diverse employment opportunities, particularly beneficial for individuals residing in rural areas. As the demand for seafood continues to rise and the industry experiences growth, there is a sustained need for skilled workers. This demand is expected to persist, creating long-term employment prospects. The

fishing and aquaculture sectors contribute to job creation and economic development, serving as a vital source of livelihood for many individuals. As the industry expands, it provides opportunities for career advancement, entrepreneurship, and developing specialised skills.

In Malaysia, the fishing and aquaculture sectors heavily depend on foreign workers to bridge the labour gap, as this industry has a shortage of skilled workers. This shortage often leads to unfilled positions and affects the overall productivity of the industries. To combat this issue, the government has implemented training centres to provide vocational training and practical work experience to school leavers. These programmes equip the local workforce with the skills and knowledge to excel in fishing and aquaculture. Additionally, the development of the OF for fishing and aquaculture is expected to establish a structured training and career development pathway for local workers. This framework will help address the skills gap and reduce the industry's reliance on foreign labour, improving productivity and long-term sustainability of Malaysia's fishing and aquaculture sector.

Furthermore, fishing and aquaculture play a crucial role in the global food industry, providing a significant source of protein and livelihood for millions of people worldwide. Recognising the importance of these sectors, the National Agrofood Policy 2021-2030 (NAP 2.0) has set forth a comprehensive plan to promote sustainable and inclusive fishing and aquaculture practices in the coming decade. Below are five initiatives designated for the fishing and aquaculture sector within the framework of NAP 2.0.

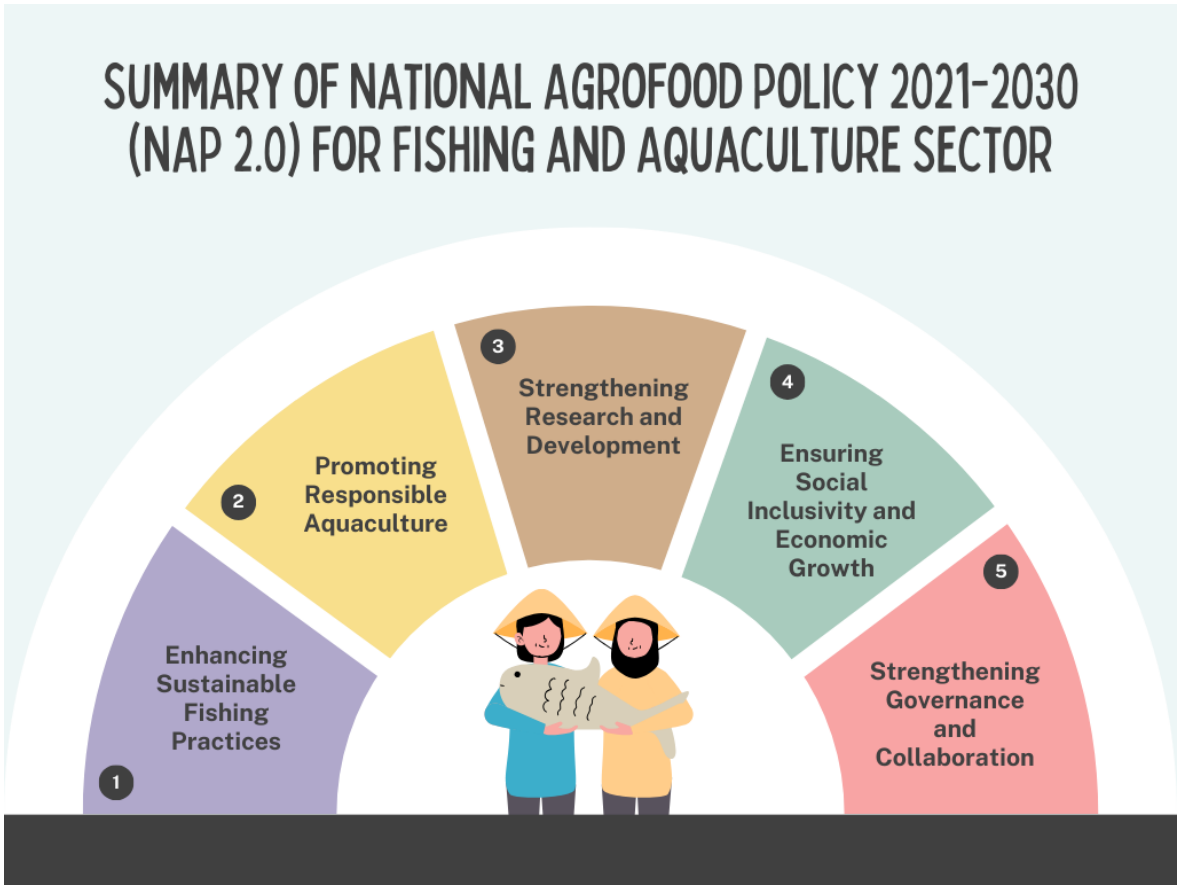

Figure 2.1: Summary of National Agrofood Policy 2021-2030 (NAP 2.0) for Fishing and Aquaculture Sector
(Source: Ministry of Agriculture and Food Security, Malaysia)

a) Enhancing Sustainable Fishing Practices: NAP 2.0 strongly emphasises sustainable fishing practices to ensure the long-term viability of fish stocks and marine ecosystems. The policy promotes the adoption of techniques such as selective fishing, gear modification, and the establishment of marine protected areas to prevent overfishing and protect vulnerable species. Additionally, it encourages using advanced technology and data-driven approaches to improve fishing efficiency and reduce bycatch.

b) Promoting Responsible Aquaculture: Aquaculture, cultivating aquatic organisms, is a rapidly growing sector that complements traditional fisheries. NAP 2.0 recognises the potential of aquaculture to meet the increasing global demand for seafood and emphasises responsible and sustainable practices. The policy encourages adopting best practices in fish farming, including proper waste management, disease prevention, and using environmentally friendly feeds. It also promotes the development of sustainable aquaculture infrastructure and implementing certification schemes to ensure consumer

confidence.

c) Strengthening Research and Development: To drive innovation and technological advancements in fishing and aquaculture, NAP 2.0 emphasises the importance of research and development. The policy supports scientific studies and collaborations to enhance our understanding of marine ecosystems, fish behaviour, and aquaculture techniques. It also encourages the development of new technologies, such as remote sensing and monitoring systems, to improve resource management and enhance productivity in both sectors.

d) Ensuring Social Inclusivity and Economic Growth: NAP 2.0 recognises the socio-economic importance of fishing and aquaculture, particularly for coastal communities and small-scale fishers. The policy aims to create an enabling environment that promotes inclusive growth and equitable distribution of benefits. It emphasises providing training and capacity-building programmes for fishers and aquaculture culturists and developing market linkages and value chains to enhance their economic opportunities.

e) Strengthening Governance and Collaboration: Effective governance and collaboration are crucial for the successful implementation of NAP 2.0. The policy emphasises the need for multi-stakeholder partnerships involving government agencies, research institutions, industry associations, and civil society organisations. It also promotes the establishment of transparent and accountable regulatory frameworks to ensure compliance with sustainable fishing and aquaculture practices.

The National Agrofood Policy 2021-2030 (NAP 2.0) sets a comprehensive roadmap for the sustainable development of fishing and aquaculture in the coming decade. By promoting sustainable practices, supporting research and development, and ensuring social inclusivity, NAP 2.0 aims to revolutionise these sectors, ensuring their long-term viability and contribution to food security, economic growth, and environmental conservation. With the implementation of this policy, we can look forward to a future where fishing and aquaculture thrive in harmony with nature and benefit communities around the globe.

2.4 National Skills Development Act 2006 (Act 652)

National Skills Development Act 2006 (Act 652) went into effect on September 1st, 2006, intending to encourage the growth and enhancement of a person's vocation-related skills through skills training. Act 652 is the first national legislation passed specifically for skill development and training. The Act serves as a vital impetus because it defines the parameters of skills training and provides a legal definition that can be used to differentiate it from other parts of the nation's national education and training system. Conversely, this Act made it possible to establish the five (5) levels of national skills qualification under the Malaysian Skills Certification System (MSCS), in which the Department of Skills Development (DSD) is the sole agency mandated to initiate, manage, and monitor all processes and procedures implemented under MSCS. Please see further discussion on MSCS below.

2.5 Malaysian Occupational Skill Qualification Framework (MOSQF)

The Malaysian Skills Certification System (MSCS) awards five (5) levels of national skills qualification, namely Malaysian Skills Certificate Level 1, 2, and 3; Malaysian Skills Diploma (Level 4); and Malaysian Skills Advanced Diploma (Level 5). The levels used in these qualifications are based on the Malaysian Occupational Skills Qualification Framework (MOSQF).

The MOSQF refers to a series of qualifications organised into different levels, each representing expertise and responsibility for occupational skills based on the national standard. The framework describes and breaks down an occupational skill into eight (8) competency levels. Each competency level corresponds to a different level of complexity, knowledge and autonomy required to demonstrate the competence commensurate with the knowledge, experience and versatility in its application at its respective level. The definition for each level of skills qualification specified based on the MOSQF can be referred to in **Annex 1**.

2.6 Malaysian Skills Certification System (MSCS)

Six (6) processes are in place to serve a common goal in contributing to developing trained labour skills in Malaysia under the MSCS. The ecosystem aims to capture and document the skills needs as driven and required by the industries to produce four public documents, namely the Occupational Framework (OF), National Occupational Skills Standard (NOSS), Written Instructional Materials (WIM) and Questions and Assessments. These documents are formulated as a baseline for training programmes to produce the industries' skilled workers and trained workforce. These training programmes can take place at training institutes as well as at the industries themselves based on the standards developed, in which the MSCS cycle entails a review of the industrial requirements from time to time to ensure the documents and standards are up to date with the current industry needs. Please refer to Figure 2.2 below for the complete cycle of the MSCS discussed.

Figure 2.2: Malaysian Skills Certification System (MSCS)
(Source: Department of Skills Development)

2.7 Occupational Framework (OF)

As part of the MSCS, OF is one of the core processes contributing to the national agenda under Act 652. This leads to the significance of OF development in many key sectors. The OF is a document that describes the job areas and job titles within a particular Malaysian sector. Before 2016, OF was known as Occupational Analysis (OA), created between 2005 and 2016 based on the Malaysia Third Industrial Master Plan's existing classifier (IMP3). The process takes into account research of pertinent employment structures and industry requirements. However, a more thorough document comprising specific aspects is required due to the Department of Statistics Malaysia (DOSM) move on industrial code entities, which impacts the OF.

2.8 Malaysia Standard Industrial Classification 2008 (MSIC) 2008 Version 1.0

All economic activities in Malaysia are categorised using the Malaysia Standard Industrial Classification (MSIC) 2008 version 1.0. This classification adapts the contents from the International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 4, published in 2008, to comply with the national standard. The MSIC 2008 replaces the MSIC 2000, which used ISIC Revision 3 produced by the United Nations Statistics Division. A collection of activities by categories is also MSIC's primary objective. It collects and disseminates data on pertinent economic operations. The industries are built by classifying units with a universal primary activity according to predetermined similarity criteria.

2.8.1. Scope of Occupational Framework Based on MSIC 2008

Based on the MSIC 2008 classification, the scope of the Fishing and Aquaculture industry is classified under Section A. In this section, there are three Divisions involved: (1) 01 – Crops and animal production, hunting and related service activities; (2) 02 - Forestry and logging; and (3) 03- Fishing and aquaculture. This document focuses specifically on A03, the Fishing and Aquaculture division. Under Division 03, two major groups of activities are Fishing and Aquaculture. Both groups are further divided into two classes and five items collectively. Table 2.1 summarises the hierarchy of sections, divisions and groups related to the fishing and aquaculture industry.

Table 2.1: Summary of Scope Based on MSIC Section, Division and Group
(Source: MSIC 2008)

Classification	Code	Title
Section	A	Agriculture, forestry and fishing
Division	03	Fishing and aquaculture
Group	**031**	**Fishing**
Class	0311	Marine fishing
Items	03111 03112 03113 03114 03115 03119	Fishing on a commercial basis in ocean and coastal waters Collection of marine crustaceans and molluscs Taking of aquatic animals: sea squirts, tunicates, sea urchins Activities of vessels engaged both in fishing and in processing and preserving of fish Gathering of other marine organisms and materials (natural pearls, sponges, coral and algae) Marine fishing n.e.c.
(1) Excludes	(a) capturing of marine mammals, except whales see 03111 (e.g. walruses, seals), see 0170 (b) processing of fish, crustaceans and molluscs on factory ships or in factories ashore, see 1020 (c) renting of pleasure boats with crew for sea and coastal water transport (e.g. for fishing cruises), see 50113 (d) fishing inspection, protection and patrol services, see 84239 (e) fishing practiced for sport or recreation and related services, see 93199 (f) operation of sport fishing preserves, see 93199	
(2) Includes	Capturing of whales	
Class	0312	Freshwater fishing
Items	03121 03122 03123 03124 03129	Fishing on a commercial basis in inland waters Taking of freshwater crustaceans and molluscs Taking of freshwater aquatic animals Gathering of freshwater flora and fauna Freshwater fishing n.e.c.
(3) Excludes	(a) processing of fish, crustaceans and molluscs, see 1020 (b) fishing inspection, protection and patrol services, see 84239 (c) fishing practiced for sport or recreation and related services, see 93199 (d) operation of sport fishing preserves, see 93199	

Classification	Code	Title
Section	A	Agriculture, forestry and fishing
Division	03	Fishing and Aquaculture
Group	**032**	**Aquaculture**
Class	0321	Marine aquaculture
Items	03211	Fish farming in sea water
	03212	Production of bivalve spat (oyster, mussel), lobster lings, shrimp post-larvae, fish fry and fingerlings
	03213	Growing of laver and other edible seaweeds
	03214	Culture of crustaceans, bivalves, other molluscs and other aquatic animals in sea water
	03215	Aquaculture activities in brackish water
	03216	Aquaculture activities in salt water filled tanks or reservoirs
	03217	Operation of hatcheries (marine)
	03218	Operation of marine worm farms for fish feed
	03219	Marine aquaculture n.e.c.
(1) Excludes	(a) frog farming, see 03225 (b) operation of sport fishing preserves, see 93199	
(2) Includes	(a) farming of marine ornamental fish	
Class	0322	Freshwater aquaculture
Items	03221	Fish farming in freshwater
	03222	Shrimp farming in freshwater
	03223	Culture of freshwater crustaceans, bivalves, other molluscs and other aquatic animals
	03224	Operation of hatcheries (freshwater)
	03225	Farming of frogs
	03229	Freshwater aquaculture n.e.c.
(3) Excludes	(a) aquaculture activities in salt water filled tanks and reservoirs, see 03216 (b) operation of sport fishing preserves, see 93199	
(4) Includes	(a) farming of freshwater ornamental fish (b) crocodile, alligators and snake	

2.9 National Occupational Skills Standard (NOSS)

The National Occupational Skills Standard (NOSS) is a document that describes the degree of proficiency necessary for an employee to work in Malaysia and the process for acquiring that level of competency. The National Skills Development Act 652's Part IV has been gazette. A team of professionals with experience in the field and excellent at their jobs design NOSS in response to market demands. When the Malaysia Skills Certification System is implemented, it serves as the primary reference. Therefore, before awarding the Malaysian Skills Certificate, the performance of industry workers and trainees will be evaluated using NOSS.

2.9.1 NOSS Relevant to MSIC 2008 Section A, Division 03

Currently, there are six (6) fishing and twenty-seven (27) aquaculture available National Occupational Skills Standards (NOSS) developed by the Department of Skills Development (DSD) that are associated with MSIC 2008 Section A, Division 03 Fishing and Aquaculture industry. Table 2.3 provides the complete information.

Table 2.2: NOSS relevant to MSIC 2008 Section A, Division 03 Fishing and Aquaculture (Source: DSD Standards Registry, 8 May 2023)

MSIC Group	No	NOSS Code	NOSS Title and Level
031– Fishing	1.	A031-001-5:2018	Fishing Fleet Management Level 5
	2.	A031-001-4:2017	Fishery Vessel Management Level 4
	3.	A031-002-3:2022	Capture Fishery Operation Level 3
	4.	Y-020-3	Fishery Technician Level 3
	5.	Y-020-2	Fishery Junior Technician Level 2
	6.	Y-020-1	Fishery Assistant Level 1
032- Aquaculture	1.	A032-001-5:2017	Fresh Water Aquaculture Management Level 5
	2.	A032-001-4:2017	Fresh Water Aquaculture Operation Administration Level 4
	3.	A032-006-3:2022	Fresh Water Aquaculture Operation Supervision Level 3
	4.	A032-006-2:2022	Fresh Water Aquaculture Operation Level 2
	5.	A032-002-5:2018	Marine Aquaculture Management Level 5
	6.	A032-002-4:2018	Marine Aquaculture Operational Administration Level 4

MSIC Group	No	NOSS Code	NOSS Title and Level
	7.	AF-022-3:2015	Marine Aquaculture Broodstock & Seed Production Level 3
	8.	A032-002-3:2017	Marine Aquaculture Operation Supervision Level 3
	9.	A032-004-3:2019	Marine Fish Seed Production Operation Level 3
	10.	A032-002-2:2017	Marine Aquaculture Operation Level 2
	11.	AF-019-3:2014	Sea Weed Farming Level 3
	12.	AF-021-3:2015	Semi-Refined Carrageenan Production Level 3
	13.	AF-032-5	Aquaculture Manager (Ornamental Fish) Level 5
	14.	AF-032-4	Aquaculture Executive (Ornamental Fish) Level 4
	15.	A032-007-3:2023	Fresh Water Ornamental Fish Farming Level 3
	16.	A032-007-2:2023	Fresh Water Ornamental Fish Farming Level 2
	17.	AF-033-5:2012	Freshwater Fry Production Management Level 5
	18.	AF-033-4:2012	Freshwater Fry Production Management Level 4
	19.	A032-005-3:2020	Freshwater Aquaculture Hatchery Operation Level 3
	20.	BT-026-5:2014	Spiny Lobster Hatchery Management Level 5
	21.	BT-026-4:2014	Spiny Lobster Hatchery Control Level 4
	22.	BT-026-3:2014	Spiny Lobster Hatchery Operation Level 3
	23.	BT-045-5:2014	Microalgae-Based Product Development & Management Level 5
	24.	BT-045-4:2014	Microalgae Culture & Bio-Mass Management Level 4
	25.	BT-045-3:2014	Microalgae Culture & Bio-Mass Production Level 3
	26.	BT-045-2:2014	Microalgae Operations Level 2
	27.	A032-003-3:2019	Marine Ornamental Fish Aquaculture Operation Supervision Level 3
	28.	A032-003-2:2019	Marine Ornamental Fish Aquaculture Operation Level 2

2.10 Industry Overview and Market Analysis

The relationship between the occupational framework and market analysis in fishing and aquaculture is symbiotic and essential for the industry's success. The occupational framework, encompassing various job roles and responsibilities, is influenced by market analysis findings. Market analysis, which examines market trends, consumer preferences, and competition, provides valuable insights that shape the occupational framework. It helps in workforce planning, identifying necessary skills, and adapting production practices to meet market demands. Market analysis also informs marketing and sales strategies, ensuring effective communication of product value to consumers. Additionally, it highlights regulatory changes that require compliance, which the occupational framework addresses by incorporating professionals with the relevant knowledge. The occupational framework and market analysis align the industry's workforce, production, marketing, sales, and regulatory practices with market dynamics and consumer needs.

Understanding how an industry's characteristics relate to its needs requires understanding the industry and the market. The knowledge is essential for creating strategies for the industry's expansion, such as those that address the development of the labour force, the need for training, and the business decisions of market participants. This section will provide insights into the aquaculture industry by examining its current growth and employment figures.

2.10.1 Growth of the Fishing and Aquaculture Sector

The majority of Malaysia's fishing is marine-based. In contrast to aquaculture, which provides only 0.39 million metric tonnes yearly, marine capture fisheries currently account for 77 % of all fishing production (Department of Fisheries, 2020), contributing over 1.45 million tonnes annually. Compared to the 1,383 300 metric tonnes in 2020, the number of marine fish captured in 2021 was 1,328,000 metric tonnes, a 4.0 % reduction (Table 2.3).

Most of the fish collected in Malaysia come from the coastal zone. Therefore, despite the monopoly of marine capture fish in the fishing industry, the trend will not continue to improve but rather fall in specific years. As a result, government support stimulates the establishment of aquaculture activities in addition to offering incentives for deep-sea fishing

ventures.

Department of Fisheries Malaysia regulates marine and inland capture fishery in Peninsular Malaysia. In Sarawak, capture fishery jurisdiction is split between the Department of Fisheries Malaysia for marine fishery and the Sarawak Ministry of Agriculture for inland fishery. A completely different governance for capture fishery exists in Sabah, which is under the Department of Fisheries Sabah (DOFS) regulations. Fishing zones in different regions of Malaysia are depicted in Figure 2.3 and Figure 2.4, respectively.

Aquaculture, which started in the 1920s, is experiencing tremendous growth and has taken the lead in supporting Malaysia's national food security. When method, cultivated species, and economic contribution were considered, aquaculture in Malaysia has significantly improved during the previous 15 years (Table 2.4). Various culture techniques and several species are presently employed to meet the demand for aquaculture goods. Marine water and freshwater cultures are currently being used, and their development is closely tied to domestic and global market demand for these products. The country's main exports are seaweed, shrimp, and marine fish.

Malaysian aquaculture is divided into various sectors, including producing food (freshwater and marine fish, shrimp and seaweed) and non-food (ornamental fish and aquatic plants) products. Up to 105,904.01 metric tonnes of fish worth more than RM 1.27 billion were produced in 2021 for freshwater aquaculture, while for marine aquaculture, the production was recorded at 311,283.67 metric tonnes with RM 3.17 billion.

The aquaculture industry in Malaysia focuses on cultivating various species, with notable mentions including marine shrimp, river catfish, African catfish, tilapia, seabass, and giant freshwater prawns. Among these species, seabass stood out as the most cultivated fish in 2021, with an impressive production of 34,186.73 metric tonnes. Freshwater catfish closely followed with a production of 31,957.80 metric tonnes. Tilapia and river catfish were popular choices, with respective productions of 30,022.49 metric tonnes and 21,144.21 metric tonnes. In the marine shrimp industry, white shrimp took the lead with an impressive production of 38,376.83 metric tonnes, while tiger shrimp followed with a production of 18,119.61 metric tonnes. These figures highlight the significance and diversity of species cultivated in the aquaculture industry in Malaysia.

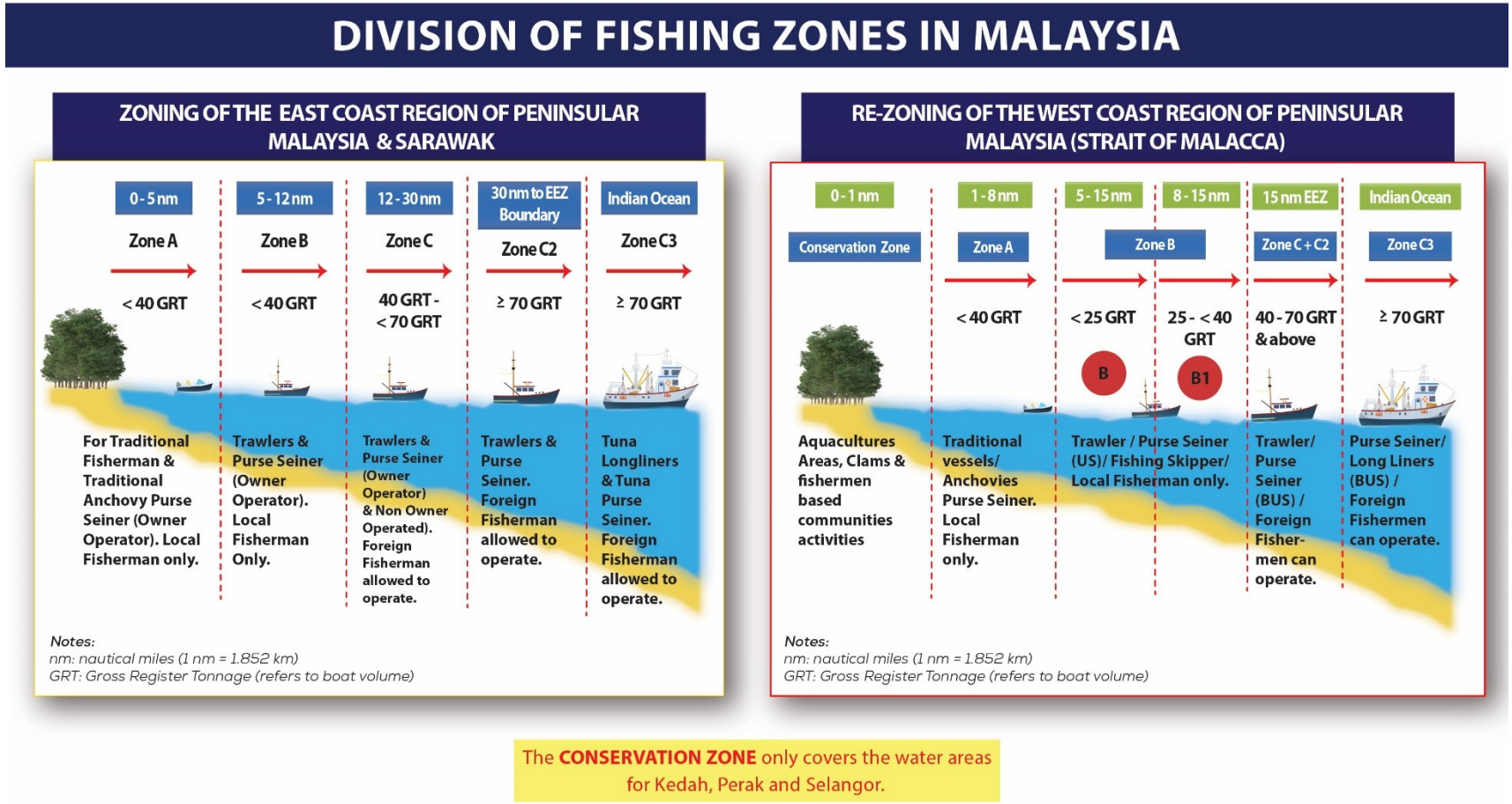

Figure 2.3: Fisheries Zones in Malaysia (Peninsular Malaysia)
(Source: Department of Fisheries, Malaysia)

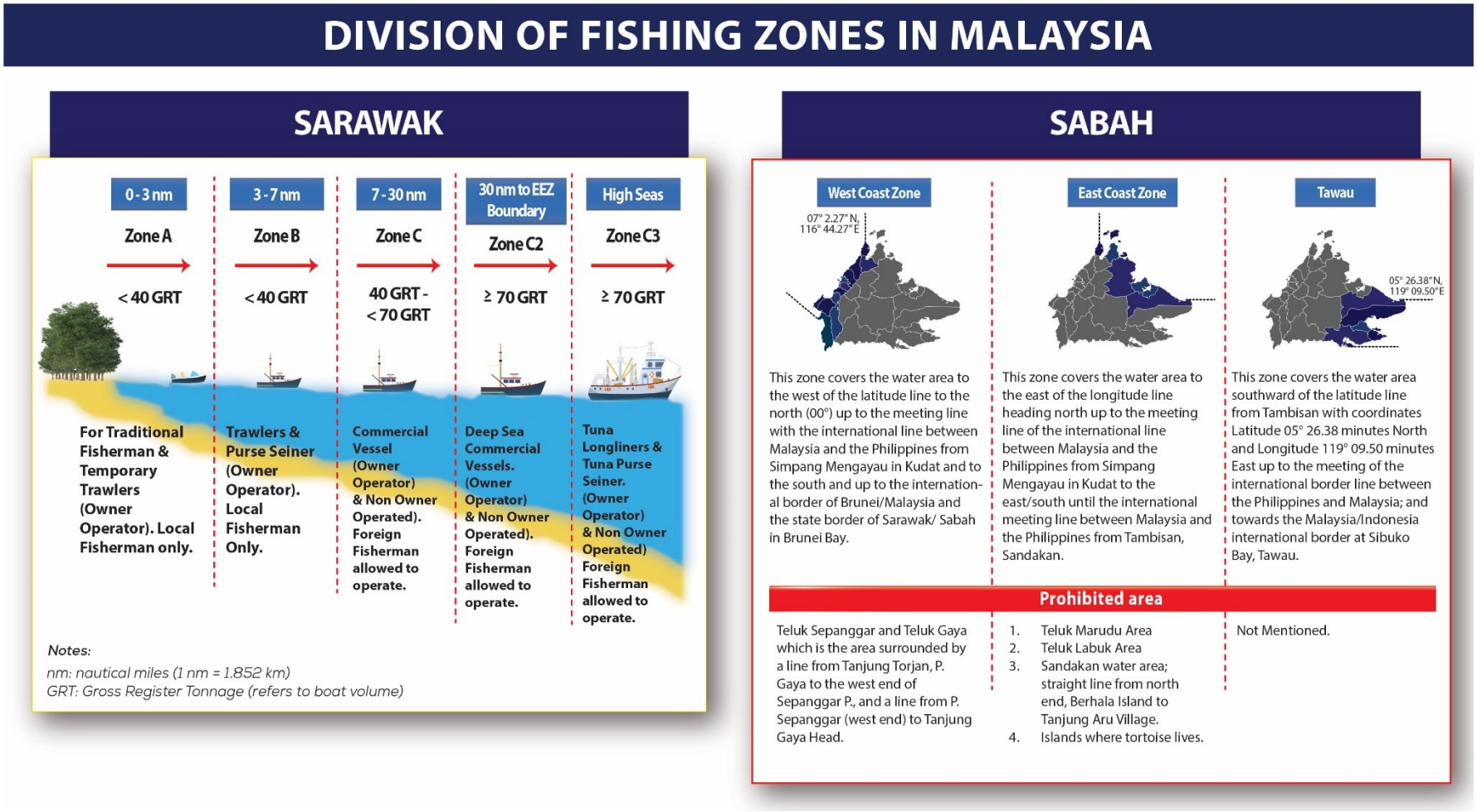

Figure 2.4: Fisheries Zones in Malaysia (Sarawak and Sabah)
(Source: Department of Fisheries Malaysia and Department of Fisheries Sabah)

The growth of the fishing and aquaculture sector in Malaysia has increased employment opportunities, particularly for workers involved in fish farming. The fishing sector in Malaysia also plays a significant role in providing employment opportunities. The marine capture fisheries, which account for 77 % of all fishing production in the country, employ fishers, boat captains, and processing workers. Despite the declining trend in marine captured fisheries production, this industry contributes to the country's economy and provides jobs for many workers.

As aquaculture production expands, more workers will be needed to fill various roles within the industry, including hatchery technicians, fish farm managers, fish feed mill operators, and fish processing workers. The rise of aquaculture as an industry has also created a demand for skilled workers with knowledge and expertise in aquaculture technology, fish biology, and environmental management.

The growth of both fishing and aquaculture sectors in Malaysia has created employment opportunities for workers in various roles within the industry. The focus on human capital development through the establishment of occupational frameworks and training programs is crucial for ensuring that the workforce is adequately trained to meet the demands of the industry. This, in turn, contributes to the sustainable growth of both industries and enhances food security in Malaysia.

Table 2.3: Fishing and Aquaculture production in Malaysia from the year 2014 to 2021 (Metric tonnes) (Source: Annual Fisheries Statistics, DOF, 2014-2021)

Year	**Aquaculture** (Metric tonnes)	**Fishing** (Metric tonnes)	
		Marine	**Freshwater**
2014	520,514.88	1,458,128	6,520
2015	506,275.55	1,486,051	5,924.19
2016	407,387.31	1,574,447	6,011.2
2017	427,015.43	1,456,113	5,177.19
2018	391,465.16	1,452,862	6,089.08

Year	Aquaculture (Metric tonnes)	Fishing (Metric tonnes)	
		Marine	Freshwater
2019	411782.14	1,455,446	5568.70
2020	400,017.59	1,383,299	5625.14
2021	417,187.68	1,328,041	5561.94

2.10.2 Employment Statistics

In Malaysia, the fishing and aquaculture sector is now growing significantly. This sector succeeded in creating and marketing high-value commodities to satisfy local demand and even export them to other countries as a commodity, contributing up to 0.2 % of the country's GDP (FAO, 2016). Government initiatives to help coastal communities out of poverty include elevating fishing and aquaculture practices (Solaymani and Kari, 2014). This industry has shown to be extraordinarily effective in enhancing the well-being of coastal households when practised under government oversight.

The employment in fishing and aquaculture is based on the data collected for the Agriculture, Forestry and Fishing sectors since these three activities are combined under one statistical team at the Department of Statistics Malaysia (DOSM). According to DOSM, there were 15,391.7 thousand persons who were employed in 2022. Among those, 1,540.8 thousand persons or 10.0 %, are engaged in agriculture, forestry, and fishing. With 67.54 % of the employed persons in this sector, Malaysian citizens continue to outnumber non-Malaysian citizens.

According to the Department of Fisheries Malaysia (DOF) figures, 24,936 local and 5,229 foreign employees worked in the aquaculture industry in 2021, an increase from 23,902 local and 5,159 foreign employees in 2020. The non-local employees are mainly from Vietnam, Indonesia, Nepal, India and Myanmar.

In the aquaculture sector, the culturist is usually a farm manager responsible for the day-to-day management of the aquaculture facility. This includes overseeing the breeding, feeding,

and harvesting fish and other aquatic species. The farm manager must deeply understand aquaculture practices and biology and know water quality and management. On the other hand, workers in the aquaculture industry are individuals employed by the aquaculture facility to carry out various tasks related to producing aquatic species. These tasks may include feeding the fish, cleaning tanks or ponds, and maintaining equipment. Table 2.4 shows the number of culturists and workers by aquaculture systems in 2020 and 2021.

Table 2.4: Number of culturists and workers by aquaculture systems in 2020 and 2021 (Source: Annual Fisheries Statistics, DOF, 2020 and 2021)

Systems	2020			2021		
	Culturist	Workers		Culturist	Workers	
		Local	Foreign		Local	Foreign
Freshwater ponds	11,692	12,413	627	12,099	12,940	654
Ex-mining pools	198	333	16	206	435	158
Freshwater cages	1,963	2,006	441	2,097	2,138	440
Cement tanks	817	919	85	986	1,143	118
Canvas tanks	86	106	-	83	107	-
Pen culture	155	157	-	145	150	-
Estate	6	21	-	7	23	-
Marine ponds	768	2,199	1,748	757	2,191	1,691
Marine cages	1,347	1,309	1,782	1,321	1,215	1,734
Brackishwater tanks	45	128	-	252	130	-
Brackishwater pen culture	376	376	-	227	377	-
Mollusc culture	813	1,599	48	883	1,493	37
Seaweed culture	1,194	1,191	-	1,187	1,183	-
Ornamental	789	1,122	406	976	1,383	391
Aquatic plant	13	23	6	15	28	6
Total	**20,262**	**23,902**	**5,159**	**21,241**	**24,936**	**5,229**

From 2010 to 2013, the number of local fishing workers gradually increased, reaching its peak at 107,509 in 2013 (Table 2.5). During this period, the number of foreign workers also experienced an increase, albeit with some fluctuations. However, from 2014 to 2015, there was a slight decline in the number of local workers, while the number of foreign workers

continued to increase, reaching its highest point at 38,612 in 2015. Between 2016 and 2019, the number of local workers fluctuated while the number of foreign workers decreased. In 2020, both local and non-local workers experienced a decrease, indicating the industry's potential challenges.

Despite these trends, the data highlights the significant reliance on foreign workers in Malaysia's fishing industry. The consistent presence of foreign workers over the years showcases their contribution to the industry's workforce, bringing specialised skills, knowledge, and expertise. The sustained number of foreign workers, even in 2021 with 24,549 individuals employed, indicates their ongoing significance to the industry. Their involvement helps address specific labour demands and skills gaps, ensuring productivity and the smooth operation of tasks within the industry. This reliance on foreign workers underscores the economic importance of the fishing industry in Malaysia, as their employment contributes to the country's overall economic growth. While the industry continues to rely on foreign workers, efforts can be made to invest in the training and development of the local workforce, aiming to bridge skills gaps and reduce dependency on foreign labour in the long term.

Table 2.5: Number of fishers working on licensed fishing vessels from 2010 to 2021 (Source: Annual Fisheries Statistics, DOF)

Year	Local	Foreign	Total
2010	93,066	36,556	129,622
2011	98,135	35,975	134,110
2012	105,891	30,623	136,514
2013	107,509	36,510	144,019
2014	107,109	36,312	143,421
2015	102,337	38,612	140,949
2016	98,279	34,026	132,305
2017	94,568	36,077	130,645
2018	94,781	33,367	128,148
2019	95,443	31,152	126,595
2020	90,443	29,385	119,828
2021	90,430	24,549	114,979

a) Labour supply

Based on the International Labour Organization (ILO), information relating to labour supply can be defined as the data on the population (actually or potentially) providing the labour input needed in the economy, that is, data on the employed, the unemployed and persons outside the labour force.

i) Number of persons engaged

According to the Department of Statistics Malaysia, there were 15,391.7 thousand persons who were employed in 2022. Among those, 1,540.8 thousand persons or 10.0 %, are engaged in agriculture, forestry, and fishing. Looking at gender distribution, more than two-thirds (79.4 %) of the employed persons are male, while another 20.6 % are female workers. 1,040.6 thousand employed persons (67.5 %) are Malaysian citizens engaged in this sector, whereas 500.2 thousand persons (32.5 %) are categorised as non-Malaysian citizens.

Table 2.6: Number of employed persons, 2022
(Source: Labour Force Survey Report 2022, Department of Statistics Malaysia)

Employed persons ('000)	2022	Male	Female	Malaysian citizens	Non-Malaysian citizens
Total	15,391.7	9,405.5	5,986.2	13,613.7	1,778.0
Agriculture, forestry and fishing	1,540.8	1,223.4	317.5	1,040.6	500.2

Further disaggregation by age group for overall employed persons, nearly one-third (33.3 %) of employed persons were in the age group of 25 to 34 years, comprising 5,124.8 thousand persons. Those aged 35 to 44 made up 25.6 % (3,933.5 thousand persons), while another 16.9 % (2,594.3 thousand) were between the ages of 45 and 54. Looking at the persons employed in the agriculture, forestry, and fishing sectors, most of the workforce was in the age group of 25 to 34 years (474.7 thousand persons), followed by the 35 to 44 age group (304.5 thousand persons). These two

categories contributed almost half the total number of people employed (50.6 %) in agriculture, forestry and fishing.

Table 2.7: Number of employed persons by age group, 2022
(Source: Labour Force Survey Report 2022, Department of Statistics Malaysia)

Employed persons ('000)	15 -24	25 - 34	35 - 44	45 - 54	55 – 64	Total
Total	2,416.1	5,124.8	3,933.5	2,594.2	1,323.1	15,391.7
Agriculture	268.4	474.7	304.5	258.8	234.4	1,540.8

ii) Salaries and wages

As of 2022, the Agriculture sector comprises 272.0 thousand (2021: 254.0 thousand) recipients, remained to record the lowest mean and median monthly salaries and wages at RM1,927 (2021: RM1,776) and RM1,504 (2021: RM1,490), respectively. Regarding gender, the mean monthly salaries and wages for male employees registered RM1,936 (2021:RM1,770), while female employees had RM1,890 (2021: RM1,798). Similarly, male employees posted a value of RM1,592 (2021: RM1,490) median monthly salaries and wages, whereas female employees at RM1,259 (2021:RM1,250). This information was obtained from the Salaries and Wages Survey Report, 2022, from the Department of Statistics Malaysia.

iii) Employment Statistics in the informal sector, 2021

Regarding the statistics of employment in the informal sector in 2021, there are 1,996.9 thousand persons, equivalent to 13.3 % of the overall employed persons in Malaysia. In terms of percentage share of employment statistics in the informal sector by economic sector, most of them were engaged in the Services sector, with 879.2 thousand persons or 44.0 %. This was followed by the Agriculture sector, which accounted for 694.1 thousand persons or 34.8 %.

Table 2.8: Number of employment statistics in the informal sector, 2021 (Source: Informal Sector and Informal Employment Survey Report 2021, Department of Statistics Malaysia)

Sector	Employment ('000)	Employment in the informal sector ('000)	Percentage Share to Informal Sector (%)	Percentage Share of (%)
Agriculture	1,550.0	694.1	34.8	44.8
Manufacturing	2,501.4	248.6	12.4	9.9
Construction	1,159.6	174.1	8.7	15.0
Services	9,771.3	879.2	44.0	9.0
Total	**15,064.2**	**1,996.9**	**100.0**	**13.3**

iv) Graduates statistics

Moving on to the statistics of graduates obtained from Graduates Statistics 2021, Department of Statistics Malaysia, the number of employed graduates in Malaysia recorded 4,569.1 thousand persons for 2021. The participation rate of graduates in the labour force remained at 85.0 % for 2021.

As for employed graduates by economic activity, the Services sector made up the most significant contributor with a share of 77.4 % (3,535.1 thousand persons). Regarding the employed graduates in the agriculture sector, there are 95.5 thousand persons or 2.1 % of the overall national employed graduates. Regarding the share by gender, males made up more than half of the country's employed graduates, with a share of 56.8 % (54.2 thousand) in 2021. Meanwhile, the female employed graduates comprised 43.2 % (41.3 thousand).

According to salaries and wages received, graduates in 2021 earned a mean monthly salary and wages of RM4,582 (2020: RM4,489). Employed graduates engaged in the Mining and quarrying sector received the highest salaries and wages at RM7,247 (2020: RM6,962), whereas the lowest mean monthly salaries and wages earned by the agriculture sector at RM3,301 (2020: RM3,229).

Similarly, mining and quarrying posted the highest median monthly salaries and wages for employed graduates, with RM5,586 (2020: RM5,576), while agriculture registered the lowest at RM2,404 (2020: RM2,374).

Table 2.9: Number of employed graduates by sector, 2021

(Source: Graduates Statistics 2021, Department of Statistics Malaysia)

Sector	Number of employed graduates ('000)	Percentage Share (%)	Mean monthly salaries and wages (RM)	Median monthly salaries and wages (RM)
Agriculture	95.5	2.1	3,301	2,404
Mining and quarrying	35.5	0.8	7,247	5,586
Manufacturing	627.8	13.7	4,113	3,072
Construction	275.3	6.0	4,246	3,284
Services	3,535.1	77.4	4,682	4,128
Total	**4,569.1**	**100.0**	**4,582**	**3,911**

b) Labour demand

According to the International Labour Organization (ILO), information related to labour demand refers to the users and uses of the labour input, that is, data on the enterprises creating employment, vacancies, jobs, and productivity.

i) Number of persons engaged, 2021

Department of Statistics Malaysia published the Annual Economic Statistics Agriculture 2022 for 2021. This publication refers to the establishment comprising the farm or estate registered with the Companies Commission of Malaysia, Co-operative Commission of Malaysia and Local Authorities.

There are 13,236 persons engaged in fishing and aquaculture activities, contributing 2.7 % of the overall workforce in the agriculture sector. The number of persons engaged in Aquaculture activities was 7,665 (57.9 %), primarily employed in marine aquaculture (73.9%). In the meantime, the fishing sector recorded 5,571 persons (42.1%), whereas marine fishing remains a crucial contributor to the total number of

persons engaged, which recorded 5,493 persons (98.6%).

Table 2.10: Number of persons engaged in 2021
(Source: Annual Economic Statistics Agriculture Sector 2022, Department of Statistics Malaysia)

Activity	Persons engaged	Percentage Share (%)
Total Agriculture	496,683	100.00
Fishing and Aquaculture	13,236	2.66
Fishing	5,571	1.12
Marine fishing	5,493	1.11
Freshwater fishing	78	0.02
Aquaculture	7,665	1.54
Marine aquaculture	5,668	1.14
Freshwater aquaculture	1,997	0.40

ii) Salaries and wages

Regarding full-time employed persons in fishing and aquaculture activities, there are 11,973 persons for the year 2021. By skills category, most of them were those classified as semi-skilled workers, comprising a share of 80.0 % or equivalent to 9,575 persons. On the other hand, employed persons in the skilled category comprised 12.2 %, recording 1,460 persons. Regarding mean monthly salaries and wages, full-time employees in the fishing sector earned RM2,290 per month during the reference period. The skilled workers received the highest mean monthly salaries and wages at RM3,909 per month, surpassing the mean monthly salaries of fisheries activity in 2021.

Table 2.11: Number of Paid Full-time Employed Persons and Salaries & Wages by Category of Skilled, Fisheries, 2021
(Source: Annual Economic Statistics Agriculture Sector 2022, Department of Statistics, Malaysia)

Skills	Persons engaged	Salaries and wages (RM '000)	Monthly salaries and wages (RM)
Total Fisheries	11,973	328,982	2,290
Skilled	1,460	68,488	3,909
Semi-skilled	9,575	241,690	2,103
Low-skilled	938	18,805	1,671

Note: Categories of skills are classified based on categorisation in the Malaysia Standard Classification of Occupations (MASCO) 2020.

- Skilled workers refer to Managers, Professionals, Technicians and associate professionals.
- Semi-skilled workers refer to clerical support workers, service and sales workers; skilled agricultural, forestry, and fishery workers; craft and related trades workers; and plant and machine operators and assemblers.
- Low-skilled workers refer to elementary occupations.

2.10.3 Education Institution

Several institutions and universities in Malaysia offer programs in fishing and aquaculture at the undergraduate and postgraduate levels, such as public universities: Universiti Putra Malaysia (UPM), Universiti Malaysia Terengganu (UMT), Universiti Malaysia Sabah (UMS), Universiti Sains Malaysia (USM), Universiti Malaysia Sarawak (UNIMAS) and Universiti Malaysia Kelantan (UMK). Polytechnics and vocational institutions in Malaysia also offer programs related to fishing and aquaculture (Table 2.12). These institutions focus on providing technical and vocational education and training to equip students with practical skills for specific industries. While they may not offer full-fledged degree programmes like universities, they offer diploma and certificate courses that are shorter in duration and more hands-on.

In the meantime, most of the workforce engaged in fishing and aquaculture are categorised as semi-skilled employment clustered together with agriculture, forestry and poultry activities. Regarding the employed graduates' statistics in the agriculture sector published by the Department of Statistics Malaysia for the year 2021, there are 95.5 thousand graduates

or 2.1 % as against the national employed graduates at 4,569.1 thousand persons. Considering salaries and wages, employed graduates in this sector received the lowest mean and median monthly salaries and wages at RM3,301 and RM2,404, respectively.

Many graduates in fishing and aquaculture chose not to pursue a career in the field, likely due to the demanding physical labour involved and the perceived lack of financial rewards. Work in fishing and aquaculture often involves strenuous activities such as manual labour, long hours, and exposure to harsh environmental conditions. Additionally, the salaries offered in this industry may not match the effort and dedication required. As a result, many graduates explore opportunities in other industries that offer higher earning potentials and do not require physically demanding work. These alternative industries may provide better financial stability and career prospects, enticing graduates to shift their focus. However, it is worth noting that a minority of graduates decide to stay in fishing and aquaculture due to their genuine interest in the field. These individuals are driven by their passion for marine life, sustainability, and the opportunity to contribute to the growth and development of the industry.

Table 2.12: Programmes Related to Fishing and Aquaculture Sector Offered in Education Institutions

Name	Programme Offered	Level
Universiti Putra Malaysia (UPM, Serdang Campus)	Agriculture (Aquaculture)	Degree
Universiti Putra Malaysia (UPM, Bintulu Campus)	Fisheries	Diploma
	Agriculture (Aquaculture)	Degree
Universiti Malaysia Terengganu (UMT)	Fisheries	Diploma
	Applied Science (Fisheries)	Degree
	Science (Aquaculture)	Degree
Universiti Malaysia Sabah (UMS)	Science (Aquaculture)	Degree
Universiti Malaysia Sarawak (UNIMAS)	Aquatic Science	Degree
Universiti Sultan Zainal Abidin (UniSZA)	Aquatic Science	Degree
Universiti Teknologi Mara, Malaysia (UiTM)	Aquaculture	Diploma
University College Sedaya International	Aquaculture with	Diploma

Name	Programme Offered	Level
(UCSI)	Entrepreneurship	
Universiti Selangor (UNISEL)	Aquaculture	Diploma
Tunku Abdul Rahman Universiti of Management and Technology (TAR UMT)	Aquaculture	Diploma
Universiti Tunku Abdul Rahman (UTAR)	Aquaculture	Diploma
Politeknik Jeli, Kelantan	Aquaculture	Diploma
Politeknik Sandakan, Sabah	Aquaculture	Diploma
Kolej Vokasional Dato' Lela Maharaja, Rembau	Aquaculture	Diploma
Kolej Vokasional Pertanian Chenor, Pahang	Aquaculture	Diploma
Kolej Vokasional (Pertanian) Teluk Intan, Perak	Aquaculture	Diploma
Kolej Vokasional Lahad Datu, Sabah	Aquaculture	Diploma
Kolej Komuniti Bera, Pahang	Aquaculture	Certificate
Kolej Komuniti Jerantut, Pahang	Aquaculture	Certificate
Kolej Komuniti Tampin, Negeri Sembilan	Basic Ornamental	Certificate
Kolej Perikanan Sultan Nazrin Muizuddin Shah	Fisheries and Aquaculture	Certificate and Diploma
Kolej Pertanian Malaysia, Bukit Tangga, Kedah	Aquaculture	Certificate
Akademi Perikanan Malaysia, Terengganu	Aquaculture	Certificate

2.11 Occupational Comparison Between Malaysia and Selected Countries

This section presents a comparative overview of the fishing and aquaculture sector, focusing on occupational comparisons among selected countries: Indonesia, Thailand, Vietnam, India, China, the United States and the United Kingdom. This comparison can provide insights into the relative importance, performance, and contributions of this sector to the economies of these countries. Comparing the value added in agriculture allows for economic analysis and assessment of the agriculture sector's contribution to the overall GDP of each country. It helps policymakers and economists understand the sector's significance in employment, income generation, and economic stability. By comparing value-added data, they can determine whether their policies increase productivity, profitability, and competitiveness in the agricultural sector.

Indonesia is one of the world's largest producers of fish and seafood. The fishing and aquaculture sector is a crucial source of employment, especially in coastal regions where the industry comprises traditional small-scale fishing and more extensive commercial operations. Thailand is a significant player in the global seafood market, with a well-developed seafood processing and export industry. The United States and the United Kingdom have a substantial seafood market, both for domestic consumption and export. China is the world's largest fish and seafood producer, and its exports play a vital role in the global market. India has a diverse fishing and aquaculture sector, focusing on freshwater and marine species. The industry employs many people, particularly in rural areas. India is also a major exporter of seafood products. Vietnam's growing seafood industry has seen significant export growth, particularly to markets like the United States and Europe. Small-scale aquaculture is prevalent in rural areas.

2.11.1 Malaysia

On an annual basis, Malaysia’s economy expanded by 8.7 % in 2022, amounting to RM1,510.9 billion at constant prices. In terms of absolute value added for the Agriculture sector, this sector grew marginally at 0.1 % to record RM99.1 billion. In the meantime, Fishing contributed 0.8 % to the overall real value added in 2022. Further disaggregation by marine fishing and aquaculture accounted for 0.5 % and 0.3 %, respectively. It is observed

that aquaculture posted a growth of 7.6 % (2021: -0.2%), while marine fishing declined to 0.3 % (2021: -0.4%) in 2022.

Table 2.13: Real Value Added for Agriculture Sector, 2021 and 2022
(Source: Gross Domestic Product 2015-2022, Department of Statistics Malaysia)

Economic activity	Real value added (RM million)		Annual percentage change (%)	Percentage share to gross domestic product (%)	
	2021	2022	2022/2021	2021	2022
Gross domestic product	1,390,644	1,510,939	8.7	100.00	100.00
Agriculture	99,000	99,073	0.1	7.12	6.56
Fishing	11,250	11,532	2.5	0.81	0.76
Marine fishing	7,266	7,245	-0.3	0.52	0.48
Aquaculture	3,984	4,287	7.6	0.29	0.28

Notes
* Includes 4-digit MSIC 0311 and 0312

2.11.2 Indonesia

The agriculture sector played a crucial role in contributing to a double-digit percentage share of 12.3 % in the Indonesian gross domestic product at constant prices for 2022. This sector registered a growth of 2.3 % to record a value of 1,435,853 billion rupiah during the reference period. In the meantime, fishing accounted for 2.4 % of overall real value added, growing 2.8 % in 2022. Indonesia is one of the world's top fish-producing countries, second only to China. Notably, Indonesia's tuna fisheries stand out as one of the largest and most prosperous globally. The thriving performance of these fisheries has not only bolstered the country's economy but has also solidified Indonesia's position as a critical player in the global fish production industry.

Table 2.14: Value added for the Agriculture sector, 2021 and 2022
(Source: Badan Pusat Statistik, Indonesia)

Economic activity	Real value added (Billion Rupiah)		Annual percentage change (%)	Percentage share to gross domestic product (%)	
	2021	2022	2022/2021	2021	2022
Gross domestic product	11,120,077	11,710,397	5.3	100.00	100.00
Agriculture	1,404,190	1,435,853	2.3	12.6	12.3
Fishing	267,966	275,452	2.8	2.4	2.4

2.11.3 Thailand

Thailand's Fishing and Aquaculture industry is overseen by the Department of Fisheries, which operates under the Ministry of Agriculture and Cooperative. Thailand holds a prominent position as one of the leading producers within the ASEAN countries. According to the Southeast Asian Fisheries Development Centre, Thailand was ranked 15th globally in capture fisheries and 10th in world aquaculture production in 2019. These rankings highlight Thailand's significant contribution to the global fishing and aquaculture industry, showcasing its importance as a key player.

2.11.4 Vietnam

AquaFeed.com stated that Vietnam produced 3.84 million tonnes of aquaculture products in 2017, including 2.69 million tonnes of fish and 723,800 tonnes of shrimp. Aquaculture accounted for more than 53 % of Vietnam's total seafood production of 7.23 million tonnes, as mentioned by Aquaculture Vietnam. Vietnam is ranked as the world's fourth-largest aquaculture producer, behind China, Indonesia, and India. The aquaculture industry in Vietnam has shown promising growth figures, positioning itself to become a significant player in the global market. Vietnam is the world's third major exporter of fish and fishery products, with exports valued at USD 8.5 billion in 2017. In 2022, Vietnam's agriculture, forestry, and fishing sectors accounted for 11.88 % of the country's gross domestic product (GDP).

2.11.5 India

Fishing and aquaculture made up over 1.5 trillion Indian rupees in gross value added to agriculture across India in fiscal year 2020, as mentioned by Statista. This sector's gross value added (GVA) has increased consistently since fiscal year 2012. Food and Agriculture Organization stated that the share of the fisheries sector in the total GDP (at current prices) increased from 0.40 % in 1950-51 to 1.03 % in 2017-18, recording an increase of 157 %. The sector contributed Rs. 1,75,573 crore to the GDP (at current prices) during the fiscal year of 2017 to 2018 (Ministry of Statistics and Programme Implementation, 2020). The sector has been showing steady growth in the total gross value added, accounting for about 6.58 % of the agricultural GDP.

2.11.6 China

China has the most significant capture fisheries and aquaculture production worldwide, accounting for 19.2 % of global marine capture fishery production and 61.5 % of global aquaculture production in 2016 (FAO, 2018). According to GlobalEconomy.com, China's Gross Domestic Product (GDP) was worth 17,963.17 billion US dollars in 2022. In 2021, the gross value of fisheries and aquaculture production in China amounted to around 1.45 trillion yuan. China contributes more than 60 % to the global aquaculture output and is expected to account for 38 % of the fish supply for the world's human consumption by 2030 (FAO, 2014).

2.11.7 United States

Even though Americans do not consume much seafood, the country's extensive coastline offers opportunities for fishing. Statista, United States, mentioned that the seafood industry received around $6.25 billion in landing income in 2021 due to capture production. The United States caught about 8.5 billion pounds of fish in the same year. Pollock, salmon, hake, and flatfish are some of the most common domestic species. In 2020, the United States was one of the world's top exporters of fish and fisheries. The aquaculture production value in the United States reached over US$1.5 billion in 2019, as stated by BlueCart, Inc. Between inland aquaculture and marine and coastal aquaculture, the Americas produced over 2.4 million tonnes of finfish in total in 2020. According to IBIS World, 10,229 people are employed in the US fish and seafood aquaculture industry as of 2023. The number of people

employed in the US's fish and seafood aquaculture industry increased by 0.5 % on average over the five years between 2018 and 2023. The average business in the US fish and seafood aquaculture industry now employs more workers than it did five years ago.

2.11.8 United Kingdom

In the United Kingdom, the agriculture sector contributed 0.71 % to the gross value added for 2022. This sector grew 3.5 % to record a value of 2,003 trillion pounds. Looking at the fishing and aquaculture activities, the percentage share of this sector was 0.04 % of the overall economy in the United Kingdom.

Table 2.15: Value added for the Agriculture sector, 2021 and 2022
(Source: Office for National Statistics, United Kingdom)

Economic activity	Real value added (million Pounds)		Annual percentage change (%)	Percentage share to gross domestic product (%)	
	2021	2022	2022/2021	2021	2022
Gross value added	1,921,434	2,003,592	4.3	100.00	100.00
Agriculture	13,811	14,293	3.5	0.72	0.71
Fishing & aquaculture	839	828	-1.3	0.04	0.04

British fishing boats bring 200,000 to 300,000 tonnes of fish from abroad and about 400,000 tonnes from within the UK annually. The UK fleet's landings increased (+5%) in 2021 compared to 2020 after dropping by almost 11 % between 2018 and 2019. Reduced pelagic fish landings, which have since increased, were primarily responsible for this initial decline. Shellfish landings fell in 2020 but rose once more in 2021. The UK fleet made more landings in recent years, totalling slightly over £1 billion in 2018, before declining to £831 million in 2020 and rising once more to £921 million in 2021. There were approximately 11,000 fishers in the UK in 2021, down from about 20,000 in the mid-1990s. Fifty-three per cent of fishers were based in England and Wales in 2021, followed by Scotland with 40 % and Northern Ireland with 8 %. Since 1996, the number of fishing boats in the UK fleet has decreased by 33 %.

2.12 Relation of Industry Revolution with Occupation

The term "Industry 4.0" refers to strategies for digitalisation and automation of the manufacturing process based on the integration of disruptive technologies that result in intelligent, autonomous, and decentralised plants ("smart factories") that communicate and cooperate with people in real-time. The abbreviation "4.0" refers to the fourth industrial revolution, which is associated with many cutting-edge technologies and has significant room for growth. These include the Internet of Things, smart manufacturing, and cloud computing. (Table 2.16).

The Industrial Revolution 4.0 shifted from an agrarian economy to a manufacturing economy where products were no longer made solely by hand but by machines, thus increasing production and efficiency, lower prices, more goods, improved wages, and migration from rural to urban areas. Industrialisation has accelerated the development of farming technology, catching and landing fish. Technology has also advanced fish processing, with beneficial results such as improved preservation, quality control, transportability, and consumer convenience.

Improved processing technologies have permitted the expansion of indirect uses of fish products and increased use of fishmeal for livestock feed or fertilizer. The increasingly large and diversified industry has created many new opportunities for paid employment in the catching, farming, processing and marketing of fish.

However, it generates concerning environmental consequences, including chemical and biological pollution, disease outbreaks, unsustainable feeds and competition for coastal space. The challenge of attaining sustainable aquaculture is to develop innovative, environmentally, socially, and economically well-balanced systems that optimise production efficiency and maintain the health of coastal and inland ecosystems. The Industrial Revolution 4.0 aquaculture systems should produce food using a comparatively lower number of natural resources, energy, and recycled wastes while generating ecosystem services simultaneously.

Table 2.16: List of technologies used in the fishing and aquaculture sector

No.	Technology	Description
1.	Automated system	Artificial feeding automation, running big offshore fish cages, including cage maintenance, removal of dead fish, and relocation of the roaming cage as needed; biofouling prevention, recirculating aquaculture system (RAS) (Gladju et al., 2022).
2.	Big Data Analytics	Analysis of large volumes of data can support productivity growth based on a real-time decision-making process (Rather et al., 2023).
3.	Cloud computing	Storing and accessing data over the Internet (Mustapha et al., 2021).
4.	Internet of Things (IoT)	All machines and systems can collect, exchange and store huge data without human intervention (Thai – Nghe et al., 2020).
5.	3D Print	Used in prototyping and small-scale production to produce desired components faster and more précised. Robotic fish, shrimp, or lobster created using 3D printing mimic the movements of stock species without changing their appearance. The camera and sensors built into their bodies continue to provide feedback on the health of the aquaculture system, including the condition of farmed species, the quality of the water, and any structural issues with the culture facilities that need to be repaired (Yue & Shen, 2022).
6.	System Integration	Linking together different computing systems and software to act as a coordinated whole via IoT (Gladju et al., 2022).
7.	Cybersecurity	Protect critical industrial systems and data collected (Thai – Nghe et al., 2020).
8.	Simulation	Leverage real-time data to reflect the physical world in virtual models. Include machines and products. Allow operators to test and optimise systems virtually before the physical changeover, saving time and increasing quality (McCausland et al., 2006).

2.13 Related Issues in the Fishing and Aquaculture Sector

The fishing sector is vital to the global economy, providing sustenance, employment, and economic value to countless communities worldwide. However, it is beset with interconnected challenges and issues that demand attention and innovative solutions. From overfishing and habitat destruction to the impacts of climate change and the need for sustainable practices, the fishing sector stands at the intersection of environmental, economic, and social concerns.

Aquaculture is a rapidly growing industry. It has become an essential food source and livelihood for millions worldwide. However, several related issues must be addressed to ensure the sustainability and ecological integrity of aquaculture practices. Some of the issues highlighted in the fishing and aquaculture sector include:

2.13.1 Environmental impact

Fishing and aquaculture activities have the potential to create both positive and negative environmental impacts. On the positive side, they can contribute to food security, economic growth, and employment opportunities. However, these activities can pose significant environmental challenges if not managed properly.

One of the critical concerns is poor waste management. Aquaculture operations generate substantial waste, such as uneaten feed, faeces, and excess nutrients. If not properly managed, these wastes can accumulate in the surrounding water bodies, leading to water pollution and degradation of water quality. This pollution can harm aquatic ecosystems, disrupt the natural balance, and affect the health of marine and freshwater species. Another environmental concern is the use of chemicals and antibiotics in aquaculture. While these substances are often necessary to prevent diseases and promote growth, their improper use or overuse can have detrimental effects. Excess chemicals and antibiotics can enter the surrounding environment, leading to water pollution and the development of antibiotic resistance in aquatic organisms (Sampantamit et al., 2020). The expansion of aquaculture activities can result in habitat destruction and loss of biodiversity (Hashim et al., 2021). The clearing of coastal areas for shrimp farms or the modification of river systems for fish farms can disrupt natural habitats and affect the populations of native species.

Captured fisheries activity can have significant and multifaceted effects on the environment. One of the most prominent concerns is overfishing, where fish stocks are harvested at a rate exceeding their natural replenishment. It can lead to the depletion of fish populations and disrupt the delicate balance of marine ecosystems. Overfishing affects the targeted species and has cascading effects throughout the food web, impacting predator-prey relationships and altering the abundance and distribution of other marine organisms.

In addition to overfishing, certain fishing practices can cause substantial habitat destruction. Bottom trawling, for example, involves dragging heavy nets or dredges along the seabed, destroying vulnerable habitats like coral reefs, seagrass meadows, and benthic communities. These habitats serve as crucial nurseries, spawning grounds, and shelter for diverse marine species. Their degradation can disrupt ecological processes, decrease biodiversity, and compromise the overall health of marine ecosystems. Fishing activities can contribute to pollution. Discarded fishing gear, often called "ghost nets," can continue to entangle and harm marine life long after being abandoned. Accidental fuel spills, chemical releases, and wastewater discharge from fishing vessels can introduce pollutants into the marine environment, impacting water quality and harming marine organisms.

Adopting sustainable fishing and aquaculture practices is essential to address these environmental challenges. It includes implementing proper waste management systems, such as recirculating systems or treatment ponds, to minimise the release of pollutants into the environment. Sustainable aquaculture also involves reducing the use of chemicals and antibiotics through responsible farming practices and disease prevention strategies. Implementing fishing quotas and gear restrictions and establishing marine protected areas can help conserve fish populations, protect vulnerable habitats, minimise bycatch, and reduce pollution. These efforts aim to strike a balance between meeting the societal need for seafood and ensuring the long-term health and sustainability of marine ecosystems and the livelihoods of fishing communities.

2.13.2 Overfishing and Depletion of Fish Stocks

Overfishing, illegal fishing, and unsustainable fishing practices have emerged as significant challenges in the fishing and aquaculture sector. These practices have resulted in the depletion of fish stocks in many regions, threatening marine ecosystems and the industry's

long-term viability. Implementing sustainable fishing practices, such as setting catch limits and quotas, establishing protected areas, and combating illegal fishing, are crucial to addressing these challenges (Johnson et al., 2021). Promoting responsible seafood consumption and raising consumer awareness about sustainable fishing can support the industry's sustainability efforts.

Efforts to address overfishing and unsustainable practices include implementing science-based management approaches, strengthening regulations, and investing in research and innovation. By promoting responsible fishing practices and encouraging selective gear to minimise bycatch, the industry can reduce its ecological impact and protect vulnerable species. Certification programs, such as the Marine Stewardship Council (MSC) and Aquaculture Stewardship Council (ASC), provide consumers with information about sustainably sourced seafood products, helping drive demand for responsibly harvested fish.

Turtle Excluder Device (TED) and MAED (Malaysia Acetes Efficiency Device) are essential measures in fisheries. Turtle Excluder Devices are devices installed in fishing nets to prevent the accidental capture of sea turtles, contributing to conservation efforts and ensuring compliance with regulations. Malaysia Acetes Efficiency Devices establish designated areas where exclusion devices, like TEDs, are mandatory, preserving marine life and enforcing conservation measures. These measures help protect vulnerable species, reduce bycatch, promote sustainability, and foster stakeholder collaboration. Overall, TEDs and MAEDs play a crucial role in resolving issues related to marine life conservation and promoting sustainable fishing practices in the fisheries industry.

Collaboration among governments, industry stakeholders, scientists, and communities is essential for sustainable fisheries. By adopting sustainable fishing practices, managing fish populations effectively, and promoting responsible consumption, we can ensure the health of our oceans and preserve fish resources for future generations.

2.13.3 Disease Transmission

High stocking densities in aquaculture facilities can spread diseases and parasites, posing challenges for the industry. Diseases like bacterial, viral, and fungal infections and sea lice infestations can affect farmed species and potentially spread to wild populations if not properly managed.

To address these challenges, maintaining suitable biosecurity measures is crucial. It involves implementing protocols to prevent disease introduction and spread within aquaculture facilities, such as disinfection procedures and regular health screenings (Padros et al., 2022). Disease prevention strategies, like managing water quality and implementing vaccination programs, also play a vital role in minimising the occurrence and impact of diseases.

Effective disease management is essential to control outbreaks and minimise economic losses. Early detection, rapid response, and appropriate treatment protocols are critical. Regular health monitoring, diagnostic testing, and targeted treatments, such as antimicrobial agents or vaccines, are essential tools in disease management.

2.13.4 Regulatory Compliance and Enforcement

Ensuring compliance with regulations, addressing illegal, unreported, and unregulated (IUU) fishing practices, and enforcing sustainable practices are ongoing challenges faced by the fishing and aquaculture sectors. It is crucial to have robust regulatory frameworks to govern fishing activities and promote responsible practices. It includes setting clear guidelines and standards for fishing operations, establishing catch limits and fishing quotas, and implementing measures to protect vulnerable species and habitats.

To address IUU fishing practices, more robust surveillance and enforcement capabilities are essential (Selig et al., 2022). It involves improving monitoring systems, increasing patrols and inspections, and collaborating with international partners to combat illegal fishing activities. Additionally, promoting industry compliance is crucial for ensuring sustainable practices. It can be achieved through education and awareness programs, incentives for sustainable fishing methods, and partnerships between government agencies, industry stakeholders, and local communities.

By strengthening regulatory frameworks, enhancing surveillance and enforcement capabilities, and promoting industry compliance, the fishing and aquaculture sector can effectively address challenges related to regulations, IUU fishing, and sustainable practices (Schmidt, 2005). These efforts contribute to the conservation of fish stocks and marine ecosystems and support the long-term viability and sustainability of the industry. It requires the collective commitment and collaboration of governments, industry players, scientific

communities, and civil society to achieve these goals and ensure the responsible management of our aquatic resources.

2.13.5 Feed Sustainability

In the context of feed sustainability, it is vital to address the reliance on wild-caught fish for farmed fish species. Many carnivorous farmed fish species require significant quantities of wild-caught fish to meet their nutritional needs, creating a potential strain on wild fish populations (Hua et al., 2019). Developing alternative feed sources that reduce reliance on wild fish stocks is crucial in promoting sustainable aquaculture.

Research and innovation in feed technology also aim to enhance the nutritional composition of alternative feeds, ensuring that farmed fish receive the necessary nutrients for healthy growth and development. It includes optimising feed formulations, improving digestibility, and exploring the use of microorganisms and novel ingredients to enhance the nutritional profile of aquafeeds.

By adopting sustainable feed practices, the aquaculture industry can contribute to conserving wild fish populations, reducing the pressure on marine ecosystems, and enhancing the industry's overall sustainability. Continued research, collaboration between industry stakeholders, and regulatory support are vital in driving the transition towards more environmentally friendly and resource-efficient feed options in aquaculture.

2.13.6 Animal Welfare

Animal welfare is a crucial aspect of fishing and aquaculture, and the OF plays a vital role in ensuring its implementation. Aquaculture facilities and fisheries operations must prioritise the humane treatment of farmed aquatic animals and wild-caught fish, providing them with appropriate living conditions to minimise stress, disease, and injury.

The OF serves as a comprehensive guide for workers in the fishing and aquaculture sector, outlining best practices and standards for animal welfare. It emphasises the importance of creating suitable habitats that mimic the animals' natural environment, ensuring adequate space, clean water, and proper nutrition. In aquaculture, where farmed fish are raised, the framework promotes using sustainable feed sources to minimise reliance on wild-caught fish, reducing pressure on wild fish stocks and improving overall sustainability.

Incorporating animal welfare standards in the OF aligns with global initiatives and guidelines for sustainable fishing and aquaculture, such as those set by the Food and Agriculture Organization of the United Nations (FAO). of the animals and the long-term sustainability of the fishing and aquaculture sector. These efforts contribute to the overall improvement of practices, the well-being of the animals, and the long-term sustainability of the fishing and aquaculture sector (Jentoft & Chuenpagdee, 2015; FAO, 2014).

2.13.7 Social and Economic Issues

Social and economic issues can arise in the aquaculture industry, leading to conflicts and concerns regarding the well-being of coastal or marine communities. The expansion of aquaculture operations can sometimes result in conflicts with traditional fishers who depend on the same coastal or marine resources. This competition for space and resources can lead to disputes over access to fishing grounds and the potential depletion of fish stocks.

In addition, labour exploitation and human rights abuses have been associated with certain aquaculture practices. In regions with inadequate labour regulations and enforcement, low-wage labour and poor working conditions have been reported in the industry. These issues raise ethical concerns and emphasise the need for fair labour practices and protecting workers' well-being and rights. A study by Belton and Little (2011) highlighted labour exploitation and poor working conditions in the aquaculture industry, particularly in

Southeast Asia.

By integrating social and economic considerations into the OF, the fishing and aquaculture sector can strive for sustainable development while ensuring the well-being of workers, communities, and the environment. Governments, industry associations, and relevant stakeholders need to collaborate in developing and implementing the OF, ensuring that it aligns with international best practices and local context.

2.13.8 Regulatory Challenges

Regulatory challenges in the aquaculture industry are crucial for ensuring sustainable practices (FAO, 2020). One key aspect is the establishment of effective regulations and monitoring systems that govern various aspects of aquaculture operations (Phillips et al., 2018). These regulations encompass zoning, water quality standards, and enforcement of best management practices (Bosma & Verdegem, 2011).

Zoning is vital in regulating aquaculture facilities' location and spatial distribution, minimising conflicts with other coastal or marine users (FAO, 2020). Water quality standards are essential for maintaining the quality of water bodies where aquaculture operations occur, ensuring the well-being of aquatic organisms and ecosystems (FAO, 2020). Enforcement of best management practices is crucial for promoting responsible aquaculture operations and mitigating environmental risks (Troell et al., 2014).

Collaboration among government agencies, industry stakeholders, and scientific experts is essential for addressing regulatory challenges (Bosma & Verdegem, 2011). This collaboration facilitates the development of robust regulatory frameworks and the implementation of effective monitoring and enforcement mechanisms (Phillips et al., 2018). Working together makes it possible to balance industry growth and environmental sustainability in aquaculture (Troell et al., 2014).

Integrating the OF with regulatory mechanisms enhances the aquaculture industry's sustainability and ethical practices. By prioritising the welfare of workers and aquatic animals, the regulatory framework supports the aquaculture industry's long-term viability and responsible development.

2.13.9 Climate Change

The impacts of climate change, such as rising sea temperatures, ocean acidification, and extreme weather events, pose risks to the fishing and aquaculture sectors (FAO, 2020). These environmental changes can disrupt marine ecosystems, affect fish populations, and alter the productivity of aquaculture systems. Adapting to climate change, building resilience, and mitigating associated risks are significant challenges facing the fishing and aquaculture sector.

Addressing these issues requires collaborative efforts among government agencies, industry stakeholders, researchers, and communities. Implementing sustainable practices, such as optimising water and energy use, reducing greenhouse gas emissions, and diversifying aquaculture species, can help minimise the industry's environmental footprint and enhance its resilience to climate change impacts. Investing in research and development is essential for understanding the specific vulnerabilities and developing innovative solutions to mitigate climate-related risks. Furthermore, enhancing regulatory frameworks to incorporate climate change considerations, such as setting guidelines for adaptation and resilience planning, can provide a supportive framework for the industry (FAO, 2020).

The OF can guide workers, industry stakeholders, and policymakers in implementing adaptive strategies to minimise the industry's vulnerability to the impacts of climate change. It includes adopting sustainable aquaculture practices, investing in research and development to identify climate-resilient species and systems, and enhancing regulatory frameworks to incorporate climate change considerations. By incorporating climate change adaptation and mitigation measures into the OF, Malaysia's fishing and aquaculture sector can enhance its resilience, minimise risks, and contribute to the sustainable management of marine resources in the face of a changing climate.

2.13.10 Summary of Related Issues in the Fishing and Aquaculture Sector

The occupational framework in fishing and aquaculture plays a critical role in addressing related issues by incorporating skilled professionals who can promote sustainable fishing practices, implement fisheries management measures, and enforce regulations to prevent overfishing. Within aquaculture, the framework enables adopting of eco-friendly practices, disease management strategies, and biosecurity measures to minimise environmental impacts and ensure the health and productivity of farmed fish. It also facilitates the implementation of quality assurance systems and traceability measures to ensure food safety and consumer confidence. Additionally, the framework can promote ethical labour practices, social responsibility, and worker welfare while supporting adaptation to climate change through resilient aquaculture systems.

2.14 Key Stakeholders

The fishing and aquaculture sector stakeholder refers to any person, group, organisation or society with interest in the industry. They will also have the capability to influence the sector or become affected by any actions, objectives and policies coming from the industry in specific or the economic environment in general. Malaysia's fishing and aquaculture sector stakeholders comprise government agencies, regulatory bodies, industry associations, professional bodies and training centres.

2.14.1 Government Agencies and Regulatory Bodies

Table 2.17 and Table 2.18 provide information on the Government Agencies and Regulatory Bodies related to fishing and aquaculture.

Table 2.17: Government Agencies Related to the Fishing and Aquaculture Sector

No.	Organisation	Overview, Roles, Functions and Responsibilities
1.	Ministry of Health (MOH)	Holds the highest authority in terms of laws, policies and guidelines related to public health
2.	Ministry of Agriculture and Food Security (KPKM)	To assess, formulate, monitor, and implement Malaysian agricultural development policies, strategies, and initiatives
3.	Department of Fisheries Malaysia	(a) To develop a dynamic market-based fisheries industry through creative and innovative approaches.

No.	Organisation	Overview, Roles, Functions and Responsibilities
	(DOF)	(b) To manage the national fishery resources efficiently, innovatively and environmentally friendly based on scientific information and good governance. (c) To enhance the delivery system through skilful, knowledgeable and professional human capital.
4.	Fisheries Development Authority of Malaysia (LKIM)	(a) Encourage and promote efficient and effective management of the fish industry and marketing. (b) Establish and supervise credit facilities for fish production and ensure that these facilities are fully utilised. (c) Participate in fisheries enterprises, boat construction, and fish supplies and equipment production. (d) Encourage, intensify, facilitate and work for the economic and social progress of Fishermen's Associations. (e) Register, control and supervise Fishermen's Associations and provide allocations for related matters.
5.	Department of Veterinary Services (DVS)	(a) To prevent, control and eradicate animal and zoonotic diseases. (b) To facilitate the growth and development of a strong animal industry. (c) To ensure that animal products for human consumption are wholesome, clean, safe and suitable. (d) To facilitate the growth and development of the animal feed industry and ensure the welfare and well-being of all animals.
6.	Ministry of Natural Resources, Environment and Climate Change	Responsible for energy, natural resources, environment, climate change, land, mines, minerals, geoscience, biodiversity, wildlife, national parks, forestry, surveying, mapping and geospatial data.
7.	Department of Environment (DOE)	(a) Set targets/compliance reports according to the type of pollution premises and regulations under AKAS 1974. (b) Regulate the receipt and distribution of environmental pollution complaints for action by the State DOE or relevant agencies. (c) Manage the database of environmental pollution complaints and periodic reports on the status of complaint resolution to KASA and the Public Complaints Bureau.

No.	Organisation	Overview, Roles, Functions and Responsibilities
		(d) Dealing with the National Disaster Management Agency (NADMA) under the Coordination of the National Security Council (MKN), JPM. (e) Update and manage inventory database of permanent sources of pollution, enforcement results, notices of instruction, compounds, prohibition orders and court actions.
8.	Department of Irrigation and Drainage (DID)	(a) Provide engineering and technical services to the Federal Government in the following areas: -Water Resources Management and Hydrology, River Basin Management, Coastal Zone Management, Flood Management, Sustainable Stormwater Management, Hydromechanical Management, Hydro Infrastructure Engineering, Dam Management, Federal Project Management, (b) Plan, design, manage and supervise projects funded by Federal Government allocations.
9.	Department of Forestry (FDPM)	Act as an agency implementing policies and enforcing forestry laws and regulations.
10.	Ministry of Science, Technology & Innovation (MOSTI)	Providing services to address national issues through scientific approaches, the latest technology, and human capital development
11.	Department of Chemistry (KIMIA)	(a) Evaluation of product specifications for government contracts to ensure value for government expenditure (b) Customs tariff classification of goods for import/export (c) Chemical laboratory evaluation for compliance with ISO Standards. (d) Food and some industrial products for export are also analysed to ensure compliance with international quality and safety standards, thereby ensuring global market competitiveness.
12.	Department of Agriculture Sarawak (DOA)	To increase the income of the farming community and become a net exporter of agro-food through the modernisation and commercialisation of agriculture
13.	Department of Fisheries Sabah (DOF Sabah)	(a) Improve the socio-economic status of fishermen and farmers in the state of Sabah. (b) Develop the sustainable fishing industry, including aquaculture, in Sabah. (c) Increase fish production from the sea fishing and

No.	Organisation	Overview, Roles, Functions and Responsibilities
		aquaculture industry in Sabah. (d) Implement the management of all fisheries resources in the state of Sabah correctly and rationally to guarantee a sustainable industry and resources. (e) Carry out research work to improve fisheries' technology and resource management efforts. Promote the fishing industry as a commercial, modern, viable business and trade sector.
14.	Ministry of Human Resources (MOHR)	Responsible for skills development, labour, occupational safety and health, trade unions, industrial relations, industrial court, labour market information analysis, and social security.
15.	Department of Occupational Safety & Health (DOSH)	Ensuring the safety, health and welfare of people at work and protecting other people from the safety and health hazards arising from the activities sector.
16.	District and Land Office	District and Land Offices act as planners, coordinators, monitors and program implementers at the district level. It also manages land development so that it is carried out in an orderly and planned manner and complies with the requirements of the law.

Table 2.18: Regulatory Bodies Related to Fishing and Aquaculture Sector

No	Organisation	Overview, Roles, Functions and Responsibilities
1.	Malaysian Quarantine and Inspection (MAQIS)	(a) To enforce all relevant written laws at entry points, quarantine stations and quarantine premises to ensure that plants, animals, carcasses, fish, agricultural products, soil, microorganisms and food imported into and exported out of Malaysia comply with health aspects humans, animals, plants, fish and food safety. (b) To issue permits, licenses and certificates to import and export plants, animals, carcasses, fish, agricultural products, soil and microorganisms. (c) To ensure that all plants, animals, carcasses, fish, agricultural products, soil, microorganisms and food imported into and exported out of Malaysia are graded, packaged and labelled following the relevant written laws. (d) To establish and manage quarantine stations (e) If necessary, participate in inspecting and certifying the exporting country's premises with relevant agencies and departments. (f) To participate in relevant agencies and departments at the international level in matters related to quarantine and import and export of plants, animals, carcasses, fish, agricultural products, soil, microorganisms and food, if necessary. (g) To provide feedback and recommendations to relevant agencies or departments on any matter related to importing and exporting plants, animals, carcasses, fish, agricultural products, soil, microorganisms and food. (h) To facilitate and provide advisory services on compliance with import and export requirements for plants, animals, carcasses, fish, agricultural products, soil, microorganisms and food to importers, exporters and agents involved in the import and export of plants, animals, carcasses, fish, agricultural products, soil, microorganisms and food. (i) To perform additional functions necessary for implementing the Malaysian Quarantine and Inspection Services Act 2011 [Act 728].

No	Organisation	Overview, Roles, Functions and Responsibilities
		(The above functions must follow policies, instructions and requirements as determined by the relevant agencies and departments).
2.	Standards and Industrial Research Institute of Malaysia (SIRIM)	It functions as the National Standards Body and the National Accreditation Body to ensure that Malaysian products and services can meet national and world standards.
3.	Immigration Department of Malaysia (JIM)	(a) Issuing of passports and travel documents to Malaysian Citizens and Permanent Residents. (b) Issuing of visa passes and permits to Foreign Nationals entering Malaysia. (c) Managing the movement of people at authorised entry and exit points. (d) Enforcing the Immigration Act 1959/63, Immigration Regulations 1963, Passport Act 1966, Anti-Trafficking in Persons and Anti-Smuggling of Migrants Act 2007 (Amendment 2010)
4.	Department of Labour Peninsular Malaysia (JTKSM)	(a) To study, review and enact amendments to labour laws, regulations, and orders as needed. (b) To plan and carry out labour education programs and promotional programs relating to enforcing the national labour legislations, focusing on laws enforced by the department. (c) To manage, handle and solve labour complaints. (d) To manage, handle and solve employee' and employers' labour disputes through the Labour Court. (e) To handle and deal with sexual harassment complaints at the workplace. (f) To manage human resources, finances, acquisitions, assets, and the development and administration of department's logistics. (g) To manage employees' retrenchment activities. (h) To process and investigate applications for certificate of accommodation under Act 446. (i) To process and investigate applications for foreign workers. (j) To process applications of labour permits. (k) To process application of private employment agencies' licences.
5.	Department of Standards Malaysia	Providing credible standardisation and accreditation services to facilitate international trade and develop

No	Organisation	Overview, Roles, Functions and Responsibilities
	(JSM)	industry competitiveness towards enhancing economic growth and societal and environmental well-being.
6.	Malaysian Maritime Enforcement Agency (MMEA)	(a) Enforce law and order under any federal law in the Malaysian Maritime Zone (b) Carry out maritime search and rescue tasks in the Malaysian Maritime Zone and in the high seas. (c) Prevent and restrict the commission of offences in the Malaysian Maritime Zone. (d) Assist in any criminal matter at the request of a foreign State as provided under the Mutual Assistance in Criminal Matters Act 2002 (Act 621). (e) Conduct aerial and coastal surveillance. (f) Provide platform services and support to any relevant agency. (g) Establish and manage a maritime institution for the training of Agency officers. (h) Perform any duty to ensure maritime welfare and safety or perform everything incidental. (i) Controlling and preventing maritime pollution in the open ocean. (j) Preventing and suppressing piracy and preventing and suppressing the illegal distribution of narcotic drugs in the high seas. (k) Functioning under the command of the Malaysian Armed Forces during extraordinary crises, emergencies, or war.

2.14.2 Industry Associations

Table 2.19 provides information on the Industry Association responsible for the Fishing and Aquaculture Sector.

Table 2.19: Industry Association Related to Fishing and Aquaculture Sector

No	Organisation	Overview, Roles, Functions and Responsibilities
1.	Malaysian Fisheries Society (MFS)	To advance knowledge on all aspects of fisheries and related activities with particular reference to Malaysia and the neighbouring region to foster rational development and management of aquaculture, capture fisheries and related

No	Organisation	Overview, Roles, Functions and Responsibilities
		activities for food, recreation and conservation. The society does this by organising meetings, seminars, forums, and various publications.
2.	Malaysia Aquaculture Development Association (MADA)	(a) To Promote and safeguard the interests of the members of the Association (b) To develop and foster friendship and cooperation among the members (c) To promote the growth and development of the aquaculture industry in Malaysia (d) To undertake and organise seminars, conferences, training courses, exhibitions and related activities of various types (e) To provide and produce relevant publications for the interest, benefits and academic pursuits of members subjects to the prior approval of the appropriate authorities (f) To acquire and exchange knowledge and experience among fish and prawn farmers and breeders and related registered bodies, local and abroad, to improve the standards and quality in the aquaculture industry (g) To strive for greater recognition of the Malaysian aquaculture industry in local and overseas market
3.	Marine Fish Farmers Association of Malaysia (MFFAM)	(a) Provide the latest information on emerging trends in the industry among its members through regular distribution of bulletins and newsletters. (b) Conduct aquaculture training and hands-on workshops by a team of industry experts to benefit its members and other interested parties. (c) Hold annual conferences and seminars on various subjects related to practical aquaculture operations and techniques. (d) Engage and affiliate with research institutions and universities to collaborate on practical research, educational and technological development and information exchange. (e) Assist its members in carrying out advocacy works at the national level. (f) Provide information on the latest pioneering findings and technological breakthroughs to its members. (g) Provide an annual membership directory to aquaculture suppliers.

No	Organisation	Overview, Roles, Functions and Responsibilities
4.	*Persatuan Nelayan Kebangsaan* (NEKMAT)	Progressive body responsible for safeguarding the well-being of the fishermen under its association.
5.	Fishing Cooperative / *Koperasi Nelayan*	Protecting the well-being of the fishermen who are members of its association.
6.	*Persatuan Nelayan Kawasan* (PNK)	Protecting the well-being of the fishermen who are members of its association.

2.14.3 Training Centres

Table 2.20 provides information on training centres related to Fishing and Aquaculture Sector in Malaysia.

Table 2.20: Training Centres on Fishing and Aquaculture Sector

No.	Training Centres	Description
1.	Aquaculture Incubator Centre, Department of Fisheries	The Aquaculture Incubator Centre is one of the central core services the Fisheries Department provides to advance the country's aquaculture subsector. The programme's implementation aims to provide exposure and application of new technologies that are more efficient in production capacity, cost savings, workforce reduction, environmental friendliness and compliance with trade standards. The implementation of this program is also one of the approaches to encourage investment by private companies in the field of aquaculture. The Aquaculture Incubator Program includes training activities (formal or informal), technical support services in the field, equipment loans, input supplies, exhibitions, demonstrations, promotions, and publication of reference media. The Aquaculture Extension Program is the main responsibility of the Aquaculture Development Division.
2.	Kolej Perikanan Sultan Nazrin Muizuddin Shah (KPSN)	Previously known as Kolej Perikanan Lumut. The establishment of this college is an aspiration to modernise and transform the primary agricultural industry through the training model and the development of a skilled human model, in addition to being able to produce a workforce among the youth and overcome the issue of a lack of skilled local workforce and dependence on foreign

No.	Training Centres	Description
		workers. Offers three categories of courses: Malaysian Skills Certificate Course, Malaysian Skills Diploma and Up Skilling Training, to the Department of Fisheries (DOF) target groups such as fish farmers and fishermen.
3.	Akademi Perikanan Malaysia	Academy under the Malaysian Fisheries Department, Ministry of Agriculture and Food Security. APM has been established to provide technical training to fishermen, fishing industry operators, and civil servants in the fisheries industry, namely Pre-Harvest and Post-Harvest.
4.	Bahagian Pembangunan Kapasiti Latihan Pertanian (BPKLP)	(a) The programmes implemented are based on the National Occupational Skills Standard (NOSS) or Standard of National Occupational Competency (SPKP), which provides competency-based training and focuses on practical training, projects, and simulations. The PLKPK certification is accredited by the Department of Skills Development (JPK), Ministry of Human Resources. (b) Produce confident, skilled, and competitive agricultural entrepreneurs. Cultivate a skilled and professional workforce to serve in the private sector in agriculture. Serve as a platform for trainees to further their education to higher levels.
6.	Institut Pertanian Malaysia	Produce a skilled workforce to help transform the country's agricultural sector.
7.	Aquaculture Extension Center	Providing technical advice to farmers covering farming methods, fish harvesting methods, fish storage methods, etc. Apart from that, it also provides theoretical and practical advisory services.
8.	Fisheries Research Institute (FRI)	(a) FRI Headquarters in planning, implementing, monitoring, and evaluating research programs, development, and commercialisation (R&D&C) for 13 institutes/divisions/centres/ units under the Fisheries Research Institute. (b) Manage, coordinate, implement and monitor the FRI management and development budget or the planned research. (c) Manage personnel, asset, financial and administrative management.
9.	*Kolej Komuniti, Politeknik*	Enable students to gain knowledge and skills not only theoretically but also practically in the field of aquaculture.

No.	Training Centres	Description
10.	*Institut Agro Usahawan* (iGROW)	Provide holistic exposure in the agricultural industry, agro-based and urban and rural enterprises.

2.15 Legislations, Policies and Initiatives

This study must incorporate references to legislation, by-laws, and policies directly relevant to the fishing and aquaculture sector to provide a comprehensive understanding of the regulatory framework and its impact on the sector. Analysing these legal and policy aspects, the research can shed light on the industry's sustainability, environmental impact, labour practices, and overall governance.

2.15.1 Government Legislations

The lists for Government Legislation related to the Fishing and Aquaculture Sector are compiled in Table 2.21 below.

Table 2.21: Government Legislations Related to Fishing and Aquaculture Sector

No	Organisation	Overview, Roles, Functions and Responsibilities
1.	Fisheries Act 1985 [Act 317]	An Act relating to fisheries, including the conservation, management and development of maritime and estuarine fishing and fisheries in Malaysian fisheries waters, turtles and riverine fishing in Malaysia, and matters connected therewith or incidental thereto).
2.	Fisheries (Prohibition of Method of Fishing) Regulations 1980	The Regulations prohibit the use or having in possession of devices as specified in the Schedule.
3.	Fisheries (Maritime) (Licensing of Local Fishing Vessel) Regulations 1985	The Regulations apply only to local fishing vessels in Malaysian fisheries waters. Provisions prescribe conditions and requirements for licenses to be issued by the Director-General of Fisheries under section 11 of the Fisheries Act.
4.	Fisheries (Marine Culture Systems) Regulations 1990	The Regulations prescribe rules for the issuing by the Director-General of Fisheries of permits for the setting up and licenses for the operation of marine culture systems and the removal of such systems. Schedules 1 and 3 specify

No	Organisation	Overview, Roles, Functions and Responsibilities
		terms and conditions for permits and licenses for various culture systems. (14 regulations)
5.	Fisheries (Prohibition of Import, etc., of Fish) Regulations, 1990 (Amendment 2011)	No person shall import into, sell, cultivate or keep live fish of the genus as specified in the Schedule to these Regulations except with the written permission of the Director General as defined by the Fisheries Act 1985. The Director–General may attach any conditions he deems fit to the written permission. Contravention of this rule or of any condition imposed is declared an offence.
6.	Fisheries (Prohibited Areas) Regulations, 1994 (Amendment 1998, 2002)	No person shall collect shells, molluscs or corals within prohibited areas as specified in the Schedule. No person shall kill or capture any fish within a prohibited area unless he holds a licence issued under section 11 of the Fisheries Act 1985 stating the respective location specified in column 1 of the Schedule as the fishing base.
7.	Fisheries (Control of Endangered Species of Fish) Regulations 1999	Without any prejudice to special written permission issued by the Director-General, the present Regulations prohibit fishing, disturbing, harassing, catching, killing, taking, possessing, transporting, and exporting and trading of the endangered fish species defined by the schedule hereby attached. Regulation 3 sets forth the penalty to be applied in case of contravention.
8.	Fisheries (Quality Control of Fish for Export to the European Union) Regulations, 2009	The Regulations provide measures to control fish for export to the European Union to comply with their requirements.
9.	Fisheries (Protected Area for Sea-Cucumber) Regulations, 2010	The Regulations establish a protected area for sea cucumbers as specified in the Second Schedule. The Regulations prohibit the catch, capture, possession, etc., of sea cucumber in the protected area and the construction of any building or structure on or over any land or waters in the protected area.
10.	Fisheries (Cockles Conservation and Culture) Regulations 2002	The Regulations make provisions in order to ensure the protection and preservation of cockles. To this purpose, Regulation 3 prohibits the taking of any cockle spat from a natural cockle bed or cultured cockle bed. On the other hand, to take cockle seeds or adult cockles from a natural cockle bed or cultured cockle bed, a licence is required prior to its issuance. In case of granting such licence,

No	Organisation	Overview, Roles, Functions and Responsibilities
		however, cockle seeds and cockle adults may be taken from a natural cockle bed only from six in the morning until six in the evening. Regulation 8 regards the licence issuance upon payment of the fee. Further prohibitions and restrictions apply to selling and purchasing cockle seeds (Regulation 9). Regulation 16 establishes the general penalty to be applied in case of violation of these provisions. Two schedules are attached: the first contains the application forms relevant to granting the licences as mentioned; the second specifies the fees to be paid for obtaining such licences.
11.	Fisheries (Fish Disease Control Compliance for Exports and Imports) Regulations 2012	The Regulations establish Fisheries (Fish Disease Control Compliance for Exports and Imports). They establish the requirements for fish trade, specifying that any person who exports or imports fish products shall comply with the measures for fish disease control prescribed by the competent authority, the origin of the fish from the culture system approved by the competent authority, and apply for a fish health certificate by writing to the Director General. In addition, they regulate the application for a fish health certificate, stating that any person who intends to export shall apply to the Director General for a fish health certificate. An application for a fish health certificate may be withdrawn at any time by the applicant before it is approved or refused.
12.	Fisheries (Inland Fisheries Aquaculture) (Federal Territory of Kuala Lumpur and Federal Territory of Labuan) Rules 2017	The Rules are enacted under the Fisheries Act 1985. The Rules shall apply to any person who carries on aquaculture activity concerning inland fisheries in the aquaculture premises for commercial purposes in the Federal Territory of Kuala Lumpur and the Federal Territory of Labuan.
13.	Fisheries (Riverine) Rules	(a) Negeri Sembilan Fisheries (Riverine) Rules, 1976 (b) Johor Fisheries (Riverine) Rules, 1984 (c) Terengganu Inland Fisheries Rules, 1988 (Amendment 1993) (d) Kedah Fisheries (Riverine) Rules, 1990 (e) Perlis Fisheries (Riverine) Rules, 1990 (f) Pahang Fisheries (River Water) Rules, 1991 (g) Perak Fisheries (Riverine) Rules, 1992 (h) Kelantan Fisheries (Riverine) Rules, 1997 (i) Kelantan Fisheries (Riverine) Rules, 1997

No	Organisation	Overview, Roles, Functions and Responsibilities
14.	Fisheries (Maritime) (Sarawak) Regulations 1976	No person shall use, set up or possess fishing stakes or appliances without a licence issued by the Fisheries Officer. Provisions also regulate the removal of fishing stakes and appliances and offences.
15.	State Fisheries Ordinance, 2003	This Ordinance was enacted to regulate fishing, promote aquaculture, and provide for the proper and sustainable management of fisheries in the State of Sarawak.
16.	Sabah Inland Fisheries and Aquaculture Enactment 2003	An Enactment to provide for the sustainable development and management of inland fisheries and aquaculture in the State of Sabah.
17.	Lembaga Kemajuan Ikan Malaysia Act, 1971 (Amendment 1990, 1999)	The Act provides for creating the "Lembaga" as a fisheries development authority.
18.	Fish Marketing Regulations, 2010	The Regulations regulate the marketing of fish by licensing wholesalers, retailers, fish processors, and importers and exporters.
19.	Malaysian Quarantine and Inspection Services Act, 2011	An Act to provide for the Malaysian Quarantine and Inspection Services to provide integrated services relating to quarantine, inspection and enforcement at the entry points, quarantine stations and quarantine premises and certification for import and export of plants, animals, carcasses, fish, agricultural produce, soils and microorganisms and includes inspection of and enforcement relating to food and for matters connected to it
20.	International Trade in Endangered Species Act, 2008 [Act 686]	An Act to implement the Convention on International Trade in Endangered Species of Wild Fauna and Flora and to provide for other connected matters.
21.	Feed Act, 2009 [Act 698]	An Act to establish the Feed Board to regulate feed quality by controlling the importation, manufacture, sale and use of feed and feed additive to ensure that feed satisfies the nutritional requirements of animals, is not harmful to animals and is not contaminated so that animals and animal products are safe for human consumption and other usage, and for other matters incidental to it.
22.	Animal Welfare Act 2015 [Act 772]	This Act is enacted to make provisions to be applied to Peninsular Malaysia and the Federal Territory of Labuan to promote the welfare and responsible ownership of animals. 2

No	Organisation	Overview, Roles, Functions and Responsibilities
23.	Food Act 1983 [Act 281]	An Act to provide for the protection of the public against health hazards and fraud in the preparation, sale and use of food, including fish
24.	Employment Act 1955 (Amendment) 2022	Enhance and improve the protection and welfare of workers in the country and ensure that labour laws align with international standards set by the International Labour Organization.
25.	Fishermen's Associations Act, 1971	An Act to regulate and establish Fishermen's associations in Malaysia and provide for connected matters.
26.	Pesticides Act 1974 [Act 149]	The principal legislation to regulate the management of pesticides in Malaysia. The Act covers the management of all pesticides and other chemicals used in agriculture.
27.	Customs Act 1967 (Act 235)	This Act, consisting of 165 articles divided into 21 parts, aims to provide for the procedures and measures applied by customs officers before the release of goods, including animals, birds, fish, plants, currency and bearer negotiable instruments and any other kinds of movable property. The import is intended by air, by road, or by sea.
28.	Conservation of Environment Enactment 1996	An Enactment to make provisions relating to the conservation of the environment and for matters connected therewith and incidental thereto.
29.	Exclusive Economic Zone Act, 1984 [Act 311] (Amendment 2006)	An Act pertaining to the exclusive economic zone and certain aspects of the continental shelf of Malaysia and to provide for the regulation of activities in the zone and on the continental shelf and for matters connected therewith.
30.	Malaysian Maritime Enforcement Agency (Act 633)	An Act to establish the Malaysian Maritime Enforcement Agency to perform enforcement functions for ensuring the safety and security of the Malaysian Maritime Zone with a view to the protection of maritime and other national interests in such zone and for matters necessary thereto or connected therewith.
31.	Environmental Quality Act 1974 [Act 127]	This Act makes provisions for the prevention, abatement, control of pollution and enhancement of the environment.
32.	Waters Act 1920 (Act 418)	This Act was enacted to make provisions to be applied to the States of Negeri Sembilan, Pahang, Perak, Selangor, Malacca, Penang, and Federal Territory to provide for the control of rivers and streams. Eighteen sections constitute the Act.

No	Organisation	Overview, Roles, Functions and Responsibilities
33.	National Land Code (Act 56) (Amendment 2001, 2008)	An Act to amend and consolidate the laws relating to land and land tenure, the registration of title to land and of dealings therewith and the collection of revenue therefrom within the States of Johor, Kedah, Kelantan, Malacca, Negri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu, and for purposes connected therewith.
34.	Land Conservation Act, 1960 (Act 3)	An Act relating to the conservation of hill land and the protection of soil from erosion and the inroad of silt.
35.	Irrigation Areas Act, 1953	The Act regulates the establishment of irrigation areas and applies only to the States of West Malaysia.
36.	Contracts Act 1950 (Act 136)	This Malaysian Contracts Act 1950 (Act 136) sets out the legislative framework governing contracts in Malaysia.
37.	Immigration Act 1959/63 (Act 155)	Governs immigration matters, controls entry, enforces immigration laws, regulates deportation and removal, addresses immigration offences and penalties, ensures national security, and establishes immigration policies.
38.	Act 446, Minimum Housing Standards and Amenities Act 199	Establish minimum standards and requirements for housing and amenities to ensure residents' decent and adequate living conditions.

2.15.2 Government Policies and Initiatives

Table 2.22 below provides information on the Government Policies and Initiatives lists regarding Malaysia's Fishing and Aquaculture Sector.

Table 2.22: Government Policies and Initiatives Related to the Fishing and Aquaculture Sector

No.	Policies	Initiatives
1.	*Dasar Agromakanan Negara* 2021-2030 (DAN 2.0) / National Agrofood Policy 2021-2030 (NAP 2.0)	Policy to increase the agrofood sector's economic contribution towards the nation, which will be gauged by parameters including the contribution of the agrofood sector to national GDP, average annual value-added growth, food trade balance CAGR, and food loss
2.	*Dasar Alam Sekitar Negara* / National Environmental Policy (2015-2025)	This policy was established to continue economic, social and cultural progress as well as improve the quality of life of Malaysians through environmental well-being and sustainable development.

No.	Policies	Initiatives
3.	*Wawasan Kemakmuran Bersama* 2030 (WKB 2030)/ Shared Prosperity Vision 2030	A commitment to make Malaysia a nation that achieves sustainable growth along with fair and equitable distribution, across income groups, ethnicities, regions and supply chains. The commitment is aimed at strengthening political stability, enhancing the nation's prosperity and ensuring that the rakyat are united whilst celebrating ethnic and cultural diversity as the foundation of the nation-state.
4.	*Rancangan Malaysia Lima Tahun*/Five-Year Plan (Current)	A five-year economic development plan by the Government
5.	*Dasar Revolusi Perindustrian Keempat* (4IR)/ National Industrial Revolution 4.0 (4IR)	A policy that provides a concerted and comprehensive transformation agenda for the manufacturing sector and its related services (including agriculture).
6.	*Pelan Pembangunan Perikanan Negara* (2021-2030)	Ensure that the fisheries industry continues contributing to the country's economic growth while safeguarding the welfare of the targeted groups.
7.	*Rangka Tindakan* (Blueprint) *Ekonomi Digital Malaysia* (Current)	A national initiative which symbolises the aspirations of the Government to successfully transform Malaysia into a digitally-driven, high-income nation and a regional leader in the digital economy.
8.	Malaysia's National Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (Malaysia's NPOA-IUU).	This document outlines Malaysia's National Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (NPOA-IUU). It was developed following the International Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU) adopted in 2001 by the Food and Agricultural Organization of the United Nations.
9.	*Pelan Strategik Jabatan Perikanan Malaysia* (2021-2030)	This document was prepared as an initiative of the Malaysian Department of Fisheries to support the government's agenda of advancing the nation towards high-income status while prioritizing the well-being of the people. By 2030, the vision, mission, objectives, focus, core values, and strategic goals of the Malaysian Department of Fisheries have been formulated in line with the National Agri-Food Policy 2.0 (DAN 2.0) and the National Food Security Policy

No.	Policies	Initiatives
		to ensure the readiness of the nation's food supply at all times, especially in unexpected situations.

2.16 Chapter Summary

Fishing and aquaculture are crucial sectors in Malaysia, contributing significantly to the economy and addressing issues with food security. Fish farmers, aquaculture technicians, fisheries officers, and seafood processors are just a few positions that may be found within these industries' occupational framework. These careers support rural development, alleviate poverty, and give people a means of subsistence. The industries' significance is demonstrated by their role in food production and supplying fish and seafood to domestic and foreign markets.

Fishing and aquaculture are crucial for supporting economic growth and export revenues as Malaysia strives to become self-sufficient in food production. The growth of these industries supports the government's goals of reducing the reliance on imports and guaranteeing a sustainable food supply. The Malaysian government has established rules and laws to encourage the sustainable development of fishing and aquaculture. These steps are expected to manage and conserve fishing resources, preserve biodiversity, and encourage ethical behaviour. Licensing and permits, fishing seasons, fish stock management, and aquaculture site selection are essential topics these policies address. By enforcing these regulations, the government hopes to advance environmental sustainability, boost production, and guarantee the long-term viability of the industries.

The Occupational Framework (OF) for Fishing and Aquaculture in Malaysia is a valuable tool in recognising the significance of these industries in job creation, food security, and economic growth. The development and implementation of the OF are essential for promoting sustainable practices and effective resource management. By establishing rules and laws, the government plays a crucial role in ensuring the long-term sustainability of the industries.

The OF provides a structured framework that defines industry-specific job titles, tasks, and

competency levels, thereby facilitating the training and development of a skilled workforce. It guides academic institutions in designing relevant courses and programs to meet the industry's needs. The OF also encourages responsible development by addressing environmental concerns and promoting sustainable practices.

By implementing the OF and adhering to government regulations, Malaysia strives to strike a balance between industry growth and environmental conservation. By promoting sustainable practices and resource management, the country aims to secure the future of its Fishing and aquaculture sector while addressing its food security requirements. Thus, the Occupational Framework for Fishing and Aquaculture in Malaysia is instrumental in recognising the importance of these industries and guiding their sustainable development.

CHAPTER III

METHODOLOGY

3.1 Introduction

Chapter 3 provides an overview of the methodology used to meet the objectives of this Occupational Framework (OF). The research method and approach were selected to produce deliverables that consist of Occupational Structure (OS), Occupational Responsibilities (OR), Occupation Description (OD), jobs in demand, critical jobs, competency in demand, as well as emerging and critical skills within the fishing and aquaculture sector. A research design using a mixed-method approach was used to develop this Occupational Framework, owing to its ability to capture the breadth and depth of this industry's current and future development.

3.2 Research Approach

When planning for a study, careful consideration must be given in choosing the research design that best fits the study's intent and the nature of the research problem or outcome (Creswell, 2014). Research design is the plan that provides the logical structure that systematically guides the investigators to address their respective research problems and objectives (DeForge, 2018). In this chapter, the discussion of the research methodology details the type of research design to be implemented. It includes explaining the data collection strategies, how many samples and respondents were selected in this study, and a data analysis plan for fulfilling the research objectives. All these methodological decisions were informed and guided by the type of research design selected.

This study employed a sequential mixed-method research design to develop this Occupational Framework. A defining feature of mixed methods is when different types of data (qualitative and quantitative) are combined within a single research study to meet the study's objectives. For sequential mixed-method design, data are elicited sequentially, beginning with qualitative data collection and then a quantitative survey. Creswell and Clark (2007) refer to this design as exploratory, where qualitative data was collected first to explore and identify job areas, occupational structure and job titles within the field of fishing and aquaculture, followed by a quantitative survey to expand the insights and provide a most robust confirmation of the data acquired.

In essence, the chosen research design can support the study's needs by combining various data sources that are collected qualitatively and quantitatively. It allows for triangulation by implementing multiple methods and types of data collected in this study. According to Denzin (1978), when differing processes are implemented in a single research study, triangulation in methods is applied and can maximise the validity of the research.

The data collection procedure was conducted in four phases, involving document analysis, focus group discussion (FGD) with industry experts, survey, and triangulation of all the data leading to the development of the Occupational Framework. The research design summary is illustrated as follows (Table 3.1).

Table 3.1: Summary of Research Design

RESEARCH APPROACH	DATA COLLECTION METHODS	DELIVERABLES
Phase 1		
Qualitative	Literature review and document analysis FGD with industry experts	• Industry overview & market analysis • Job Areas • Occupational Structure and Job Titles
Phase 2		
Qualitative	FGD with industry experts	• Occupational Responsibilities (OR) and Competencies (Knowledge, Skills, and Ability) • Identify Emerging Skills • Identify Related Issues • Development of Survey Form and

RESEARCH APPROACH	DATA COLLECTION METHODS	DELIVERABLES
		Constructs
Phase 3		
Quantitative	Survey	• Competency in Demand • Jobs in Demand/Critical Jobs • Other Related Issues
Phase 4		
Data analysis, triangulation of data and verification of findings		Occupational Framework

The following sections elaborate on the critical activities involved following the research design above.

3.2.1 Phase 1: Literature Review and Document Analysis

A literature review systematically synthesises previous work around a particular topic (Card, 2018). Reviewing existing literature related to the fishing and aquaculture sector provides the critical baseline information for developing this Occupational Framework. Using a systematic search of relevant literature, the review searched, identified, evaluated, and synthesised relevant literature to support the development of this Occupational Framework. The primary aim of this approach is to provide an industry overview and market analysis of the fishing and aquaculture sector, including industry and employment growth, trends, and prospects related to this industry. This study gathered resources from supporting academic literature and reports from relevant official agencies, including published and unpublished materials, colloquially known as the grey literature (Auger, 2017). Grey literature is a crucial component of a systematic review and adds value to it because it is frequently more current than published literature and has less publication bias.

Documents can serve various purposes as part of a research undertaking, in which document analysis provides the systematic procedure for reviewing or evaluating these documents to meet the study's objectives (Bowen, 2009). The objectives determined the selection of documents that were included in this study. In specificity, the following four were considered as the primary resources when conducting this literature review:

a) Statistical information

Statistical information used in this publication relates to economic performance and labour market analysis. Information is released according to the standard classification of economic activities based on statistical information from two primary agencies, as follows:

i) Malaysia Standard Industrial Classification (MSIC) 2008; Gross Domestic Product 2015-2022, Labour Force Survey Report 2022; Salaries and Wages Survey Report 2022; Graduates Statistics 2021; Informal Sector and Informal Employment Survey Report 2021; Annual Economic Statistics Agriculture 2022 and selected Agricultural Indicator Malaysia from Department of Statistics Malaysia (DOSM), Ministry of Economy; and

ii) Malaysia Standard Classification of Occupations (MASCO) 2020, published by the Ministry of Human Resources.

b) Reports from other relevant local agencies

Reports from local agencies that contained relevant information on the fishing and aquaculture sector were referred in support of the information needed to develop this Occupational Framework. The reports were sourced from the following agencies:

i) Lists of published NOSS related to the fishing and aquaculture sector from the Malaysian Skills Integration Management System (MySPIKE) and Standard Registry from the Department of Skills Development, Ministry of Human Resources (MoHR);

ii) Annual Fisheries Statistics (2010-2021) by the Department of Fisheries by Ministry of Agriculture and Food Security (*Kementerian Pertanian dan Keterjaminan Makanan*, *KPKM*); and

iii) Annual Review 2021 and Critical Occupations Lists (MyCOL) report 2022/2023 by Talent Corporation Malaysia Berhad (TalentCorp), Ministry of Human Resources (MoHR);

c) Portals from international agencies

Portals from international agencies were also referred to obtain information for comparison with international standards. The reports were sourced from the following international agencies:

i) Office for National Statistics, United Kingdom;
ii) Statistics Indonesia (*Badan Pusat Statistik (BPS) Indonesia*);
iii) Southeast Asian Fisheries Development Center, Thailand;
iv) Statista;
v) BlueCart, Inc.;
vi) IBIS World;
vii) AquaFeed.com;
viii) Aquaculture Vietnam;
ix) TheGlobalEconomy.com;
x) Food and Agriculture Organization

d) Past literature and other scientific publications

A review of relevant scientific publications in the industry was also carried out. Findings from these scientific publications are critical for supporting discussions and findings from the primary data collection. Synthesis from this literature review is elaborated in Chapter 2 (Literature Review), covering the following scopes:

i) The sector's economic performance as measured by several macroeconomic indicators such as industry growth and employment statistics;
ii) The profile of the current and future workforce of the industry;
iii) The industry outlook as compared to regional and global perspectives;
iv) The start of technological development in the industry;
v) The identification of relevant legislations and stakeholders; and
vi) The underlying background of the industry‘s issues.

3.2.2 Phase 2: Focus Group Discussion (FGD)

The defining element of focus groups is using the participants’ discussion as a form of data collection (Morgan, 2018). To achieve the objectives of this Occupational Framework, a series of Focus Group Discussions (FGD) were held with a group of industry experts, who were selected based on a set of criteria and through a sampling strategy as discussed below. During the focus group, the researcher team played the moderator role to facilitate participant interaction to generate data. Engaging these industry panel experts as FGD respondents enabled the data to be collected from multiple perspectives or collective views

simultaneously (Braun & Clarke, 2013) to provide input for and verify the Occupational Framework (OF) findings.

The most basic requirement for a focus group discussion is that the topic is relevant to the participants (Mitchell & Branigan, 2000). Therefore, this study employed a purposive sampling technique for selecting industry experts with experiences and knowledge relevant to the industry for which this Occupational Framework is being developed. Two key sampling strategies were used: criterion sampling, where panels were identified based on the criteria listed and snowball sampling, where recommendations of panel experts in the areas needed were recommended by their peers (Patton, 2014) and then recruited as FGD participants upon their consent.

These panel experts, also called development panels, were identified as industry players familiar with the industry landscape, labour market, and practices in this industry. A total of 17 panels representing experts from the fishing and aquaculture sectors were selected based on their availability to provide a comprehensive and in-depth understanding of the topic. The following criteria were used to guide the selection of the panel experts, who were then appointed as development panels for this OF:

i) Have direct involvement or at least five years of experience in the identified sector or job areas involved;
ii) Can communicate with the researchers and willing to be a team player to support the completion of the Occupational Framework; and
iii) Well-prepared to provide information based on the experiences they had in the industry.

In addition, a maximum variation strategy was also applied as part of the sampling strategy to ensure that various panel experts representing all possible job areas within the industry, for both the fishing and aquaculture sectors, are included in the development of this OF. The list of panel experts is included in the list of development panel members in **Annex 2: List of Panel Experts/Development Panel in the Fishing and Aquaculture Sector.**

During FGD, semi-structured questions were used to guide and facilitate the discussions to yield input from the panel experts. These semi-structured questions were constructed primarily based on the central questions listed below, followed by probing questions as

needed:

i) What pertains to the Occupational Structure in the fishing and aquaculture sector?
ii) What are the relevant job titles in this industry, and what are the corresponding job descriptions for each of these job titles?
iii) What are the required competencies needed to perform these jobs?
iv) What are the critical jobs in this industry, and how do we determine them?
v) What are this industry's emerging skills, and why are they gaining importance?

Based on the central questions above, probing questions were asked to clarify and gather a more in-depth explanation of the occupational details of these sectors based on the elements required in this Occupational Framework. In total, the panel experts were involved in four FGD sessions, with each session planned to gain their input for developing the preliminary structure of the Occupational Framework and subsequently for improvisation verification, leading to the completion of the final OF. The conduct of the FGD was based on the following schedule:

Table 3.2: Schedule of FGD sessions

Session/Date	Location
Session 1/ 2-5 September 2022	KSL Resort, Johor Bahru
Session 2/ 4-7 November 2022	Bukit Jawi Golf Resort, Pulau Pinang
Session 3/ 30 April – 3 May 2023	Klana Beach Resort, Port Dickson
Session 4/ 30 July -2 August 2023	Felda Residence, Kuala Terengganu

3.2.3 Phase 3: Survey

Surveys are composed of multiple questions assessing the constructs of interest (Mrug, 2018). A quantitative survey was used to expand the information gained from the Focus Group Discussions (FGD) with industry experts to classify the jobs in demand, critical jobs, competency in demand, jobs relevant to the technology and industrial revolution, and emerging skills.

The instrument used to collect the data was a questionnaire survey. Close-ended questions with 5-point Likert scales, dichotomous scales, multiple choices, and open-ended questions

to capture opinions were used in the questionnaire to obtain the necessary information to achieve the research objectives. A self-administered questionnaire in hard copies and online circulation was deployed, and respondents answered the questions within the specified time frame.

Before being deployed, the questionnaire was face-validated by an academic to validate the structure of the questions, grammar, and translation accuracy, and vetted once again with the industry panels to validate the suitability of the content, including any jargon or terms used. In addition, a pilot study was also conducted to test the self-administered questionnaire, such as clarity of instructions and ease of the survey format, as well as clarity of questions that can facilitate the accurate understanding from the target group intended (Persaud, 2018). Therefore, with insights gained from the validation from survey experts and the pilot study conducted, the questionnaire was improved before being deployed to the primary target sample.

In particular, the survey was divided into two main areas (Fishing and Aquaculture) to differentiate answers collected from these two industries within the Fishing and Aquaculture sector, with each area consisting of similar survey questions comprised of five sections. The summary of each section is shown in Figure 3.1, with further details provided below.

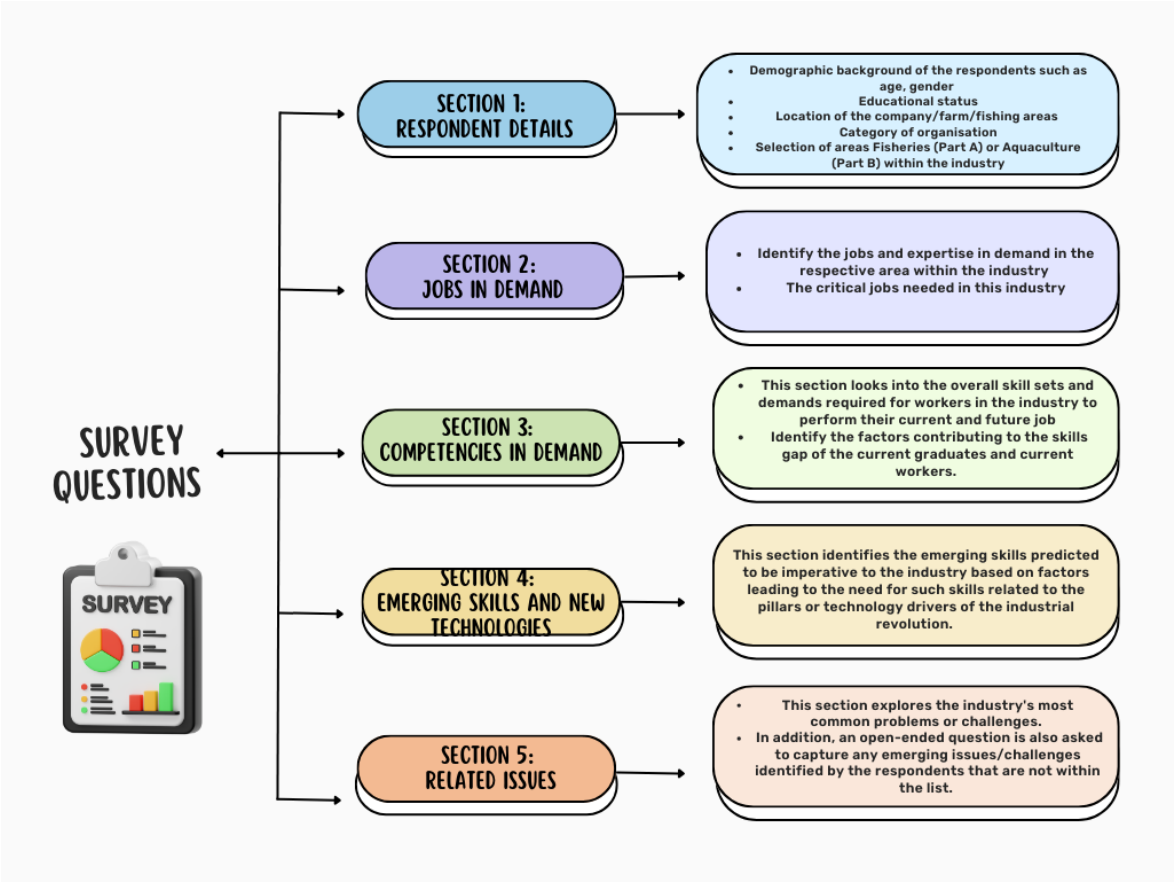

Figure 3.1: Summary of Survey Sections

a) Section 1: Respondent Details

This section gathers the demographic background of the respondents, such as age, gender, educational status, location of the company/farm/fishing areas, category of organisation, and selection of areas Fisheries (Part A) or Aquaculture (Part B) within the industry.

b) Section 2: Jobs in Demand

This section aims to identify the jobs and expertise in demand in the respective area within the industry, such as which worker categories are needed, challenging to fulfil/hire and the number of people needed for each job title identified. This section also highlights the critical jobs needed in this industry.

c) Section 3: Competencies in Demand

This section looks into the overall skill sets and demands required for workers in the

industry to perform their current and future jobs, using an interval scale of 5 (Very Important), 4 (Important), 3 (Fairly Important), 2 (Less Important) and 1 (Not Important). Another goal of this section is to identify the factors contributing to the skills gap between current graduates and work requirements.

d) Section 4: Emerging Skills and New Technologies

This section identifies the emerging skills predicted to be imperative to the industry based on factors leading to the need for such skills related to the pillars or technology drivers of the industrial revolution. In this section, respondents are asked to respond to how relevant each pillar is in their line of work and identify the emerging skills that correspond to the new technologies that arise, if any.

e) Section 5: Related Issues

This section explores the industry's most common problems or challenges. In this section, the respondents are asked to respond to five interval scales of 5 (Strongly Agree), 4 (Agree), 3 (Fairly Agree), 2 (Disagree) and 1 (Strongly Disagree) on the list of issues presented. In addition, an open-ended question is also asked to capture any emerging issues/challenges identified by the respondents that are not on the list.

The survey questionnaire is attached in **Annex 3**.

3.2.3.1 Sampling Strategy and Sample Size

This study also considered a suitable sampling strategy to ensure a more comprehensive representation of the survey results. A subset of a population is called a sample. Since it is impossible to measure or observe all members of the population of interest, a sample represents the population of interest.

An appropriate sample size depends on the parameter(s) of interest, the research study's goal, and the population characteristics from which the data are sampled (Kelley, 2018). The goal of selecting this sample is to acquire the best possible representation of the population of interest within the Fishing and Aquaculture sector within the stipulated time and budget to develop this OF.

In this study, the interest population is divided into two main sectors: Fishing and Aquaculture. Each industry's workforce and labour market are of different entities and calculated based on the data from Annual Fisheries Statistics (Department of Fisheries, Ministry of Agriculture and Food Security, 2021). The breakdown of population of interest is presented based on the total number of fishermen representing the Fishing sector (Table 3.1) and total number of culturists representing the Aquaculture sector (Table 3.2).

Table 3.2: Total number of targeted population and samples for the Fishing sector

Area	**Total (Fishermen)** Source: DoF, 2023	**Proportion percentage within the total population**	**The targeted number of samples**
Coastal	104,297	81.63%	**223**
Deep-sea	12,064	9.44%	**25**
Open sea	252	0.2%	**2**
Inland	11,149	8.73%	**33**
Total	**127,762**	**100%**	**283***

*Sample size calculated using Raosoft calculation, set for a 5 % margin of error, 90 % confidence level using the total targeted population (minimum target sample = 271), with an additional 20 % oversampling for minority strata.

Table 3:3 Total number of target population and samples for Aquaculture sectors

Area	**Total (Culturists*)** Source: DoF, 2023	**Proportion percentage within the total population**	**The targeted number of samples**
Marine and Brackish	3,440	16%	**52**
Freshwater	15,623	74%	**198**
Ornamental	976	4.6%	**15**
Aquatic Plant	1,202	5.6%	**18**
Total	21,241	100%	**283****

*Culturists refer to Aquaculture farmers in this Occupational Framework

**The sample size was calculated using Raosoft calculation, set for a 5 % margin of error and 90 % confidence level using the total targeted population (minimum target sample = 268), with an additional 20 % oversampling for minority strata.

*** Aquaculture farmers are referred to as culturist

A sample size calculation using Raosoft was used to determine the recommended number of samples in the survey. In addition, a proportionate stratified sampling strategy was used to identify respondents within these sectors' naturally occurring groups (areas), and a nonprobability sampling was employed to get a representation of these samples based on their proportionate percentage. The selective oversampling approach was also used for minority strata accounting for an additional 20 % of the proportionate representation. This sampling strategy helps to increase the representativeness of the total sample selected from the total population (Lemm, 2018).

In acquiring the sample size targeted above, the research team worked with the Department of Fisheries (DOF) and identified several representative states to target the survey data. The five states identified were Selangor, Perak, Sabah, Sarawak, and Terengganu. These states were selected based on Malaysia's highest number of fishing and aquaculture activities and productions/landings.

It should also be noted that survey locations were also chosen considering time and budget constraints. Convenience sampling was also used to effectively acquire the targeted samples through a partnership with DOF and ensure accessibility to the relevant respondents (fishermen and aquaculture farmers) who have been identified as a hard-to-reach population to enable efficient data collection within available resources. In addition, survey data was also collected through circulation, as facilitated by our FGD panel experts, to increase the number of samples obtained for the states aimed.

3.2.4 Phase 4: Data Analysis

Based on the research activities conducted, data collected were analysed using two main approaches as follows:

a) Content and thematic analysis for qualitative data

This iterative analysis process of the qualitative data combines elements of content analysis and thematic analysis. Content analysis is the process of organising information into categories related to the targeted outcomes of the research, such as identifying job areas, occupational structure and job titles, occupational responsibilities, and occupational descriptions. Meanwhile, thematic analysis is a form of pattern recognition within the data, with emerging themes becoming the categories for analysis (Fereday & Muir-Cochrane, 2006) and was used to group the themes occurred for identification of jobs in demand, critical jobs, competency in demand, emerging skills and issues relevant to the industry.

b) Descriptive analysis for quantitative survey

Descriptive analysis refers to the survey data that was statistically analysed using Microsoft Excel to generate descriptive results such as frequency (count) and percentage (distribution of representations). The following were the outcomes produced from the analysis of data (Figure 3.2).

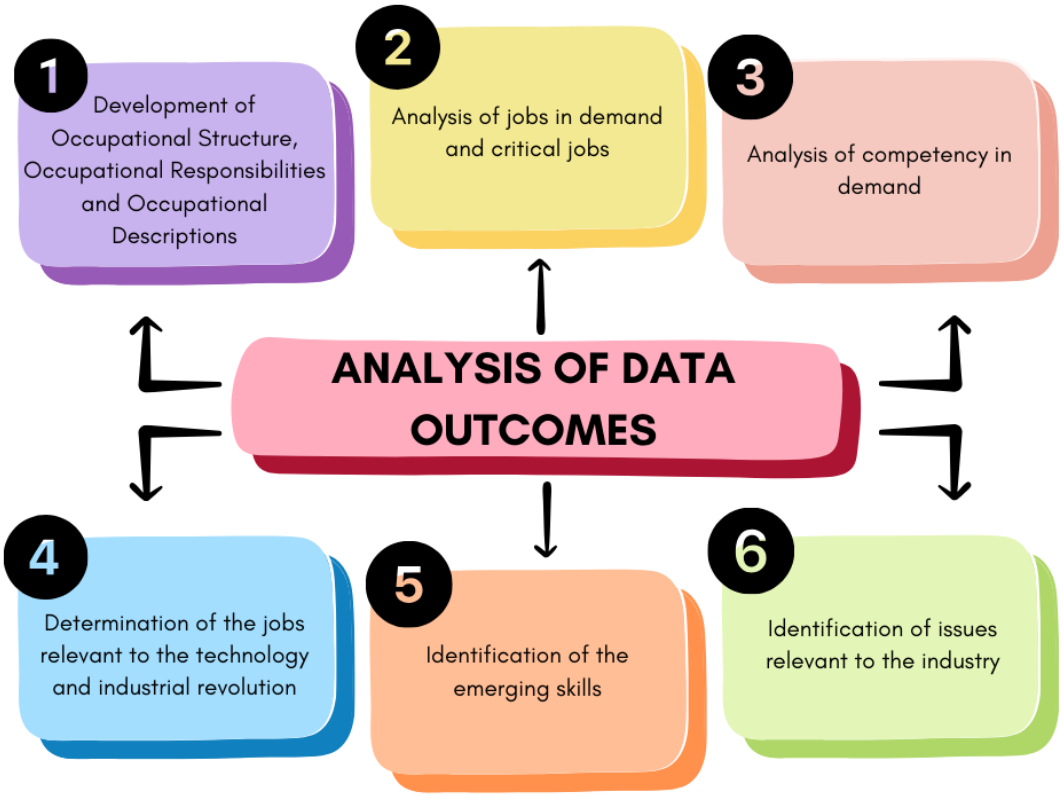

Figure 3.2: Analysis of Data Outcomes

The following were the outcomes produced from the analysis of data:

a) Development of Occupational Structure, Occupational Responsibilities and Occupational Descriptions;
b) Analysis of jobs in demand and critical jobs;
c) Analysis of competency in demand;
d) Determination of the jobs relevant to the technology and industrial revolution;
e) Identification of the emerging skills; and
f) Identification of issues relevant to the industry.

All the data collected were analysed and triangulated. Then, the findings were validated with our panel experts several times before the Occupational Framework was concluded during our final validation session conducted as per the following:

Table 3.3: Final Validation Session

Session/Date	Location
Session 5/ 8 - 10 October 2023	Concorde Hotel, Shah Alam, Selangor

3.3 Chapter Summary

This chapter elaborated on the methodology used in developing this Occupational Framework. The study was conducted in four phases involving three types of data collected Using a mixed method sequential design: document analysis through literature review, qualitative data through focus group discussions, and quantitative data through survey. The final phase focused on analysing and triangulating the data into findings, leading to the development of this Occupational Framework. These results and findings are presented next in Chapter 4: Findings.

CHAPTER IV

FINDINGS

4.1 Introduction

This chapter provides a detailed explanation of the study's results, which centre on achieving specific objectives. The validated findings from each method outlined in Chapter 3 can be identified by reviewing the chapter's content. Examining this chapter, one can determine the results and findings confirmed through the chosen research methods. These findings are based on the data collected, analysed, and interpreted according to the specific approach detailed in Chapter 3.

4.2 Findings Analysis

This section presents the results obtained from the analysis of three primary research methods: document analysis, Focus Group Discussions (FGD) with industry representatives, and a survey conducted with workers in the fishing and aquaculture sector. These findings were utilised to create the Occupational Framework specific to the fishing and aquaculture sector. The discussion of the results will encompass the two main groups identified under Division A03 of MSIC 2008, which are:

a) 031 Fishing
b) 032 Aquaculture

4.3 Socio-demographic Profiles

A total of 549 respondents were acquired through the survey, engaging industry practitioners within the fishing and aquaculture sectors. The quantity of respondents accumulated is within the target sample. It reflects the representation of the broader workforce within this industry, as represented by 240 respondents from Fishing practitioners (fishermen), 277 respondents from Aquaculture practitioners (aqua farmers), and 32 stakeholders representing government officers and members of associations from both sectors). This robust number of respondents reinforces the credibility of the findings.

Moreover, the demographic breakdown underscores the survey's comprehensiveness. The respondents' profiles spanned a broad spectrum of occupational groups under Division A03. Furthermore, these participants hail from diverse regions across various Malaysian states. Table 4.1 presents an overview of the respondent's socio-demographic characteristics. This data presentation succinctly encapsulates the range and diversity of perspectives incorporated within the survey, amplifying the depth and breadth of the insights obtained. Figure 4.1 presents a summary of the respondents' socio-demographic profiles.

Table 4.1: Respondents' Socio-demographic Profiles

Profile	Item		Frequency	Percentage (100%)
Gender	Male		450	82
	Female		97	17.7
	**Unmarked		2	0.4
	Total		**549**	**100**
Age* *Age count includes Fishing/Aquaculture stakeholders*	**Fishing**	<20	5	1.9
		20 - 29	18+3=21	7.9
		30 - 39	39+6+1=46	17.4
		40 - 49	55+4+4=63	23.8
		50 - 59	73+1+4=78	29.4
		>60	46+2=48	18.1
		Unmarked	4	1.5
		Total for Fishing	**265**	**100**
	Aquaculture	<20	0	0
		20 - 29	43+2=45	15.8
		30 - 39	102+3=105	37.0
		40 - 49	64+1+1=66	23.2
		50 - 59	42	14.8
		>60	23	8.1
		Unmarked	3	1.1
		Total for Aquaculture	**284**	**100**

Profile	Item		Frequency	Percentage (100%)
		Total	**549**	
Background	Fishing Practitioners (Fishermen)		240	43.7
	Aquaculture Practitioners (Aquaculture Farmers)		277	50.5
	Stakeholders in Fishing/Aquaculture		32	5.8
	Total		**549**	**100**
Location	Selangor		70	12.8
	Sabah		240	43.7
	Sarawak		27	4.9
	Terengganu		132	24.0
	Perak		80	14.6
	Total		**549**	**100**
Job Area*	Fishing	Coastal	167	57.4
		Deep-sea	69	23.7
		Open	20	6.9
		Inland	31	10.7
		Unmarked	4	1.4
		Total	**291**	**100**
	Aquaculture	Marine/Brackish (Grow out)	138	35.0
		Marine/Brackish (Hatchery/Nursery)	48	12.2
		Freshwater (Grow out)	110	27.9
		Freshwater (Hatchery/Nursery)	73	18.5
		Ornamental	18	4.6
		Aquatic plant	7	1.8
		Total	**394**	**100.0**

*For Job Areas, some practitioners marked more than one within the Fishing or Aquaculture job areas as they may also be involved in both sectors. Therefore, the total for job area counts (Fishing = 291, Aquaculture = 394, total areas represented in the survey = 685) exceeded the total number of respondents (n = 594).

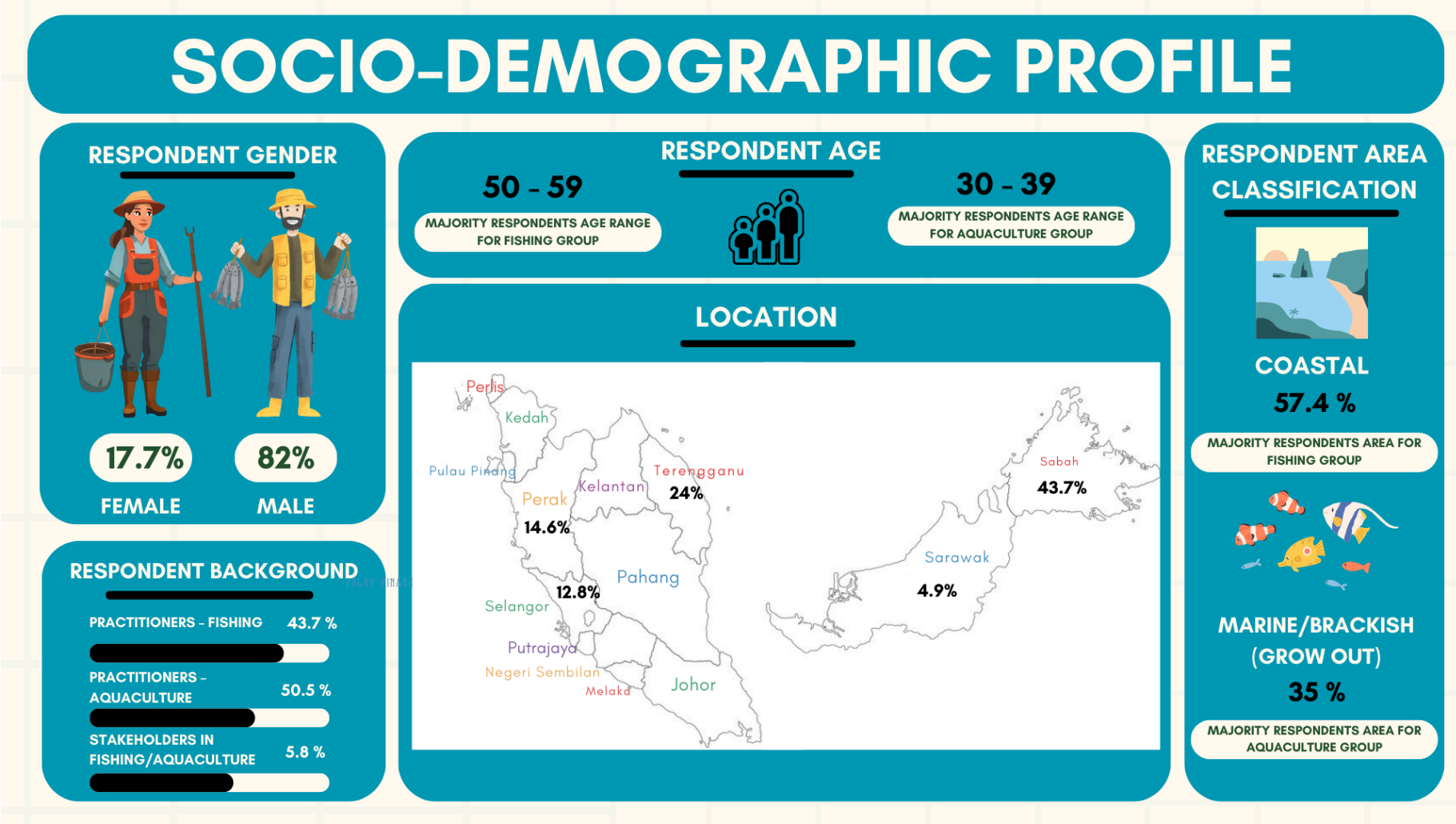

Figure 4.1: Summary of Respondents Socio-demographic Profiles

4.4 Occupational Structure

An occupational structure can be defined as a system of job classification where similar or related occupations are organised and grouped based on specific descriptions, such as skills, functions, and employment characteristics. This classification is established according to the guidelines provided by the Malaysia Standard Classification of Occupations (MASCO). The aim is to create a structured framework that categorises jobs into coherent groups, making it easier to understand and analyse the workforce composition and employment patterns in a given industry or region. OS is one of the findings acquired from FGD. According to the insights from discussions with expert panels in the fishing and aquaculture sector, a comprehensive list of 10 job areas has been compiled. These job areas are categorised under the MSIC 2008 group and presented with their respective descriptions for Group A031 in Table 4.1 and Group A032 in Table 4.2.

Table 4.2: List of Job Area and Its Description for A031-Fishing

NO.	JOB AREA	AREA DESCRIPTION
1.	Coastal Fisheries	Fishing activities operated near the shoreline, owner or non-owner-operated, using traditional or commercial fishing gears, divided by respective fishing zones (Peninsular Malaysia Fishing Zones - Zone A, B and C which up to 30nm), target species mainly fishes, cephalopods and shellfish. Required certain skills such as vessel operation and management, fishing gear operation and management, post-harvest management (pre- and post-landing), biosecurity etc.
2.	Deep Sea	Fishing activities operated near coastal water, owner or non-owner-operated, using traditional or commercial fishing gears, divided by respective fishing zones (Peninsular Malaysia Fishing Zones - Zone C2 from 30nm to EEZ, and west coast from 15nm to EEZ) target species mainly fishes, cephalopod and shellfish. Required certain skills such as vessel operation and management, fishing gear operation and management, post-harvest management (pre- and post-landing), biosecurity etc.
3.	Open Sea	Fishing activities operated beyond EEZ, owner or non-owner-operated, using longlines or purse seines, usually regulated by the Regional Fisheries Management Organization (RFMO) such as the Indian Ocean Tuna Commission (IOTC), target species, mainly oceanic tuna and tuna-like species.

NO.	JOB AREA	AREA DESCRIPTION
		Required certain skills such as vessel operation and management, fishing gear operation and management, post-harvest management (pre- and post-landing), biosecurity etc.
4.	Inland Fisheries	Fishing activities operated in freshwater environments such as rivers, lakes, ponds and estuaries, owner-operated, using traditional fishing gears such as angling, driftnets and traps, target species mainly edible fishes, ornamental fishes and shellfish.

Table 4.3: List of Job Area and Its Description for A032-Aquaculture

NO.	JOB AREA	AREA DESCRIPTION
1.	Marine Grow-Out	Finfish and shellfish culture, culture systems (ponds, cages, tanks, pen, line / rope, rack / compartment), production (culture preparation, stocking, nursing, feeding, monitoring, grading, harvesting), and biosecurity.
2.	Marine Hatchery	Includes fish and shellfish fry/fingerlings production, broodstock management, breeding, nursing, live feed management, and biosecurity.
3.	Freshwater Grow-Out	Finfish and shellfish culture, culture systems (ponds, cages, tanks, pen, line/ rope, rack/ compartment), production (culture preparation, stocking, nursing, feeding, monitoring, grading, harvesting), and biosecurity.
4.	Freshwater Hatchery	Including fish and shellfish fry production, broodstock management, breeding, nursing, live feed management and biosecurity.
5.	Ornamental	Marine/brackish/freshwater fish and shellfish (breeding, production, culture preparation, stocking, nursing (feeding, monitoring, grading, harvesting), biosecurity and services.
6.	Aquatic Plant	Marine/freshwater (seaweed, microalgae, ornamental plant) - culture preparation, harvesting and biosecurity.

The occupational structure, as identified from the insights provided by the expert panels, has been compiled and presented in Table 4.4 for group 031 and Table 4.5 for group 032. These tables outline the various job titles of each group and their corresponding descriptions within the fishing and aquaculture sectors.

From the occupational structure listed in the tables mentioned above, 62 job titles have been identified as relevant to this industry. Of these job titles, 24 have been classified as critical, signifying their significant importance in the sector. Additionally, 39 job titles have been

recognised as relevant to the Industrial Revolution, reflecting their alignment with the evolving technological advancements in the industry.

A summarized overview of the total job titles, critical job titles, and job titles relevant to the Industrial Revolution is presented in Table 4.7, providing a clear picture of the workforce composition and the critical roles within the fishing and aquaculture sectors.

Table 4.4: Group 031 Occupational Structure

Section	**(A) Agriculture, Forestry and Fishing**			
Division	**(03) Fishing and Aquaculture**			
Group	**(031) Fishing**			
Area / Level	**Coastal Fisheries**	**Deep Sea**	**Open Sea**	**Inland Fisheries**
Level 8	No Job Title	No Job Title	No Job Title	No Job Title
Level 7	No Job Title	No Job Title	No Job Title	No Job Title
Level 6	Fishing Operation Manager	Fishing Operation Manager	Fishing Operation Manager	No Job Title
Level 5	Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master***	Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master***	Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master***	No Job Title
Level 4	Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer**	Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer**	Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer**	No Job Title
Level 3	Senior Crew / Foreman / Fishing Gear Operator / Engineman***	Senior Crew / Foreman / Fishing Gear Operator / Engineman***	Senior Crew / Foreman / Fishing Gear Operator / Engineman***	Boat Owner/ Operator
Level 2	Deck Hand / Fishery Worker / Crew / Diver / FAD Operator	Deck Hand / Fishery Worker / Crew / Diver / FAD Operator	Deck Hand / Fishery Worker / Crew / Diver / FAD Operator	Boat Crew
Level 1	Fish Sorter / General Worker	Fish Sorter / General Worker	Fish Sorter / General Worker	No Job Title

Note: **Job relevant to IR
***Critical and job titles relevant to IR

Table 4.5: Group 032 Occupational Structure

Section	**(A) Agriculture, Forestry and Fishing**					
Division	**(03) Fishing and Aquaculture**					
Group	**(032) Aquaculture**					
Area / **Level**	**Marine Grow-Out**	**Marine Hatchery**	**Freshwater Grow-Out**	**Freshwater Hatchery**	**Ornamental**	**Aquatic Plant (Micro and Macro)**
Level 8	No Job Title	No Job Title	No Job Title	No Job Title	No Job Title	No Job Title
Level 7	Aquaculture Expert / Consultant***	Aquaculture Expert / Consultant***	Aquaculture Expert / Consultant***	Aquaculture Expert / Consultant***	Aquaculture Expert / Consultant***	Aquaculture Expert / Consultant***
Level 6	Aquaculture Division Manager**	Aquaculture Division Manager**	Aquaculture Division Manager**	Aquaculture Division Manager**	Farm Manager**	Farm Manager**
Level 5	Farm Manager**	Hatchery Manager**	Farm Manager**	Hatchery Manager**	Operation Head**	Operation Head**
Level 4	Aquaculture Executive***	Aquaculture Executive***	Aquaculture Executive***	Aquaculture Executive***	Technical Executive***	Aquatic Plant Technical Executive***
Level 3	Farm Technician**	Hatchery Technician**	Farm Technician**	Hatchery Technician**	Ornamental Culturist**	Aquatic Botanist**
Level 2	Supervisor	Supervisor	Supervisor	Supervisor	Supervisor	Supervisor
Level 1	General Worker*	General Worker*	General Worker*	General Worker*	General Worker*	General Worker*

Note: *Critical Job Title
**Job relevant to IR
***Critical and job titles relevant to IR

Table 4.6: Summary of Job Titles

No	Job Area	Level								Total Identified Job Titles	Total Critical Job Titles	Total Job Titles relevant to IR
		1	2	3	4	5	6	7	8			
031- FISHING												
1	Coastal Fisheries	1	1	1	1	1	1	NJT	NJT	6	2	3
2	Deep Sea	1	1	1	1	1	1	NJT	NJT	6	2	3
3	Open Sea	1	1	1	1	1	1	NJT	NJT	6	2	3
4	Inland Fisheries	NJT	1	1	NJT	NJT	NJT	NJT	NJT	2	0	0
032- AQUACULTURE												
5	Marine Grow-Out	1	1	1	1	1	1	1	NJT	7	3	5
6	Marine Hatchery	1	1	1	1	1	1	1	NJT	7	3	5
7	Freshwater Grow-Out	1	1	1	1	1	1	1	NJT	7	3	5
8	Freshwater Hatchery	1	1	1	1	1	1	1	NJT	7	3	5
9	Ornamental	1	1	1	1	1	1	1	NJT	7	3	5
10	Aquatic Plant (Micro and Macro)	1	1	1	1	1	1	1	NJT	7	3	5
Grand Total of Identified Job Titles, Critical Job Titles, and Job Titles relevant to IR										**62**	24	39

NJT: No Job Titles

4.5 Occupational Responsibilities

The Occupational Responsibilities (OR) encompass each job title's primary duties and responsibilities listed under the Occupational Structure (OS). These responsibilities are aligned with the specific area and level of the respective job within the fishing and aquaculture sector. While the OR listed in this section may include other responsibilities beyond fishing and aquaculture, they mainly focus on this particular industry.

The OR descriptions provided in this section will serve as valuable references for the future development of the National Occupational Skills Standard (NOSS) specific to the fishing and aquaculture sector, following the MSIC 2008 classification, Division A03, including Groups A031 and A032.

The detailed Occupational Responsibilities (OR) are presented in Table 4.6 to Table 4.7 on the following pages. These tables provide comprehensive insights into the roles and tasks associated with each job title, helping to outline the skill requirements and competencies needed for efficient and effective job performance in this industry.

DIVISION: 03 - FISHING AND AQUACULTURE

GROUP: 031 – FISHING

Table 4.7: List of Responsibilities for Group 031 Based on Table 4.4 (1 of 2)

Area / Level	Coastal Fisheries	Deep Sea
Level 8	No Job Title	No Job Title
Level 7	No Job Title	No Job Title
Level 6	**Fishing Operation Manager** 1) Plan Business development. 2) Coordinate law and regulation compliance. 3) Plan fishing and post-harvest operation. 4) Coordinate enforcement and compliance. 5) Coordinate safety aspects. 6) Coordinate Hygiene on Board (HOB). 7) Coordinate staff's welfare. 8) Recruit competent crew members for specific job requirements. 9) Analyse business feasibility. 10) Conduct and implement risk management. 11) Establish operation strategy and budgets, monitoring capture yield.	**Fishing Operation Manager** 1) Plan Business development. 2) Coordinate law and regulation compliance. 3) Plan fishing and post-harvest operation. 4) Coordinate enforcement and compliance. 5) Coordinate safety aspects. 6) Coordinate Hygiene on Board (HOB). 7) Coordinate staff's welfare. 8) Recruit competent crew members for specific job requirements. 9) Analyse business feasibility. 10) Conduct and implement risk management. 11) Establish operation strategy and budgets, monitoring capture yield.

Area / Level	Coastal Fisheries	Deep Sea
	12) Monitor demand and supply of fishery catch products and marketing. 13) Oversee product pricing.	12) Monitor demand and supply of fishery catch products and marketing. 13) Oversee product pricing.
Level 5	**Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master** 1) Comply with the domestic and international regulations and legislation. 2) Manage the fishing vessel and ensure equipment is inspected, functioning and seaworthy before sailing. 3) Navigate and operate the fishing activities. 4) Train and assign specific jobs to crew members. 5) Monitor crew members' job performance. 6) Ensure crew members' welfare onboard. 7) Instruct fishing operations and supervise crew members. 8) Record daily activities in the captain’s ship log and catch in the catch logbook. 9) Comply with safety and hygiene on board, including waste management.	**Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master** 1) Comply with the domestic and international regulations and legislation. 2) Manage the fishing vessel and ensure equipment is inspected, functioning and seaworthy before sailing. 3) Navigate and operate the fishing activities. 4) Train and assign specific jobs to crew members. 5) Monitor crew members' job performance. 6) Ensure crew members' welfare onboard. 7) Instruct fishing operations and supervise crew members. 8) Record daily activities in the captain’s ship log and catch in the catch logbook. 9) Comply with safety and hygiene on board, including waste management.

Area / Level	Coastal Fisheries	Deep Sea
Level 4	**Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer** 1) Monitor and ensure crew members perform fishing activities and are given tasks per standard operating procedure. 2) Capable of being in charge of the vessel and on-board activities. 3) Assist in handling navigation and operation equipment. 4) Monitor and report any abnormality in operational and safety aspects. 5) Operate and manage coastal fisheries vessels. 6) Monitor the safety and hygiene on-board compliance during fishing operations.	**Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer** 1) Monitor and ensure crew members perform fishing activities and are given tasks per standard operating procedure. 2) Capable of being in charge of the vessel and on-board activities. 3) Assist in handling navigation and operation equipment. 4) Monitor and report any abnormality in operational and safety aspects. 5) Operate and manage coastal fisheries vessels. 6) Monitor the safety and hygiene on-board compliance during fishing operations.
Level 3	**Senior Crew / Foreman / Fishing Gear Operator / Engineman** 1) Lead fishing activities. 2) Coordinate the worker/crew. 3) Identify catch to ensure compliance with legal size and record the catchment product information (species, weight, pieces, endangered species).	**Senior Crew / Foreman / Fishing Gear Operator / Engineman** 1) Lead fishing activities. 2) Coordinate the worker/crew. 3) Identify catch to ensure compliance with legal size and record the catchment product information (species, weight, pieces, endangered species).

Area / Level	Coastal Fisheries	Deep Sea
	4) Manage the fishery, catch loading and storage for on-vessel post-harvest activities. 5) Oversee vessel maintenance (engine and fishing gears) and overcome technical problems (obstacles). 6) Ensure the safety and hygiene on board compliance during fishing operations.	4) Manage the fishery, catch loading and storage for on-vessel post-harvest activities. 5) Oversee vessel maintenance (engine and fishing gears) and overcome technical problems (obstacles). 6) Ensure the safety and hygiene on board compliance during fishing operations.
Level 2	**Deck Hand / Fishery Worker / Crew / Diver / FAD Operator** 1) Handle fish-catching operations/activities. 2) Handle the general operation of fishing gears. 3) Handle the general operation of fish aggregating device (FAD). 4) Handle the general operation of the support vessel (including the MPPI Vessel). 5) Ensure fishing gear is in good condition. 6) Handle on vessel post-harvest activities (sorting, storage). 7) Handle catch product unloading activities. 8) Up-keep the cleanliness of the vessel per hygiene onboard requirements.	**Deck Hand / Fishery Worker / Crew / Diver / FAD Operator** 1) Handle fish-catching operations/activities. 2) Handle the general operation of fishing gears. 3) Handle the general operation of fish aggregating device (FAD). 4) Handle the general operation of the support vessel (including the MPPI Vessel). 5) Ensure fishing gear is in good condition. 6) Handle on vessel post-harvest activities (sorting, storage). 7) Handle catch product unloading activities. 8) Up-keep the cleanliness of the vessel per hygiene onboard requirements.

Area / Level	Coastal Fisheries	Deep Sea
	9) Handle dive work (e.g., to confirm fish population location).	9) Handle dive work (e.g., to confirm fish population location).
Level 1	**Fish Sorter / General Worker** 1) Perform fish catching process. 2) Sort catch products by species, quality and size. 3) Pack the catch products. 4) Keep the catch product in good condition using standard procedures.	**Fish Sorter / General Worker** 1) Perform fish catching process. 2) Sort catch products by species, quality and size. 3) Pack the catch products. 4) Keep the catch product in good condition using standard procedures.

Table 4.7: List of Responsibilities for Group 031 Based on Table 4.4 (2 of 2)

Area / Level	Open Sea	Inland Fisheries
Level 8	No Job Title	No Job Title
Level 7	No Job Title	No Job Title
Level 6	**Fishing Operation Manager** 1) Plan Business development. 2) Coordinate law and regulation compliance. 3) Plan fishing and post-harvest operation. 4) Coordinate enforcement and compliance. 5) Coordinate safety aspects. 6) Coordinate Hygiene on Board (HOB). 7) Coordinate staff's welfare. 8) Recruit competent crew members for specific job requirements. 9) Analyse business feasibility. 10) Conduct and implement risk management. 11) Establish operation strategy and budgets, monitoring capture yield 12) Monitor demand and supply of fishery catch products and marketing. 13) Oversee product pricing.	No Job Title

Area / Level	Open Sea	Inland Fisheries
Level 5	**Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master** 1) Comply with the domestic and international regulations and legislation. 2) Manage the fishing vessel and ensure equipment is inspected, functioning and seaworthy before sailing. 3) Navigate and operate the fishing activities. 4) Train and assign specific jobs to crew members. 5) Monitor crew members' job performance. 6) Ensure crew members' welfare onboard. 7) Instruct fishing operations and supervise crew members. 8) Record daily activities in the captain’s ship log and catch in the catch logbook. 9) Comply with safety and hygiene onboard, including waste management.	No Job Title
Level 4	**Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer** 1) Monitor and ensure crew members perform fishing activities and are given tasks per standard operating procedure. 2) Capable of being in charge of the vessel and on-board activities.	No Job Title

Area / Level	Open Sea	Inland Fisheries
	3) Assist in handling navigation and operation equipment. 4) Monitor and report for any abnormality in operational and safety aspects. 5) Operate and manage coastal fisheries vessels. 6) Monitor the safety and hygiene of onboard compliance during fishing operations.	
Level 3	**Senior Crew / Foreman / Fishing Gear Operator / Engineman** 1) Lead fishing activities. 2) Coordinate the worker/crew. 3) Identify catch to ensure compliance with legal size and record the catchment product information (species, weight, pieces, endangered species). 4) Manage the fishery, catch loading and storage for on-vessel post-harvest activities. 5) Oversee vessel maintenance (engine and fishing gears) and overcome technical problems (obstacles). 6) Ensure the safety and hygiene on board compliance during fishing operations.	**Boat Owner/ Operator** 1) Plan and determine the fishing site and activities. 2) Instruct and execute fishing activities. 3) Operate boat (registered with authorised bodies). 4) Identify and record the catch products by quality, species, and size. 5) Train, assign and monitor crew members. 6) Ensure crew member safety and welfare. 7) Maintain boat and fishing gear. 8) Record daily catches in the Catch Logbook.
Level 2	**Deck Hand / Fishery Worker / Crew / Diver / FAD Operator**	**Boat Crew**

Area / Level	Open Sea	Inland Fisheries
	1) Handle fish-catching operations/activities. 2) Handle the general operation of fishing gears. 3) Handle the general operation of fish aggregating device (FAD). 4) Handle the general operation of the support vessel (including the MPPI Vessel). 5) Ensure fishing gear is in good condition. 6) Handle on vessel post-harvest activities (sorting, storage). 7) Handle catch product unloading activities. 8) Up-keep the cleanliness of the vessel per hygiene onboard requirements. 9) Handle dive work (e.g., to confirm fish population location).	1) Handle fishing activities. 2) Handle and maintain the general operation of fishing gears. 3) Assist in boat operation. 4) Up-keep the cleanliness and the arrangement of all fishing gear. 5) Comply with all the safety and operation procedures. 6) Sort the catch products by quality, species and size. 7) Handle the post-harvest activities.
Level 1	**Fish Sorter / General Worker** 1) Perform fish catching process. 2) Sort catch products by species, quality and size. 3) Pack the catch products. 4) Keep the catch product in good condition using standard procedures.	No Job Title

Table 4.8: List of Responsibilities for Group 032 Based on Table 4.5 (1 of 3)

Area / Level	Marine Grow-Out	Marine Hatchery
Level 8	No Job Title	No Job Title
Level 7	**Aquaculture Expert / Consultant** 1) Develop and implement feasible aquaculture technology. 2) Problem-solving and mitigating issues overall in the culture system. 3) Transfer knowledge and marine grow-out technologies.	**Aquaculture Expert / Consultant** 1) Develop and implement feasible hatchery technology. 2) Problem-solving and mitigating issues overall in the culture system. 3) Transfer knowledge and marine hatchery technologies.
Level 6	**Aquaculture Division Manager** 1) Establish, review and strategies aquaculture technologies. 2) Establish and review the budget (CAPEX, OPEX) of farm development. 3) Establish and review Company Policies, Visions, Missions, Objectives, and KPIs. 4) Ensure compliance with regulations and legislation related to the aquaculture industry.	**Aquaculture Division Manager** 1) Establish and review hatchery technologies. 2) Establish brood-stock sourcing. 3) Establish and review the budget (CAPEX, OPEX) for hatchery development. 4) Establish and review Company Policies, Visions, Missions, Objectives, and KPIs. 5) Ensure compliance with regulations and legislation related to hatchery operation.

Area / Level	Marine Grow-Out	Marine Hatchery
	5) Establish and maintain relationships with stakeholders. 6) Plan, control and monitor company finances. 7) Ensure and manage employee welfare.	6) Establish and maintain relationships with stakeholders and customers. 7) Ensure and manage employee welfare.
Level 5	**Farm Manager** 1) Execute culture strategies and technologies. 2) Execute production planning. 3) Manage overall operation cost (expenses) within budget and assets management. 4) Manage, validate and report on farm performance regarding productivity and profitability to top management. 5) Ensure compliance with regulatory bodies, standards and company policies. 6) Identify talent and people development. 7) Establish and maintain relationships with customers and other stakeholders. 8) Conduct and implement risk management. 9) Establish and maintain social engagement with the surrounding communities.	**Hatchery Manager** 1) Plan and ensure production output (fry/fingerlings). 2) Broodstock management and breeding program. 3) Ensure customer satisfaction on fry quality (Quantitative & Qualitative). 4) Responsible for fry production facilities. 5) Manage overall operation cost (expenses) within budget and assets management. 6) Validate and report on hatchery performance in terms of productivity and profitability. 7) Identify talent and people development. 8) Establish and maintain relationships with customers and other stakeholders. 9) Conduct and implement risk management. 10) Establish and maintain social engagement with the surrounding communities.

Area / Level	Marine Grow-Out	Marine Hatchery
	10) Establish and maintain employee engagement and a safe work environment.	11) Establish and maintain employee engagement and a safe work environment.
Level 4	**Aquaculture Executive** 1) Ensure and review the achievement of the company policies, objectives, and KPIs. 2) Establish and review department SOP. 3) Implement compliance with regulatory bodies, standards and legislation. 4) Handle and resolve the operational problems 5) Manage culturing performance 6) Manage disease outbreak 7) Enforce farm safety and biosecurity 8) Reporting the progress and issues to management. 9) Evaluate workforce performance, competency program management and training programs. 10) Responsible livestock quality management. 11) Coordinate and communicate with stakeholders to ensure smooth operation. 12) Ensure and manage employee welfare.	**Aquaculture Executive** 1) Ensure and review the achievement of the company policies, objectives, and KPIs. 2) Establish and review department SOP. 3) Implement compliance with regulatory bodies, standards and legislation. 4) Review the department activities following the hatchery operation. 5) Responsible for troubleshooting problems and resolving them. 6) Handle and resolve operational problems. 7) Manage hatchery production. 8) Manage disease outbreaks. 9) Enforce hatchery safety and biosecurity. 10) Plan spawning program for livestock. 11) Evaluate workforce performance, competency program management and training programs. 12) Coordinate and communicate with stakeholders to ensure smooth hatchery operation.

Area / Level	Marine Grow-Out	Marine Hatchery
		13) Ensure and manage employee welfare.
Level 3	**Farm Technician** 1) Coordinate workforce training. 2) Manage feeding regime. 3) Plan preventive maintenance program. 4) Monitor the growth performance of organisms. 5) Ensure the implementation of SOP and biosecurity by providing the policies, processes, and standards. 6) Handle stocking procedure. 7) Handle livestock. 8) Monitor aquatic health and diseases. 9) Oversee general cleaning, pest control, sanitisation, and other routine biosecurity. 10) Ensure proper chemical application. 11) Collect and update farm data. 12) Conduct wastewater management activities. 13) Ensure and monitor water quality parameters. 14) Identify and report problems.	**Technician** 1) Coordinate workforce training. 2) Manage feeding regime. 3) Plan preventive maintenance program. 4) Monitor growth performance, mortality rate and animal health of organisms. 5) Responsible for fry quality management. 6) Ensure the implementation of SOP and biosecurity according to the policies, processes, and standards. 7) Handle spawning program for livestock. 8) Handle stocking procedure for livestock. 9) Oversee general cleaning, pest control, sanitisation, and other routine biosecurity. 10) Ensure proper chemical application. 11) Collect and update hatchery data. 12) Conduct wastewater management activities. 13) Ensure and monitor water quality parameters. 14) Identify and troubleshoot problems.

Area / Level	Marine Grow-Out	Marine Hatchery
Level 2	**Farm Supervisor** 1) Repair and service equipment. 2) Perform pond preparation, 3) Perform livestock stocking. 4) Perform feeding regime. 5) Perform sampling. 6) Perform harvesting. 7) Handle waste disposal. 8) Record stock inventory. 9) Identify and report any actual or potential health and safety hazards. 10) Prepare work instructions for general workers. 11) Coordinate, assign and supervise general cleaning, pest control, sanitisation, and other routine biosecurity requirement.	**Farm Supervisor** 1) Repair and service equipment. 2) Perform pond/tank preparation. 3) Perform breeding program. 4) Perform broodstock stocking. 5) Perform live food preparation. 6) Perform feeding. 7) Perform sampling. 8) Perform grading. 9) Perform harvesting. 10) Perform packing. 11) Handle waste disposal. 12) Record stock inventory. 13) Identify and report any actual or potential health and safety hazards. 14) Prepare work instructions for general workers. 15) Ensure employees' safety and welfare. 16) Coordinate, assign and supervise general cleaning, pest control, sanitisation, and other routine biosecurity requirements.

Area / Level	Marine Grow-Out	Marine Hatchery
Level 1	**General Worker** 1) Perform all general duties and routine work as per standard operating procedure (SOP). 2) Follow instructions from superiors to perform manual labour tasks (e.g. repairing farm fencing, disposing of waste, stacking up goods, cutting grass, cleaning tanks and ponds, liming and disinfecting, following feeding regime).	**General Worker** 1) Perform all general duties and routine work as per standard operating procedure (SOP). 2) Follow instructions from superiors to perform manual labour tasks (e.g. repairing hatchery fencing, disposing of waste, stacking up goods, cutting grass, cleaning tanks and ponds, disinfecting, following feeding regime).

Table 4.8: List of Responsibilities for Group 032 Based on Table 4.5 (2 of 3)

Area / Level	Freshwater Grow-Out	Freshwater Hatchery
Level 8	No Job Title	No Job Title
Level 7	**Aquaculture Expert / Consultant** 1) Develop and implement feasible aquaculture technology. 2) Mitigate issues and solve problems in the culture system overall. 3) Transfer knowledge and technologies.	**Aquaculture Expert / Consultant** 1) Develop and implement feasible hatchery technology. 2) Mitigate issues and solve problems in the culture system overall. 3) Transfer knowledge and technologies.
Level 6	**Aquaculture Division Manager** 1) Establish, review and strategies aquaculture technologies. 2) Establish and review the budget (CAPEX, OPEX) of farm development. 3) Establish and review Company Policies, Visions, Missions, Objectives, and KPIs. 4) Ensure compliance with regulations and legislation related to the aquaculture industry.	**Aquaculture Division Manager** 1) Establish and review hatchery technologies. 2) Establish brood-stock sourcing. 3) Establish and review the budget (CAPEX, OPEX) for hatchery development. 4) Establish and review Company Policies, Visions, Missions, Objectives, and KPIs. 5) Ensure compliance with regulations and legislation related to hatchery operation.

Area / Level	Freshwater Grow-Out	Freshwater Hatchery
	5) Establish and maintain relationships with stakeholders. 6) Plan, control and monitor company finances. 7) Ensure employee welfare.	6) Establish and maintain relationships with stakeholders and customers. 7) Ensure employee welfare.
Level 5	**Farm Manager** 1) Execute culture strategies and technologies. 2) Execute production planning. 3) Manage overall operation cost (expenses) within budget and assets management. 4) Manage, validate, and report on farm performance to top management regarding productivity and profitability. 5) Ensure compliance with regulatory bodies, standards and company policies. 6) Identify talent and people development. 7) Establish and maintain relationships with customers and other stakeholders. 8) Conduct and implement risk management. 9) Establish and maintain social engagement with the surrounding communities.	**Hatchery Manager** 1) Plan and ensure production output (fry/fingerlings). 2) Broodstock management and breeding program. 3) Ensure customer satisfaction on fry quality. 4) Responsible for fry production facilities. 5) Manage overall operation cost (expenses) within budget and assets management. 6) Validate and report on hatchery performance in terms of productivity and profitability. 7) Identify talent and people development. 8) Maintain relationships with customers and other stakeholders. 9) Conduct and implement risk management. 10) Establish and maintain social engagement with the surrounding communities. 11) Establish and maintain employee engagement and a safe work environment.

Area / Level	Freshwater Grow-Out	Freshwater Hatchery
	10) Establish and maintain employee engagement and a safe work environment.	
Level 4	**Aquaculture Executive** 1) Ensure and review the achievement of the company policies, objectives, and KPIs. 2) Establish and review department SOP. 3) Implement compliance with regulatory bodies, standards and legislation. 4) Handle and resolve operational problems. 5) Manage culturing performance. 6) Manage disease outbreaks. 7) Enforce farm safety and biosecurity. 8) Report progress and issues to management. 9) Evaluate workforce performance, competency program management and training programs. 10) Responsible livestock quality management. 11) Coordinate and communicate with stakeholders to ensure smooth operation. 12) Ensure employee welfare.	**Aquaculture Executive** 1) Ensure and review the achievement of the company policies, objectives, and KPIs. 2) Establish and review department SOP. 3) Implement compliance with regulatory bodies, standards and legislation. 4) Review department activities following the hatchery operation. 5) Responsible for troubleshooting problems and resolving them. 6) Handle and resolve operational problems. 7) Manage hatchery production. 8) Manage disease outbreaks. 9) Enforce hatchery safety and biosecurity. 10) Plan spawning program for livestock. 11) Evaluate workforce performance, competency program management and training programs. 12) Coordinate and communicate with stakeholders to ensure smooth hatchery operation.

Area / Level	Freshwater Grow-Out	Freshwater Hatchery
		13) Ensure employee welfare.
Level 3	**Farm Technician** 1) Coordinate workforce training. 2) Manage feeding regime. 3) Plan preventive maintenance programme. 4) Monitor the growth performance of organisms. 5) Ensure the implementation of SOP and biosecurity by providing the policies, processes, and standards. 6) Handle stocking procedure. 7) Handle livestock. 8) Monitor aquatic health and diseases. 9) Oversee general cleaning, pest control, sanitisation, and other routine biosecurity. 10) Ensure proper chemical application. 11) Collect and update farm data. 12) Conduct wastewater management activities. 13) Ensure and monitor water quality parameters. 14) Identify and troubleshoot problems.	**Technician** 1) Coordinate workforce training. 2) Manage feeding regime. 3) Plan preventive maintenance programme. 4) Monitor growth performance, mortality rate and animal health of organisms. 5) Responsible for fry quality management. 6) Ensure the implementation of SOP and biosecurity according to the policies, processes, and standards. 7) Handle spawning program for livestock. 8) Handle stocking procedure for livestock. 9) Oversee general cleaning, pest control, sanitisation, and other routine biosecurity. 10) Ensure proper chemical application. 11) Collect and update hatchery data. 12) Conduct wastewater management activities. 13) Ensure and monitor water quality parameters. 14) Identify and report problems.

Area / Level	Freshwater Grow-Out	Freshwater Hatchery
Level 2	**Farm Supervisor** 1) Repair and service equipment. 2) Perform pond preparation, 3) Perform livestock stocking. 4) Perform feeding regime. 5) Perform sampling. 6) Perform harvesting. 7) Handle waste disposal. 8) Record stock inventory. 9) Identify and report any actual or potential health and safety hazards. 10) Prepare work instructions for general workers. 11) Coordinate, assign and supervise general cleaning, pest control, sanitisation, and other routine biosecurity requirement.	**Farm Supervisor** 1) Repair and service equipment. 2) Perform pond/tank preparation. 3) Perform breeding program. 4) Perform broodstock stocking. 5) Perform live food preparation. 6) Perform feeding. 7) Perform sampling. 8) Perform grading. 9) Perform harvesting. 10) Perform packing. 11) Handle waste disposal. 12) Record stock inventory. 13) Identify and report any actual or potential health and safety hazards. 14) Prepare work instructions for general workers. 15) Ensure employees' safety and welfare. 16) Coordinate, assign and supervise general cleaning, pest control, sanitisation, and other routine biosecurity requirement.

Area / Level	Freshwater Grow-Out	Freshwater Hatchery
Level 1	**General Worker** 1) Perform all general duties and routine work as per SOP. 2) Follow instructions from superiors to perform manual labour tasks (e.g. repair farm fencing, digging, stacking up goods, cutting grass, cleaning tanks and ponds, liming and disinfecting, following feeding regime).	**General Worker** 1) Perform all general duties and routine work as per SOP. 2) Follow instructions from the superior to perform manual labour tasks (e.g. repairing hatchery fencing, digging, stacking up goods, cutting grass, cleaning tanks and ponds, disinfecting, following feeding regime).

Table 4.8: List of Responsibilities for Group 032 Based on Table 4.5 (3 of 3)

Area / Level	Ornamental	Aquatic Plant (Micro and Macro)
Level 8	No Job Title	No Job Title
Level 7	**Aquaculture Expert / Consultant** 1) Develop and implement feasible ornamental fish operation technology. 2) Develop new varieties, e.g., cross-breeding. 3) Mitigate issues and solve problems in the ornamental industry. 4) Transfer knowledge and technologies.	**Aquaculture Expert / Consultant** 1) Develop and implement feasible aquatic plant technology. 2) Introduce new varieties. 3) Develop cell culture technology. 4) Mitigate issues and solve problems in the aquatic plant industry. 5) Transfer knowledge and technologies.
Level 6	**Farm Manager** 1) Establish and review ornamental aquatic animal operation technologies. 2) Establish brood-stock sourcing, husbandry activities, and marketing. 3) Establish and review the budget (CAPEX, OPEX) of ornamental aquatic animal operation.	**Farm Manager** 1) Establish and review aquatic plant operation technologies. 2) Establish seed sourcing, growing activities, and marketing. 3) Establish and review the aquatic plant operation's budget (CAPEX, OPEX).

Area / Level	Ornamental	Aquatic Plant (Micro and Macro)
	4) Establish and review Company Policies, Visions, Missions, Objectives, and KPIs. 5) Ensure compliance with regulations and legislation related to ornamental aquatic animal operational procedures. 6) Establish and maintain relationships with stakeholders and customers.	4) Establish and review Company Policies, Visions, Missions, Objectives, and KPIs. 5) Ensure compliance with regulations and legislation related to aquatic plant operational procedures. 6) Establish and maintain relationships with stakeholders and customers.
Level 5	**Operation Head** 1) Plan and ensure production output. 2) Responsible for ornamental aquatic animal breeding success rate. 3) Ensure customer satisfaction with fish quality and quantity. 4) Manage overall operation cost. 5) Monitor operation performance in terms of productivity and profitability. 6) Ensure compliance with regulatory bodies, standards, and company policies. 7) Conduct and implement risk management. 8) Manage assets and facilities. 9) Identify talent and people development.	**Operation Head** 1) Execute aquatic plant operation technologies. 2) Responsible for sourcing aquatic plant species variation, genetic and seed selection. 3) Responsible for overall production planning based on demand and season. 4) Manage overall operation cost. 5) Monitor farm performance in terms of productivity and profitability. 6) Ensure compliance with regulatory bodies, standards and company policies. 7) Identify talent and people development. 8) Establish and maintain relationships with customers and other stakeholders.

Area / Level	Ornamental	Aquatic Plant (Micro and Macro)
	10) Establish and maintain relationships with customers and other stakeholders.	9) Conduct and implement risk management. 10) Manage assets and facilities.
Level 4	**Technical Executive** 1) Ensure and review the achievement of the company policies, objectives, and KPIs. 2) Manage ornamental husbandry activities. 3) Establish and review department SOP. 4) Implement compliance with regulatory bodies, standards and legislation. 5) Review the department activities following the operation strategy. 6) Responsible for troubleshooting problems and mitigating issues. 7) Report progress and issues to management. 8) Evaluate workforce performance, competency program management and training programs. 9) Manage broodstock and species selection as per production planned. 10) Prepare export and import documentation. 11) Coordinate and communicate with stakeholders to ensure smooth operation.	**Aquatic Plant Technical Executive** 1) Ensure and review the achievement of the company policies, objectives, and KPIs. 2) Establish and review department SOP. 3) Implement compliance with regulatory bodies, standards and legislation. 4) Review the department activities following the operation strategy. 5) Responsible for troubleshooting and problem-solving 6) Report progress and issues to management. 7) Manage plant tissue culture and seeding process. 8) Evaluate workforce performance, competency program management and training programs. 9) Coordinate and communicate with stakeholders to ensure smooth operation. 10) Ensure and manage employee welfare.

Area / Level	Ornamental	Aquatic Plant (Micro and Macro)
	12) Ensure and manage employee welfare.	
Level 3	**Ornamental Culturist** 1) Ensure the implementation of SOP and Biosecurity by following the policies, processes, and standards. 2) Coordinate workforce training. 3) Manage feeding management. 4) Manage broodstock and species selection. 5) Manage survivability and quality (aesthetic value, size, colour, body shape, variety, high tolerance). 6) Monitor activities such as pond/tank preparation, maturation, selection, spawning, stocking, feed preparation and feeding, sampling, grading, harvesting, packing, and waste disposal. 7) Ensure proper chemical application. 8) Monitor water quality parameters. 9) Conduct wastewater management activities. 10) Conduct packing management. 11) Plan on livestock and live feed production. 12) Oversee general cleaning, pest control, sanitisation, and other routine biosecurity. 13) Collect and update data.	**Aquatic Botanist** 1) Coordinate workforce training. 2) Manage fertilising regime. 3) Collect and update data. 4) Ensure implementation of SOP. 5) Plan seeding and handling, harvesting and packing procedures for plant. 6) Perform plant tissue culture process. 7) Oversee general cleaning, pest and predator control, sanitisation, and routine biosecurity. 8) Ensure proper chemicals, fertiliser and light illumination application. 9) Monitor water quality and chemical and physical factors. 10) Manage aquatic plant quality. 11) Identify and troubleshoot problems.

Area / Level	Ornamental	Aquatic Plant (Micro and Macro)
	14) Identify and report problems.	
Level 2	**Supervisor** 1) Perform husbandry activities in ornamental aquatic animals. 2) Perform food preparation. 3) Perform feeding regimes. 4) Perform selection based on species value. 5) Perform harvesting. 6) Perform packaging. 7) Record stock inventory. 8) Handle waste disposal. 9) Identify safety hazards. 10) Prepare work instructions for general workers. 11) Coordinate, assign and supervise general cleaning, pest control, sanitisation, and other routine biosecurity requirement.	**Supervisor** 1) Perform growing/culture system preparation/ substrate preparation. 2) Perform seeding. 3) Perform fertilizing. 4) Perform trimming. 5) Perform harvesting. 6) Handle waste disposal. 7) Maintain growing/culture facilities. 8) Coordinate, assign and supervise general cleaning, pest control, sanitisation, and other routine biosecurity requirement. 9) Record inventory. 10) Prepare work instructions for general workers. 11) Identify safety hazards.

Area / Level	Ornamental	Aquatic Plant (Micro and Macro)
Level 1	**General Worker** 1) Perform all general duties and routine work. 2) Follow instructions from superiors to perform manual labour tasks (e.g. repair farm fencing, digging, stacking up goods, cutting grass, cleaning tanks and ponds, pond liming and disinfection, following feeding regime).	**General Worker** 1) Perform all general duties and routine work. 2) Follow instructions from superiors to perform manual labour tasks (e.g., cleaning and preparing the culture system). 3) Perform fertilising regime as per SOP.

4.6 Occupational Description

Occupational Descriptions (OD) are detailed and factual statements describing a particular job title's specific functions and responsibilities. In this study, the OD refers specifically to the job titles identified as in-demand and critical to the smooth functioning of the fishing and aquaculture sector.

These ODs provide a comprehensive summary of the responsibilities associated with each job title, the respective job levels, and the required competencies. The competencies outlined in the ODs include the necessary knowledge, skills, and job-specific attributes essential for successful job performance.

In Annex 6, there are 24 Occupational Descriptions (OD) provided. These ODs represent the job titles identified as critical or hard-to-fill roles. The job in demand or critical job titles were marked with * at the OS table as suggested by the development panel during the Focus Group Discussions (FGD). By defining these ODs, employers and stakeholders can understand the crucial roles within the industry and the specific skill sets required to excel in these positions. This information can guide recruitment efforts, training programs, and talent development initiatives to ensure a skilled and capable workforce that meets the industry's demands.

4.7 Mapping Occupational Structure (OS) to Available NOSS

This section maps the OS and the available National Occupational Skills Standards (NOSS). Thrty-four (34) existing NOSS have been identified and linked to the corresponding job titles within the occupational structure. This mapping connects the defined job roles and the existing industry-standard skill standards. By aligning the occupational structure with the relevant NOSS, it becomes easier to identify the specific skills and competencies required for each job title within the fishing and aquaculture sector.

This mapping is a valuable reference for employers, employees, and training institutions, ensuring that the skills training and development programs align with the industry's recognised standards. Additionally, it helps streamline workforce development efforts and

improve the workforce's overall efficiency and quality within the fishing and aquaculture sectors.

Additionally, this mapping is a prospective point of reference for developing NOSS. The development panel has validated all associated NOSS content to ascertain its continued alignment with present industry practices or determine if it necessitates a comprehensive review.

4.7.1 Group A031 - Fishing

Group A031, which pertains to the fishing sector, initially encompassed six (6) existing NOSS. However, following feedback from the development panel, it was determined that only three (3) of these NOSS remain pertinent to current industry practices. The other three (3) NOSS were deemed irrelevant due to their content not aligning with the roles of individuals involved in the fishing sector.

The three (3) relevant NOSS that have been associated with the fishing group are as follows: Fishing Fleet Management Level 5 (A031-001-5:2018), Fishery Vessel Management Level 4 (A031-001-4:2017), and Capture Fishery Operation Level 3 (A031-002-3:2022). These NOSS have been linked to activities within Coastal Fisheries, Deep Sea, and Open Sea areas.

In contrast, Fishery Technician Level 3 (Y-020-3), Fishery Junior Technician Level 2 (Y-020-2), and Fishery Assistant Level 1 (Y-020-1) have been identified as unsuitable for inclusion in group A031. The development panel has recommended a review of these NOSS.

4.7.2 Group A032 - Aquaculture

Concerning group A032, the initial mapping process encompassed 28 National Occupational Skills Standards (NOSS) as per the 8 May 2023 version of the DSD Standards Registry. However, subsequent deliberations and input from the development panels identified 24 NOSS that maintain relevance for integration into the constructed Occupational Structure (OS). This selection process is substantiated by a methodical consideration of the distinct sectors within the OS, with each area being associated with existing NOSS.

Within the context of the Marine Grow-Out area, four (4) existing NOSS—namely Marine Aquaculture Management Level 5 (A032-002-5:2018), Marine Aquaculture Operational Administration Level 4 (A032-002-4:2018), Marine Aquaculture Operation Supervision Level 3 (A032-002-3:2017), and Marine Aquaculture Operation Level 2 (A032-002-2:2017)—have been identified. The perspective conveyed by the development panels underscores the ongoing pertinence of these existing NOSS as viable training resources. However, it is duly recognised that reviewing these materials is warranted in light of the continuously evolving landscape of industry practices and technological advancements. Moreover, scrutiny of the alignment between the specified responsibilities and the evolving industry requisites is imperative.

Shifting focus to the Marine Hatchery area, the initial alignment entailed six (6) existing NOSS. Subsequent discussion with the development panel led to the exclusion of three (3) NOSS—Spiny Lobster Hatchery Management Level 5 (BT-026-5:2014), Spiny Lobster Hatchery Control Level 4 (BT-026-4:2014), and Spiny Lobster Hatchery Operation Level 3 (BT-026-3:2014). This exclusion is underpinned by the rationale that these NOSS exhibit a narrow scope centred around a specific product. Conversely, two (2) additional NOSS—AF-022-3:2015 and A032-004-3:2019—have been ascertained to be aligned and pertinent for inclusion within this area.

Moreover, thoughtful consideration is recommended for Marine Aquaculture Operation Supervision Level 3 (A032-002-3:2017). The development panel proposes evaluating its existing level in light of the responsibilities and competency units delineated in the respective NOSS. A plausible elevation to a higher level is posited, aligning with the established definitions of levels and considering insights gleaned from feedback provided by the development panels.

Within the area of Freshwater Grow-Out operations, a compilation of four (4) existing NOSS has been identified for consideration. Specifically, these standards are denoted as follows: Fresh Water Aquaculture Management Level 5 (A032-001-5:2017), Fresh Water Aquaculture Operation Administration Level 4 (A032-001-4:2017), Fresh Water

Aquaculture Operation Supervision Level 3 (A032-006-3:2022), and Fresh Water Aquaculture Operation Level 2 (A032-006-2:2022).

The perspective conveyed by the development panels underscores the enduring relevance of these incumbent NOSS as practical and viable skills standards. It is imperative, however, to duly acknowledge the necessity for a comprehensive review of these instructional resources. This imperative stems from the perpetually evolving landscape of industry practices and the ever-advancing realm of technology. Consequently, a meticulous assessment of the alignment between the delineated responsibilities encapsulated within these standards and the evolving exigencies of the industry is of paramount importance.

In the area of Freshwater Hatchery, a trio of existing NOSS has been identified for consideration. Specifically, these standards are denominated as follows: Freshwater Fry Production Management Level 5 (AF-033-5:2012), Freshwater Fry Production Management Level 4 (AF-033-4:2012), and Freshwater Aquaculture Hatchery Operation Level 3 (A032-005-3:20207). The perspective the development panels convey emphasises the enduring relevance of these established NOSS as practical skills standards. Nonetheless, the necessity for a comprehensive review of these skills standards must be acknowledged. This necessity arises from the dynamic and evolving nature of industry practices and the relentless progress of technological advancements. Consequently, rigorous scrutiny of the alignment between the specified responsibilities encapsulated within these standards and the continuously evolving demands of the industry is of paramount significance.

Six (6) existing NOSS have been duly identified in the context of the Ornamental area. These standards are denominated as follows: Marine Aquaculture Manager (Ornamental Fish) Level 5 (AF-032-5), Aquaculture Executive (Ornamental Fish) Level 4 (AF-032-4), Fresh Water Ornamental Fish Farming Level 3 (A032-007-3:2023), Fresh Water Ornamental Fish Farming Level 2 (A032-003-3:2019), Marine Ornamental Fish Aquaculture Operation Supervision Level 3 (A032-003-2:2019), and Marine Ornamental Fish Aquaculture Operation Level 2 (A032-007-2:2023). The viewpoint articulated by the development panels underscores the sustained relevance of these existing NOSS as commendable and pragmatic skills standards. Nonetheless, the necessity for a comprehensive review of these instructional

resources must be acknowledged. This imperative emanates from the continually evolving panorama of industry practices and the dynamic progressions in technological realms. Furthermore, a methodical and thorough assessment of the correlation between the designated responsibilities enshrined within these standards and the ever-fluctuating requisites of the industry remains an imperative focal point.

Moreover, the development panels have recommended combining the marine and freshwater ornamental NOSS. This proposition is grounded in the observation that these two domains share congruent operational procedures despite the existing NOSS being independently developed. This consolidation stands to capitalise on these shared processes for greater efficiency and coherence.

In Aquatic Plant (Micro and Macro), the initial alignment entailed six (6) existing NOSS. Subsequent consultations with the development panels led to the removal of two (2) NOSS from consideration: Semi-Refined Carrageenan Production Level 3 (AF-021-3:2015) and Microalgae-Based Product Development & Management Level 5 (BT-045-5:2014). The rationale behind this exclusion is that these NOSS are specific to product-related aspects and involve developmental considerations that fall beyond the scope of A032.

However, for the remaining four (4) NOSS Microalgae Culture & Bio-Mass Management Level 4 (BT-045-4:2014), Microalgae Culture & Bio-Mass Production Level 3 (BT-045-3:2014), Sea Weed Farming Level 3 (AF-019-3:2014), and Microalgae Operations Level 2 (BT-045-2:2014)—the view shared by the development panels underscores the sustained relevance of these existing NOSS as valuable instructional resources. Given the ever-evolving nature of industry practices and the continuous technological advancements, it is essential to acknowledge the need for a comprehensive review of these skills standards. Moreover, careful consideration of how well the specified responsibilities in these standards align with the changing demands of the industry remains of utmost importance. The outcomes of the mapping process are concisely summarised in Table 4.8.

Table 4.9: Mapping OS vs Available NOSS (1 of 2)

Section	**(A) Agriculture, Forestry and Fishing**			
Division	**(03) Fishing and Aquaculture**			
Group	**(031) Fishing**			
Area / **Level**	**Coastal Fisheries**	**Deep Sea**	**Open Sea**	**Inland Fisheries**
Level 8	No Job Title	No Job Title	No Job Title	No Job Title
Level 7	No Job Title	No Job Title	No Job Title	No Job Title
Level 6	Fishing Operation Manager	Fishing Operation Manager	Fishing Operation Manager	No Job Title
Level 5	A031-001-5:2018	A031-001-5:2018	A031-001-5:2018	No Job Title
Level 4	A031-001-4:2017	A031-001-4:2017	A031-001-4:2017	No Job Title
Level 3	A031-002-3:2022	A031-002-3:2022	A031-002-3:2022	Boat Owner/ Operator
Level 2	Deck Hand / Fishery Worker / Crew / Diver / FAD Operator	Deck Hand / Fishery Worker / Crew / Diver / FAD Operator	Deck Hand / Fishery Worker / Crew / Diver / FAD Operator	Boat Crew
Level 1	Fish Sorter / General Worker	Fish Sorter / General Worker	Fish Sorter / General Worker	No Job Title

Table 4.9: Mapping OS vs Available NOSS (2 of 2)

Section	**(A) Agriculture, Forestry and Fishing**					
Division	**(03) Fishing and Aquaculture**					
Group	**(032) Aquaculture**					
Area / **Level**	**Marine Grow-Out**	**Marine Hatchery**	**Freshwater Grow-Out**	**Freshwater Hatchery**	**Ornamental**	**Aquatic Plant (Micro and Macro)**
Level 8	No Job Title	No Job Title	No Job Title	No Job Title	No Job Title	No Job Title
Level 7	Aquaculture Expert / Consultant	Aquaculture Expert / Consultant	Aquaculture Expert / Consultant	Aquaculture Expert / Consultant	Aquaculture Expert / Consultant	Aquaculture Expert / Consultant
Level 6	Aquaculture Division Manager	Aquaculture Division Manager	Aquaculture Division Manager	Aquaculture Division Manager	Farm Manager	Farm Manager
Level 5	A032-002-5:2018	Hatchery Manager	A032-001-5:2017	AF-033-5:2012	AF-032-5	Operation Head
Level 4	A032-002-4:2018	A032-002-3:2017	A032-001-4:2017	AF-033-4:2012	AF-032-4	BT-045-4:2014
Level 3	A032-002-3:2017	AF-022-3:2015 A032-004-3:2019	A032-006-3:2022	A032-005-3:2020	A032-007-3:2023 A032-003-3:2019	BT-045-3:2014 AF-019-3:2014
Level 2	A032-002-2:2017	Supervisor	A032-006-2:2022	Supervisor	A032-007-2:2023 A032-003-2:2019	BT-045-2:2014
Level 1	General Worker	General Worker	General Worker	General Worker	General Worker	General Worker

4.8 Jobs in Demand

Job in demand or critical jobs can be defined as job titles that are challenging to fill due to various factors such as a shortage of qualified candidates, specialised skill requirements, or high demand within the industry. These positions are strategically crucial to the organisation's or industry's functioning and success.

The findings related to critical job titles have been derived from the insights obtained through Focus Group Discussion (FGD). These discussions involved industry experts and stakeholders who provided valuable input on the key roles that are deemed critical within the fishing and aquaculture sector.

Based on the development panel's feedback, the job in demand or critical job titles were marked with * at the OS table, and the list can be referred to in Table 4.10.

Table 4.10: Critical Job Title for Fishing and Aquaculture Sector

No.	Area	Critical Job Title	Level
1.	Coastal Fisheries	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
2.	Deep Sea	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
3.	Open Sea	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
4.	Marine Grow-Out	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Executive	4
		c) General Worker	1
5.	Marine Hatchery	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Executive	4
		c) General Worker	1
6.	Freshwater	a) Aquaculture Expert / Consultant	7

No.	Area	Critical Job Title	Level
	Grow-Out	b) Aquaculture Executive	4
		c) General Worker	1
7.	**Freshwater Hatchery**	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Executive	4
		c) General Worker	1
8.	**Ornamental**	a) Aquaculture Expert / Consultant	7
		b) Technical Executive	4
		c) General Worker	1
9.	**Aquatic Plant (Micro and Macro**	a) Aquaculture Expert / Consultant	7
		b) Aquatic Plant Technical Executive	4
		c) General Worker	1

Based on the survey, as shown in Figure 4.2, respondents agree that Fish Operating Manager and Senior Crew/ Foreman/ Fishing Gear Operator/ Engineman are the jobs in demand in the fishing sector.

Shifting the focus to the aquaculture sector, illustrated in Figure 4.3, respondents agree that Aquaculture Expert / Consultant, Head of Department (Production, Quality Control, Maintenance, Harvesting & Packing, Biosecurity, OSHA, Water Management) and General Worker are the jobs that are in demand for the aquaculture industry.

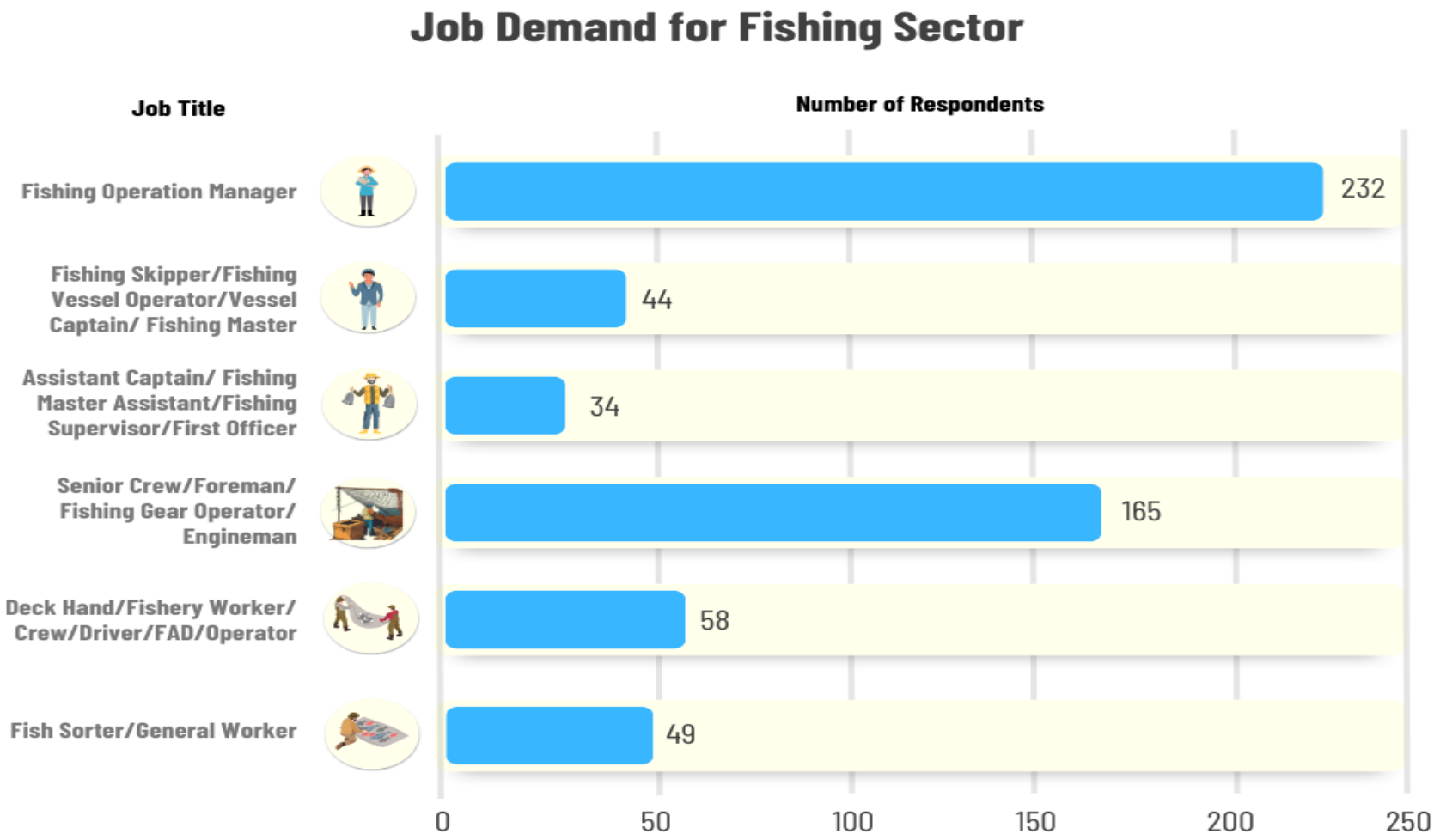

Figure 4.2: Job in Demand for Fishing Sector

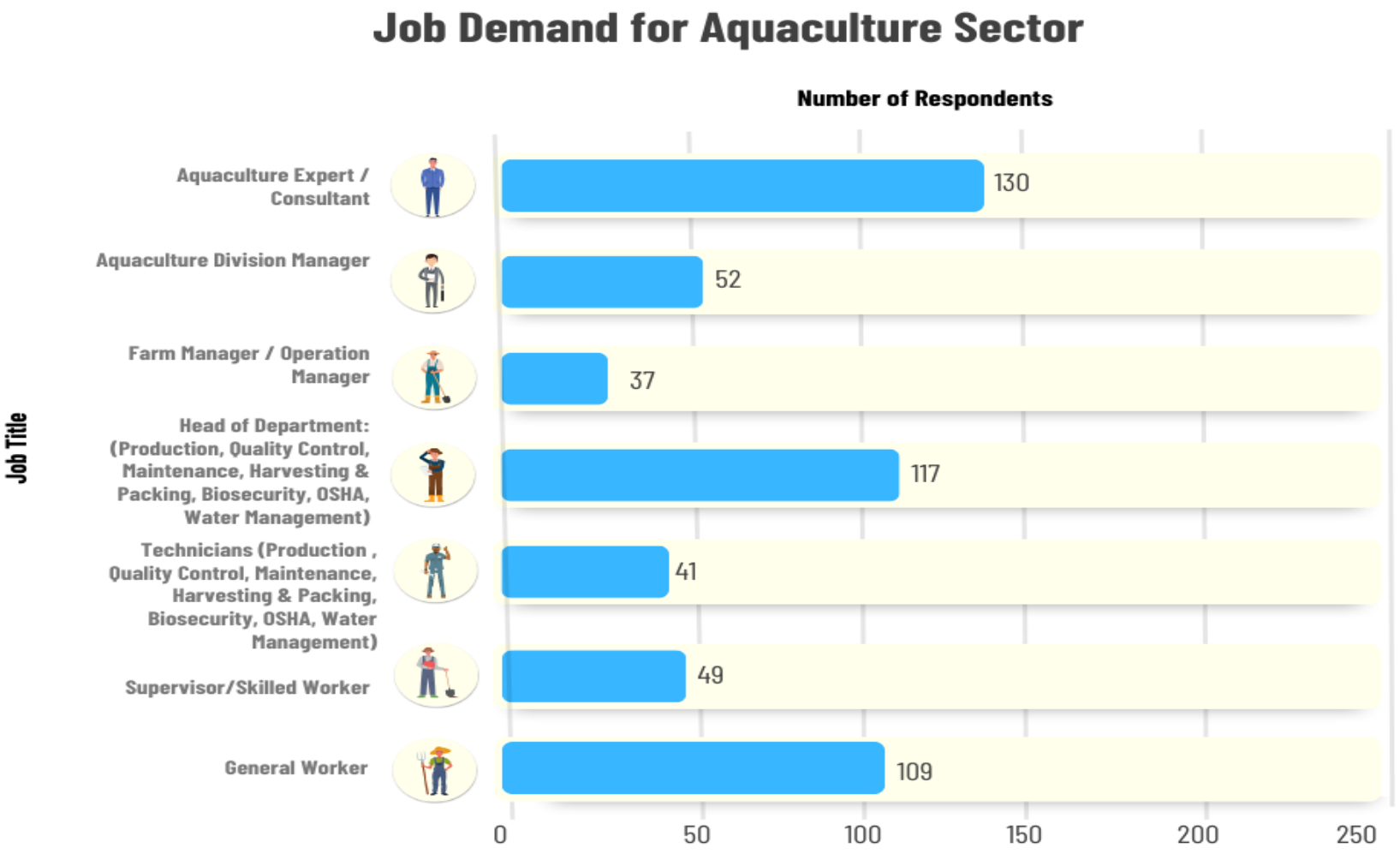

Figure 4.3: Job in Demand for Aquaculture Industry

4.9 Competencies in Demand

This section focuses on identifying and discussing the competencies in demand within the fishing and aquaculture sector. Competencies in demand refer to specific skills and abilities highly sought by the industry in current job roles.

The emphasis is on pinpointing the critical skills for successful job performance within the fishing and aquaculture sectors. These skills could include technical proficiencies, specialised knowledge, problem-solving capabilities, communication skills, adaptability to new technologies, and other relevant competencies.

By understanding and highlighting the competencies in demand, stakeholders in the industry can focus on talent development, training programs, and recruitment strategies to ensure that the workforce possesses the necessary skills to meet the industry's evolving demands and challenges effectively.

As per the feedback provided by the development panels, there are three distinct categories of competencies: general skills, fishing skills, and aquaculture skills. The comprehensive list of these skills can be found in Table 4.11, sorted according to the list of most important based on survey results.

Table 4.11: Competencies in demand in fishing and aquaculture sector

Competencies in demand			
General Skills (Fishing) (Figure 1, Annex 7)	Fishing Skills (Figure 2, Annex 7)	General Skills (Aquaculture) (Figure 3, Annex 7)	Aquaculture Skills (Figure 4, Annex 7)
1) Strong attitude 2) Collecting and updating data 3) Asset management 4) Quality control 5) Risk management 6) Staff's welfare 7) Problem-solving 8) Operation and maintenance 9) Technology skills 10) Communication and interpersonal skills 11) Initiative 12) Record keeping 13) Analytical skills 14) Services operations 15) Husbandry	1) Fishing gears, fish aggregating devices, support vessel operation 2) Waste management and environmental control 3) Navigation 4) Fishery market and demand monitoring 5) Fishing operation 6) Post-harvest operation 7) Diving	1) Husbandry 2) Strong attitude 3) Quality control 4) Problem-solving 5) Staff's welfare 6) Risk management 7) Operation and maintenance 8) Initiative 9) Asset management 10) Record keeping 11) Technology skills 12) Collecting and updating data 13) Analytical skills 14) Services operations 15) Communication and interpersonal skills	1) Diseases management 2) Feed management 3) Water quality management 4) Brood stocks management 5) Production system 6) Hatchery management 7) Live feed culture 8) Waste management 9) Biosecurity 10) Sorting and packing 11) Chemicals handling

Based on the survey, as shown in Figure 1-2 in Annex 7, the most important general skills for the fishing sector selected by most respondents are strong attitude, collecting and updating data, asset management, quality control, risk management and staff welfare. As for fishing skills, the most crucial fishing skills selected by most respondents are fishing gear, fish aggregating devices, support vessels operation, waste management and environmental control, navigation, fishery market and demand monitoring and fishing operation.

Shifting the focus to the aquaculture sector, illustrated in Figures 3-4 in Annex 7, the most important general skills for the aquaculture industry selected by most respondents are husbandry, assertive attitude, quality control, problem-solving, staff welfare and risk

management. Husbandry in fishing and aquaculture refers to managing and caring for aquatic organisms for profit, including day-to-day care, selective breeding, and raising aquatic organisms to enhance production. In contrast, aquaculture skills selected by a majority of respondents are disease management, feed management, water quality management, broodstock management and production system.

4.10 Emerging Skills

The Industrial Revolution has significantly evolved from the first IR, which marked the industrialisation era, to the current fifth IR. The fishing and aquaculture sectors have shown readiness to adapt to these changes and prepare for future transformations.

The effect of the Industrial Revolution's eight (8) technology pillars has been mapped to each job area to understand this relationship better. Development panels were asked to mark Jobs related to IR with ** in the OS table. This mapping aims to identify how these technological pillars' advancements align with and impact the various job roles within the fishing and aquaculture sectors.

By analysing the mapping between the technology pillars and areas, stakeholders in the industry can better grasp the technological requirements and opportunities that arise from the Industrial Revolution. This knowledge will enable them to strategise and implement measures to leverage these technological advancements effectively, fostering innovation and enhancing the overall efficiency and competitiveness of the industry. Table 4.12 shows the mapping of the Industrial Revolution Pillar with the fishing and aquaculture sector based on feedback from the development panel.

Table 4.12: Industrial Revolution Pillar with Fishing and Aquaculture Sector

No.	Area	Industry Revolution Pillar	Technology
1.	**Fishing**	a) Autonomous Robot	• Net Hauler • Mobile Tracking Unit (MTU) • Refrigerated Sea Water (RSW) • Uncrewed Aerial Vehicle (UAV)-Drone

No.	Area	Industry Revolution Pillar	Technology
			• Underwater drone
		b) Internet of Things (IoT)	• Real-Time Climate Monitoring • Fishing Site Identification System (FSI) • Real-Time E-logbook • Electronic Catch Documentation Scheme • On Board Security monitoring system
		c) System Integration	• Sonar • Global Packet Radio System (GPRS) • Global Positioning System (GPS)
		d) Big Data Analytics	• Blockchain System • Smart Weighing System
		e) Simulation	• Individual-Based Model (IBM) for Fish Population Dynamics
		f) Cloud Computing	• Vessel Monitoring System (VMS) • Fisheries Monitoring Centre (FMC)
		g) Cybersecurity	• Vessel Identification System
2.	**Aquaculture**	a) Autonomous Robot/System	• Automatic Feed Control System • Backup Power Auto Switching Systems • Automatic Sludge Discharge System • Water Management and Auto Recovery System
		b) Internet of Things (IoT)	• Real-Time Water Quality Monitoring • Real-Time Growth and Health Monitoring • Real-Time Smart Weather Monitoring
		c) System Integration	• Recirculating Aquaculture System (RAS) • Closed Culture System

No.	Area	Industry Revolution Pillar	Technology
			• Microbial Culture System • Solar System
		d) Cloud Computing	• E-logbook
		e) Big Data Analytics	• Shrimp Post Larvae (PL) and Fish Fry, Live Food Counting Machine & Software for forecasting • Smart Farming Management System • Blockchain Technology
		f) 3D Print	• Makers Printer
		g) Simulation	• Culture System Modelling • Water Quality Simulation
		h) Cybersecurity	• Uncrewed Aerial Vehicle (UAV)-Drone • Monitoring security system (CCTV) • Underwater Drone

As shown in Figure 4.4, the survey results indicate a consensus among respondents that most technology pillars associated with the Industrial Revolution are underutilised or anticipated to be underutilised in aquaculture and fisheries industries. Many stakeholders within the fishing and aquaculture sector may not be fully aware of the potential benefits of adopting advanced technologies. This lack of awareness hinders their willingness to invest in technological solutions. Limited access to information about cutting-edge technologies, best practices, and research findings can hinder technology adoption. Implementing advanced technologies requires a significant initial investment, which may be prohibitive for industry players. However, there is a growing interest in applying Industry 4.0 and 5.0 technologies to revolutionise fishery and aquaculture management.

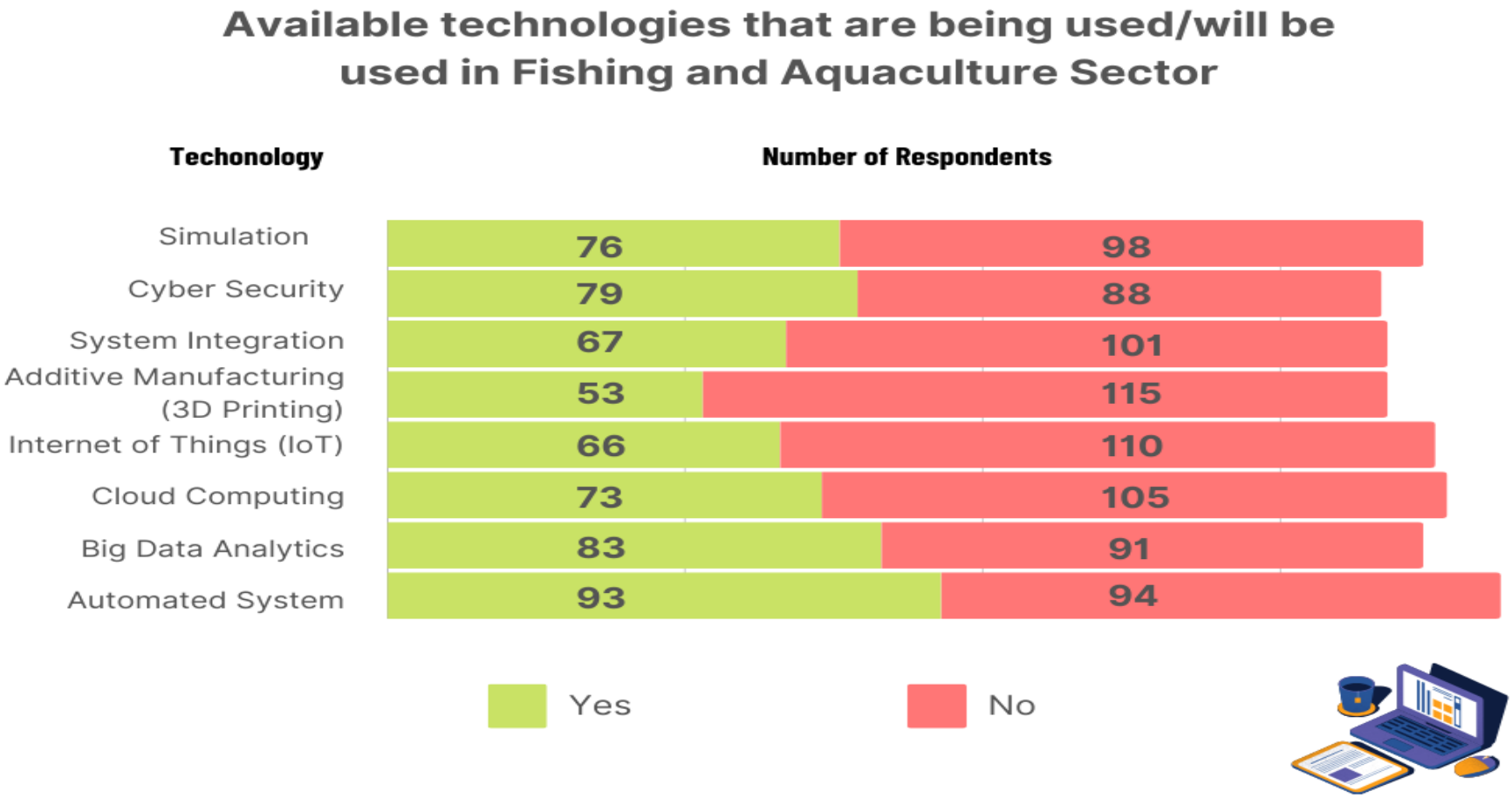

Figure 4.4: Available technologies that are being used/will be used in the Fishing and Aquaculture Sector

4.11 Related Issues in the Fishing and Aquaculture Sector

This section focuses on shedding light on the common issues within the fishing and aquaculture sector. Based on insights provided by expert panels from the fishing and aquaculture sector, eleven (11) key issues have been identified. These issues encompass a range of challenges and concerns that are relevant to the industry.

These fundamental issues are likely to impact the skills requirements within the sector significantly. Addressing these challenges is crucial for ensuring a skilled and capable workforce that can effectively tackle the complexities of the fishing and aquaculture sector.

By understanding and acknowledging these critical issues, stakeholders and decision-makers in the industry can develop targeted strategies and initiatives to address the skills gaps and enhance the overall efficiency and sustainability of the fishing and aquaculture sector. This proactive approach is vital for fostering growth and innovation in the sector and ensuring the workforce remains equipped to handle the evolving demands of the fishing and aquaculture sectors. The list of related issues in the fishing and aquaculture sector is presented below. The following lists were derived from the data elicited and analysed from the FGD session.

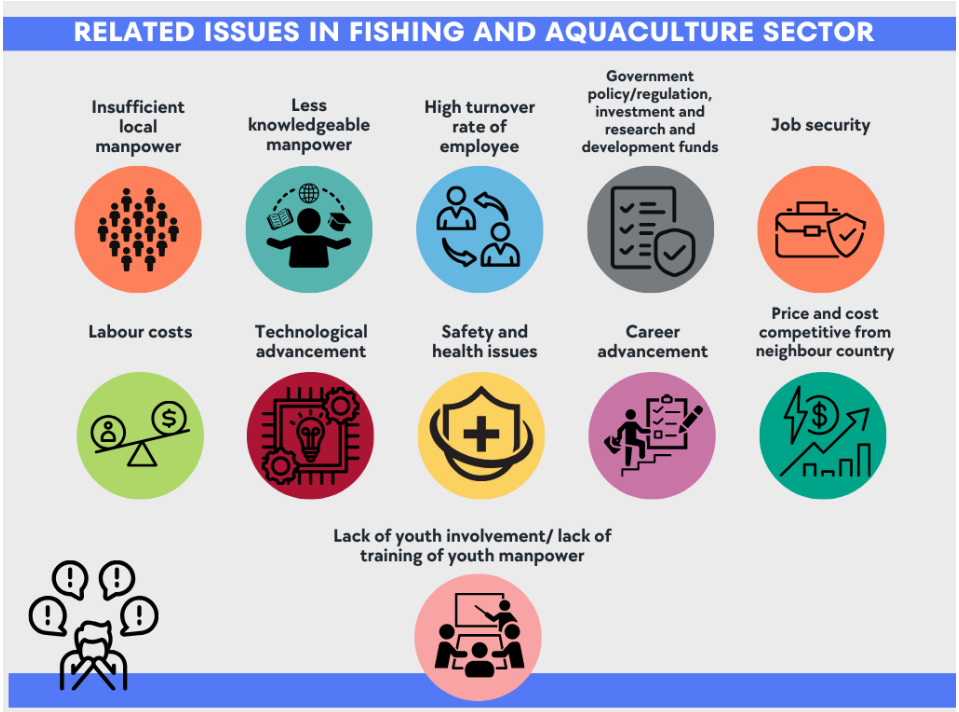

Figure 4.5: Related Issues in the Fishing and Aquaculture Sector

Subsequently, the issues above were incorporated as the items in the survey to confirm and validate the issues and identify the most prominent issues identified by the industry through the survey.

According to the survey results shown in Figure 4.6, a significant majority of respondents (114 individuals) identified job security as the primary concern within the industry. Following closely behind are safety and health issues, which garnered the attention of 108 respondents, while 102 respondents noted the lack of youth involvement and insufficient training for the young workforce.

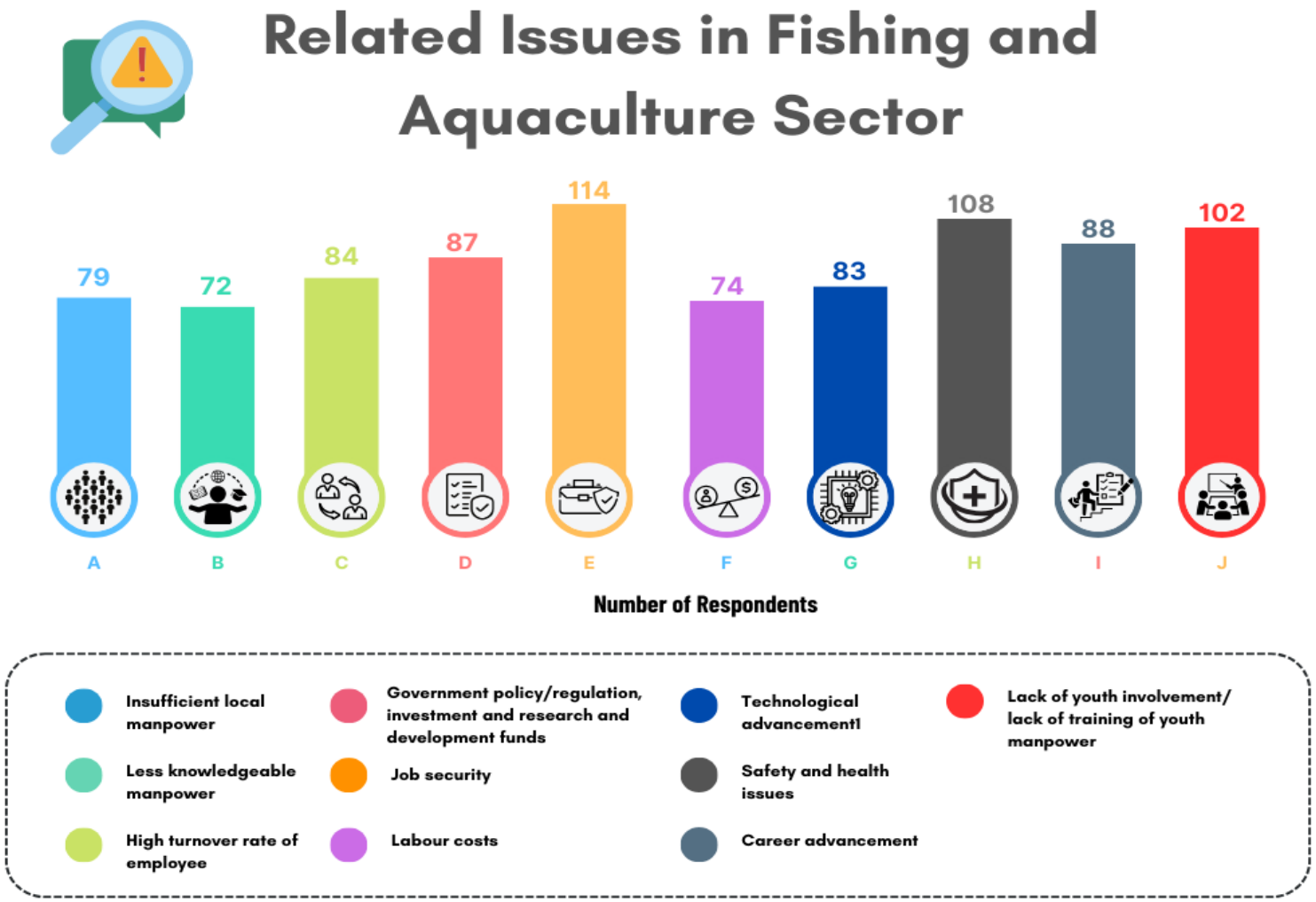

Figure 4.6: Related Issues in Fishing and Aquaculture Sector

4.12 Chapter Summary

In conclusion, this chapter has provided a comprehensive overview of all the findings derived from the research methods implemented in this study. By primarily referring to MSIC 2008, the Occupational Structure (OS) for the fishing and aquaculture sector has been meticulously developed, considering the MOSQF Level Descriptors specific to this sector. The development of the OS resulted from extensive discussions held with expert panels from the fishing and aquaculture sector during the Focus Group Discussion (FGD) sessions and the collective responses from the survey.

Ten (10) distinct job areas and 62 job titles have been identified within the OS, each associated with specific economic activities classified in MSIC 2008. Moreover, critical jobs that are challenging to fill, competencies in demand for the industry, and critical issues affecting the fishing and aquaculture sectors were also identified and analysed.

The responsibilities, knowledge, skills, and attributes required for each critical job have been thoroughly described, providing a clear understanding of the expertise needed for effective job performance.

Furthermore, twenty-four (24) National Occupational Skills Standards (NOSS) have been identified and mapped to the job titles within the fishing and aquaculture sectors. This mapping serves as a valuable reference for the future development of NOSS, ensuring that skill development programs align with the industry's specific needs and requirements.

Overall, the findings from this Occupational Framework can serve as a significant reference point for the future development of skills standards, training programs, talent development initiatives and advanced technology adoption within the fishing and aquaculture sector. The insights provided in this chapter can assist industry stakeholders in addressing challenges, enhancing workforce capabilities, and fostering growth and innovation within the fishing and aquaculture sectors.

CHAPTER V

DISCUSSION, RECOMMENDATIONS AND CONCLUSION

5.1 Discussion

The fishing and aquaculture sector can be considered a well-established industry with enormous potential. The study identified ten (10) job areas, four belonging to 3-digit MSIC 2008 Group 031: Fishing and six to 3-digit MSIC 2008 Group 032: Aquaculture. These job areas encompass various roles and responsibilities within the industry.

5.1.1 Survey Considerations and Outcomes

Several practical factors were considered when choosing the location of survey distribution: convenience, budget, and availability. The survey was collected from five states: Sabah, Sarawak, Terengganu, Selangor and Perak. The chosen locations provide a representative sample of the population or phenomenon being studied. Overall, in Malaysia, Sabah, Sarawak, Selangor, Perak, and Terengganu have significant fishing and aquaculture sectors that could be studied to better understand the country's sector. Sabah and Sarawak recorded the most significant number of respondents involved in the fisheries sector. These states are known for their marine biodiversity, where their waters are rich in fish and other marine resources, making them attractive locations for fishing activities (The et al., 2009).

Some respondents were involved in both inland fisheries and aquaculture. Individuals might take advantage of the resources in areas where natural water bodies (such as rivers and lakes.) and aquaculture ponds or facilities are available.

Based on the survey conducted, it has been observed that the fishing and aquaculture sector

is a predominantly male-dominated sector. However, the notion that females lack resilience is an archaic generalisation that does not hold for all women. Many women worldwide have demonstrated remarkable resilience in various sectors, including fisheries and aquaculture. The fisheries and aquaculture sectors are diverse, encompassing various roles beyond fishing. Women are often involved in processing, marketing, and trade, contributing significantly to the value chain. Generally, female graduates from this field find employment in laboratory-based, hatchery, or farming-based positions. Promoting gender diversity in the sector should focus on creating an inclusive environment where women feel encouraged to pursue a wide range of roles.

5.1.2 Capture Fishery Outlook

Based on the collected survey, the age range of personnel involved in the fisheries sector is 50 to 59 years old. On the other hand, the age range of personnel involved in the aquaculture sector is 30 to 39 years old. A few possible reasons exist for the lack of youth involvement in the fisheries sector. There is a negative perception of the fisheries sector among youth. This perception may stem from factors such as the physically demanding nature of the work, long working hours, and the perception that the sector lacks modernisation and career prospects. Many young people may not be aware of the opportunities and potential benefits that the fisheries sector can offer. The lack of clear career development pathways and opportunities for growth within the sector may discourage youth from pursuing careers in this field. Hence, an occupational framework provides clear career pathways and progression opportunities within fisheries. It outlines the roles, skills, and qualifications required for various positions. By providing a structured framework that outlines career pathways, skills development, recognition, and support, an occupational framework can inspire and empower youth to consider and pursue careers in the fisheries sector. It helps address the challenges of negative perception, limited awareness, and lack of career development opportunities, ultimately promoting youth engagement and ensuring the sector's sustainability.

The fishing license system in Malaysia has been identified as a challenge in attracting youth and new players to the fishing sector. Since 1982, a moratorium policy was enforced on issuing new licenses in coastal water areas encompassing A, B and C Fishing Zones. The moratorium initiative was initiated to manage fishery resources sustainably and white-list

licensed fishing vessels. By addressing these challenges and promoting youth engagement, the fisheries sector in Malaysia can ensure its sustainability and contribute to economic growth. It is important to note that while the moratorium of fishing licenses may have some limitations and challenges, it is also intended to ensure that genuine fishermen hold licenses and prevent misuse or speculative practices. Balancing the need for sustainable fishing practices with the aspirations of young individuals to enter the industry is crucial for Malaysia's fishing sector's long-term viability.

In the fisheries sector in Malaysia, it has also been observed that the jobs often lack salary slips or specific job titles. This situation highlights the need for the construction of an occupational framework. The fishing industry's lack of specific job titles can make it difficult to establish clear employment structures and ensure fair compensation for workers (Rahman, 2022). The fishing industry is not attracting many young people due to various factors, including the perception of low income and the demanding nature of the work. The unattractiveness further highlights the need for a more structured and attractive occupational framework to encourage youth participation.

5.1.3 Prevalent Preference Towards Aquaculture

There are several reasons why people may be more interested in the aquaculture sector compared to the fisheries sector. The fisheries sector has traditionally focused on producing fish to feed the human population, but its focus has shifted to economic profit and controlling environmental impact (Brugere et al., 2023). The demand for seafood is increasing due to a larger and more affluent population, and aquaculture production is seen as a way to meet this demand (Boyd et al., 2022). The fisheries sector is facing environmental challenges, such as overfishing and habitat degradation, which can limit the potential for growth and profitability (Kurniawan et al., 2021). Aquaculture, on the other hand, has the potential to be more sustainable and environmentally friendly. The aquaculture sector has seen rapid technological advancements in recent years, which have improved production efficiency and quality.

5.1.4 Stakeholder Involvement and Government Initiative

The stakeholders' lack of involvement in Malaysia's fisheries sector is a concern. The topical scope of fisheries stakeholder assessments in Southeast Asia has been focused primarily on stakeholders operating within private-sector commercial fisheries (Pomeroy et al., 2016). The lack of distribution suggests that other stakeholders, such as small-scale fishermen and coastal communities, may not be adequately represented. To address inadequate stakeholder involvement in the fisheries sector in Malaysia, proper communication and engagement with all stakeholder segments in fisheries stakeholder assessments and decision-making processes is vital. Efforts should be made to support the artisanal fisheries sector and address the challenges faced by small-scale fishermen. Promoting fishing as an entrepreneurship activity and addressing the perception of low-income may also help attract more young people to the industry. Finally, there is a need to ensure the long-term sustainability of the fisheries sector and its resilience to environmental challenges.

Nevertheless, government agencies do assist in this sector. The government has come up with different incentives and support to promote the development of the capture fisheries sector, such as modernising fishing vessels through offering lower financing rate loans and matching grants to the fishers. Government agencies provide input assistance for aquaculture feed, fish fry, culture equipment, biosecurity facilities, and technical assistance for the aquaculture sector. Kolej Perikanan Sultan Nazrin Muizzuddin Shah, Aquaculture Extension Centre and Fisheries Research Institute are a few training centres under the Department of Fisheries focusing on aquaculture. Moreover, '*Bahagian Latihan Sijil Perikanan Malaysia*' is a program that offers certification in fisheries provided by the Department of Fisheries Malaysia and implemented by *Akademi Perikanan Malaysia*. The program aims to produce skilled workers in the fisheries sector to meet the needs of both the government and private sectors. This initiative aims to provide individuals with the necessary skills and knowledge to pursue a career in the fisheries industry.

Incentivising potential workers to become a part of the industry can be a more practical approach than bemoaning the lack of quality personnel. General workers are usually foreign citizens, as labour costs have emerged as an issue in the aquaculture sector (Engle, 2021). Labour is a significant production cost, making finding workers for general jobs difficult.

5.1.5 Challenges Facing Capture Fishery

Based on the survey for the fishing sector, fishing gear handling was highlighted as the expertise required in this sector. Small-scale fisheries in Malaysia typically require one or two crew members with fishing gear handling skills. The artisanal fisheries sector in Malaysia, which includes many small-scale fishermen, supports poor rural and coastal communities economically in more ways than just through local incomes and livelihoods (Rahman, 2022). Job titles that are difficult to fulfil include fish sorter, general worker, deckhand, fishery worker, or crew. These jobs are known to be physically demanding work that requires long hours of standing, lifting, and performing strenuous tasks. Working on a fishing vessel can be challenging, with cramped and messy working conditions. This type of work environment may not appeal to everyone, particularly those who prefer a more comfortable one. Many deck hand/fishery worker/crew jobs are seasonal, making it difficult to find workers willing to work for a short period. Plus, the turnover rate for these jobs is generally high. Deckhand positions are often entry-level roles with limited opportunities for career advancement.

The survey highlights that lack of relevant training, lack of interest and significant changes in standards, systems and technologies that require new skills are the reasons for the skills gap in fishing and aquaculture industries. This drawback could be due to a lack of awareness of the availability of training, lack of aptitude in gathering relevant information, low level of education or qualification or merely the doubt on the usefulness or relevance of the training received for current work. Attending training can lead to income loss for workers, especially if the program is unpaid and they cannot work during the training hours. This cost represents the potential income that could have been earned if the worker had not attended training.

Generally, most respondents believed that the Industrial Revolution would impact this sector. The fishing industry is still mainly in the dark regarding technology despite the sweeping changes that technology has brought to other economic sectors. Equipping boats with powerful digital tools could help stem industry losses while targeting the biggest threat to our oceans: overfishing. Many activities related to small-scale fisheries, including fishing, gear manufacture, and processing, are not full-time occupations, which may limit the adoption of new technologies. (Arthur et al., 2022).

Insufficient local workforce and underpaid wages lead to a high employee turnover rate, a current issue that needs to be addressed in the fishing industry. The construction of an OF can help address these issues. An occupational framework can help standardise job roles and responsibilities in the fishing industry, which can help ensure fair wages and prevent underpayment of workers. An occupational framework can help promote the fishing industry as an attractive career option, particularly among young people. The OF's recommendations can help address the insufficient local workforce in the industry.

5.1.6 Potential and Challenges for Aquaculture

Aquaculture has been identified as a sector in the fisheries industry that has the potential to contribute significantly to Malaysia's economy. Aquaculture seems more attractive for people, especially youth, as this sector has significant growth potential in Malaysia, which can create new opportunities for employment and entrepreneurship. New technologies and practices can improve production efficiency, quality, and environmental management (Bandira et al., 2021). Some of the higher institutions in Malaysia that offer aquaculture courses are Universiti Putra Malaysia, Universiti Malaysia Terengganu, Universiti Teknologi Malaysia, Universiti Malaysia Sabah, polytechnics, Kolej Komuniti and Kolej Vokasional. These institutions offer a range of undergraduate and postgraduate programs in aquaculture, providing students with the knowledge and skills needed to pursue careers in the sector. Students can explore fish biology, aquaculture systems, aquatic ecology, and fish nutrition.

Challenges that aquaculture graduates who decide to become entrepreneurs may face include the lack of guidance and support in establishing a farm. The lack of 'starter packs', typically of essential equipment or resources, can hinder their ability to establish and operate their aquaculture ventures effectively. It is vital for stakeholders, including educational institutions, government agencies, and industry associations, to collaborate and develop initiatives offering support and resources to aquaculture graduates. The support could include providing access to funding, equipment, technical assistance, and mentorship programs to help them establish and succeed in their aquaculture ventures. Aquaculture graduates must explore various avenues for support, such as seeking guidance from industry

professionals, networking with experienced aquaculturists, and exploring funding opportunities or grants that may be available to them. By actively seeking resources and support, graduates can increase their chances of overcoming the challenges they may face when starting their businesses.

The aquaculture survey highlights that sales and marketing are essential areas of expertise. Aquaculture businesses require more than just production skills. Business management skills, including sales and marketing, are crucial for the success of an aquaculture venture (Webster et al., 2008). These skills help ensure the products are effectively promoted, sold, and reached the target market. Likewise, respondents also believed that breeding skills are also critical. Selective breeding is integral to increasing future aquaculture production and improving the biological productivity of farmed fish and shellfish species (Gjedrem et al., 2012). Breeding technology is considered relevant to ensuring sustainable aquatic production and ecosystem services (Azra et al., 2022). By improving the genetic traits of farmed species, aquaculture can become more efficient and environmentally friendly.

Most respondents believe that aquaculture expert/consultant are job titles that are difficult to be fulfilled. Through the focus group discussions, panels agreed that this job title is critical and relevant to the Industrial Revolution. An aquaculture expert/consultant's responsibilities include developing and implementing feasible technology, problem-solving and mitigating cultural system issues, and transferring knowledge and technologies.

The most essential skill categories related to personnel involved in aquaculture are strong attitude and risk management. A strong attitude is crucial for personnel involved in aquaculture as it requires dedication, perseverance, and a positive mindset. Aquaculture operations can be challenging, and personnel must be resilient and adaptable to overcome obstacles and achieve success (Webster et al., 2008). Risk management is a critical skill for personnel in aquaculture. The industry is considered high-risk, and identifying, assessing, and mitigating risks is essential for the sustainability and profitability of aquaculture operations (Luna et al., 2023).

5.1.7 Jobs and Competencies Identification

From the identified ten job areas, 62 job titles have been recognised, with 24 classified as critical jobs and 39 deemed relevant to the Industrial Revolution. The development of the Occupational Structure (OS) proves highly beneficial in elevating careers in the A03: Fishing and Aquaculture sector to a more professional level. Simultaneously, the OS can help mitigate the shortage of skilled workers in the industry by providing clear guidelines and qualifications for job positions.

The OS is a valuable guide for the industry, streamlining the process of filling existing positions based on the necessary qualification requirements. It also facilitates a thorough understanding of the OR associated with each job title and filled position.

Regarding skills development, the job titles identified in the OS require a holistic view to develop standards, skills training, and certification for recognition. While Table 2.3 in Chapter 2 presents a list of National Occupational Skills Standards (NOSS) developed under 2-digit MSIC 2008 Division A03, this study provides a more comprehensive view of the industry's specific skill development needs. This insight can aid in developing other critical job areas and refining the skills training programs to meet the industry's evolving demands.

Overall, the Occupational Structure developed in this study offers valuable insights and solutions to enhance the fishing and aquaculture sector's efficiency, professionalism, and workforce capabilities.

5.2 Recommendations

As the Occupational Framework (OF) outcome is utilised for plans and strategies, it becomes a crucial reference point to enhance the development of skilled personnel and implement a robust certification system in the fishing and aquaculture sectors. The insights from the OF will play a vital role in elevating the value and quality of the local workforce, positioning them with a competitive edge. Moreover, it will strengthen Malaysia's fishing and aquaculture sector, aligning it with standards observed in developed countries.

5.2.1 Overall Recommendations for the Fishing and Aquaculture Industry

Based on the recommendations gathered during document analysis and focus group discussions, the recommendations for enhancing the fishing and aquaculture sector should be based on the prioritization outlined in Figure 5.1, with further details provided below.

Figure 5.1: Recommendations for Enhancing the Fishing and Aquaculture Sector

a) **Sustainable Practices**: Strong emphasis on adopting and promoting sustainable practices within the fishing and aquaculture sector, which includes responsible fishing and farming methods that protect marine ecosystems and ensure long-term viability. Promoting fishery sustainability entails implementing science-backed catch limits, enforcing strict regulations to prevent overfishing, reducing bycatch with selective gear, creating marine protected areas, and encouraging responsible aquaculture. Traceability, community engagement, research, climate adaptation, and market incentives are crucial for a holistic fisheries management and resource preservation approach. Training promotes responsible and sustainable fishing and aquaculture practices, which are

essential for the long-term health of ecosystems and the industry's viability. As the demand for fish grows, sustainable aquaculture helps reduce pressure on wild fish stocks. Cultivating fish in controlled environments can meet consumer needs without depleting natural fish populations.

b) **Skills Development and Training**: Invest in comprehensive skills development and training programs for workers in the fishing and aquaculture sectors. Enhance their expertise in sustainable practices, fish health management, breeding techniques, and other relevant areas. Training is essential in sustainable practices, safety, and technology use. These programs empower workers, improve efficiency, and promote sustainable practices, ensuring the long-term viability of the industry and safeguarding livelihoods. The development of OF ensures that workers receive proper training in safety protocols, reducing accidents and promoting the well-being of individuals working in often hazardous conditions. Fostering talent through education, vocational training, and skill-building initiatives is essential for sustainable fisheries and aquaculture development.

c) **Research, Development and Innovation**: Highly encourage the involvement of government and private sector in research and innovation in the industry to improve breeding methods, disease management, feed efficiency, and overall productivity. Collaboration between industry stakeholders and research institutions is crucial in driving progress. The investment includes grants in scientific research to enhance understanding and uplifting of the fishing and aquaculture sector. Innovations in equipment technology and sustainable practices reduce environmental impacts. This knowledge and innovation drive the industry toward sustainability, resource conservation, and economic growth. A well-trained workforce is more ready to adopt and adapt to technological innovations that improve productivity, reduce environmental impact, and enhance competitiveness.

d) **Industry Regulation and Compliance**: Implement and enforce regulations that support sustainable and responsible practices in aquaculture and fisheries. The enforcement should include establishing a monitoring program and a robust enforcement system to ensure compliance and protect the industry's reputation. An OF is crucial for industry

regulation and compliance. It ensures workers are trained to adhere to regulations, promoting responsible practices. This standardised approach helps authorities monitor and enforce compliance efficiently, safeguarding fish stocks, ecosystems, and the industry's reputation for responsible resource management.

e) **Capacity Building for Small-Scale Fishers:** Support and capacity-building initiatives for small-scale fishers, empowering them to adopt sustainable practices and improve their livelihoods. An OF is vital for capacity building among small-scale fishers. It offers structured training and skill development opportunities, enabling these individuals to enhance their efficiency, safety, and sustainable practices. This empowerment is essential for small-scale fishers' economic resilience and long-term viability.

f) **Market Access and Branding**: Focus on marketing and branding initiatives to promote sustainably farmed, responsibly caught seafood products domestically and internationally. Creating awareness about eco-friendly practices can attract environmentally-conscious consumers. A well-trained workforce contributes to producing high-quality, sustainable seafood products, enhancing a country's reputation in international markets and ensuring access to global trade opportunities.

g) **Public Awareness and Engagement**: Increase public awareness about the importance of sustainable seafood consumption and the role of aquaculture and fisheries in food security and economic development. Engaging with the public will foster support for sustainable practices and current technology. An OF is essential for enhancing public awareness and engagement in the fisheries and aquaculture sector. Establishing professional standards and education builds trust and credibility with the public. Workers trained under this framework can better communicate industry practices, sustainability efforts, and conservation, fostering informed consumer choices and positive public perception.

h) **Collaboration and Strategic Partnerships**: Foster collaboration and knowledge-sharing among industry stakeholders, research institutions, government agencies, and NGOs. This collective effort can address challenges and drive positive change. OF sets

common standards, skills, and qualifications, facilitating cohesive efforts by stakeholders. This framework enables coordinated action, information sharing, and collective problem-solving, leading to more effective resource management, sustainability, and industry growth through collaborative initiatives.

i) **Incentives and Support**: Incentives and financial support could be offered for projects that promote sustainable practices and innovation in the fishing and aquaculture sectors. An OF is essential for providing incentives and support within the fisheries and aquaculture sector because it establishes a structured pathway for skill development and career progression. Offering training and educational opportunities encourages individuals to enter the industry, improves job satisfaction, and enhances the attractiveness of careers in fisheries and aquaculture. The incentive, in turn, strengthens the workforce, fosters a sense of professional identity, and promotes economic growth within the sector. Additionally, it can facilitate access to support mechanisms such as healthcare, insurance, and social benefits, improving the overall well-being of workers and their families.

j) **Continuous Improvement**: Encourage a culture of continuous improvement within the industry, focusing on adapting to new technologies, best practices, and evolving market demands. This OF ensures that workers are continually updated with the latest best practices, technological advancements, and sustainability measures. It promotes a culture of learning and innovation, fostering the sector's resilience and long-term growth while addressing evolving challenges and opportunities.

k) **Digitalise technologies/industries:** Digitalisation enhances efficiency, sustainability, and profitability in fisheries while contributing to better resource management and conservation efforts. However, it is vital to ensure these technologies are accessible and affordable to all stakeholders, including small-scale fishermen and aquaculture operators, to promote inclusive growth in the industry**.** An OF is vital in the fisheries and aquaculture sector to equip workers with digital skills. Affordable access will enable them to harness the potential of digitalised technologies for resource management, safety, compliance, sustainability, and competitiveness, ensuring the sector's adaptation

to the digital age while safeguarding its long-term viability.

By prioritising these suggestions, Malaysia's fishing and aquaculture sector can further enhance its productivity, sustainability, and competitiveness. The boost will contribute to economic growth and ensure the industry's long-term viability and environmental conservation.

5.2.2 Recommendations for National Occupational Skills Standards (NOSS)

Throughout the Occupational Framework (OF) development phases, the importance of advancing the development of National Occupational Skills Standards (NOSS) has been emphasized continuously. Specifically, expert panellists highlighted the need to identify job titles that are critical to the industry and relevant to the ongoing industrial revolution, even if there are no existing NOSS for these roles. This urgency stems from the industry's current demands and the swift pace of technological advancements.

To elaborate further, the panel recognized that in today's rapidly evolving industrial landscape, certain job titles have emerged as crucial. These roles play a pivotal role in driving innovation and growth within their respective industries. However, it has become evident that the existing NOSS framework may not encompass these newly emerging job roles adequately. As a result, there is a pressing need to address this gap by developing NOSS tailored to these critical positions.

The driving force behind this initiative is the ever-increasing demand for skilled professionals in areas directly impacted by technological advancements. These advancements have disrupted traditional job descriptions and created entirely new roles that require specific skills and competencies. By developing NOSS for these roles, the industry can ensure that its workforce is adequately trained and prepared to meet the challenges and opportunities presented by the ongoing industrial revolution.

The panel's recommendation underscores the importance of proactively identifying and developing NOSS for critical job titles relevant to the industrial revolution. This strategic approach will enable industries to adapt to the changing landscape and ensure a skilled workforce that can contribute to sustained growth and innovation.

Nine (9) National Occupational Skills Standards (NOSS) have been recommended for review by developmental panels. These NOSS are under consideration for revision as their content no longer accurately reflects the responsibilities of individuals involved in the fisheries sector, particularly concerning product-related aspects. Additionally, they may encompass developmental considerations that exceed the scope of aquaculture. The list of recommended NOSS for review can be cross-referenced with the contents in Table 5.1 below.

The OS-NOSS mapping also reveals that the job title “Hatchery Manager” at Level 5 in the Marine Hatchery job area has not been mapped with any existing NOSS despite an existing NOSS, AF-033-5:2012 Fresh Water Fry Production Management, being mapped with a similar job title in Freshwater Hatchery job area. It is recommended that the NOSS AF-033-5:2012 be reviewed to cover hatchery operation and management competencies for marine and freshwater hatcheries completely.

Reviews on the existing NOSS may be facilitated by gap analysis mapping the Competency Units (CU) from an existing NOSS against Occupational Responsibilities (OR) items covering the respective Job Titles. It is worth noting that DSD is also pursuing Micro-Credential certification that allows combining CUs from different NOSS titles for an accumulative certification equivalent to a full NOSS. Micro-credential certification would enable existing Malaysian Skills Certificate (SKM) holders to upgrade their skills credential by taking only the necessary CUs from a newer NOSS for their qualification upgrades rather than signing up for another full NOSS certificate altogether. Reviewing the selected existing NOSS to cover the latest competencies could greatly boost this micro-credential initiative.

This Occupational Framework (OF) also wishes to open an opportunity for fresh NOSS development. The mapping exercise reveals that the Level 5 job title “Operation Head” in the Aquatic Plant job area could not be mapped to any available NOSS. It is recommended that a Level 5 NOSS titled “Aquatic Plant Cultivation” to be built from scratch to aptly cover this occupation.

The job title “Fishing Operation Manager” at Level 6 across all three marine fishery Job Areas in MSIC Group 031 Fishing covers a significant upgrade in Occupational Responsibilities (OR) over their respective Level 5 counterparts. A similar pattern is

observed for the "Aquaculture Division Manager" and "Farm Manager" job titles across Level 6 in MSIC Group 032 Aquaculture. In line with DSD's drive to extend the Malaysian Skills Certification System (SPKM) beyond Level 5, this Occupational Framework recommends that two Level 6 NOSS be developed to cover the advanced competencies in fishing and aquaculture, respectively. Competency Units (CU) for these NOSS may be derived from the Occupational Responsibility (OR) items concurrent to the Job Titles covered. The details entailing each CU, however, are best left to the prospective NOSS development teams. Table 5.2 outlines the recommended fresh NOSS and their corresponding Job Titles.

Table 5.1: List of NOSS proposed to be reviewed for A031 and A032

MSIC Group	NOSS Code	NOSS Title and Level
031-Fishing	Y-020-3	Fishery Technician Level 3
	Y-020-2	Fishery Junior Technician Level 2
	Y-020-1	Fishery Assistant Level 1
032-Aquaculture	BT-026-5:2014	Spiny Lobster Hatchery Management Level 5
	BT-026-4:2014	Spiny Lobster Hatchery Control Level 4
	BT-026-3:2014	Spiny Lobster Hatchery Operation Level 3
	AF-021-3:2015	Semi-Refined Carrageenan Production Level 3
	BT-045-5:2014	Microalgae-Based Product Development & Management Level 5
	AF-033-5:2012	Fresh Water Fry Production Management

Table 5.2: Recommendation for new NOSS development

MSIC Group	Job Area	Job Title	Level	Proposed NOSS Title and Level
031-Fishing	Coastal Fisheries	Fishing Operation Manager	6	Capture Fisheries Development Level 6
	Deep Sea	Fishing Operation Manager	6	
	Open Sea	Fishing Operation Manager	6	
032-Aquaculture	Marine Grow-out	Aquaculture Division Manager	6	Aquaculture Development Level 6
	Marine Hatchery	Aquaculture Division Manager	6	
	Freshwater Grow-out	Aquaculture Division Manager	6	

MSIC Group	Job Area	Job Title	Level	Proposed NOSS Title and Level
	Freshwater Hatchery	Aquaculture Division Manager	6	
	Ornamental	Farm Manager	6	
	Aquatic Plant	Farm Manager	6	
	Aquatic Plant	Operation Head	5	Aquatic Plant Cultivation Level 5

5.3 Conclusion

The developed OF proves to be the most practical and economical approach in ensuring that the fishing and aquaculture sector remains up-to-date, well-equipped, and adequately prepared to adapt to the changes brought about by the various industrial revolutions.

The objectives and sub-objectives of developing the OS has been successfully achieved. Division A03 has been divided into ten (10) major job areas within the OS. Job titles, representative of each area and level of competencies have been meticulously presented, extracting 41 job titles. The detailed OS can be found in Table 4.4.

Critical job titles, relevancy to the Industrial Revolution (IR), and skills in demand for each job title have been carefully addressed. Twenty-four job titles have been identified as critical job titles within Division A03. Thirty-nine job titles have been recognised as relevant to the IR. The criticality and relevancy of each job title to the IR can be seen in Tables 4.4 and 4.5.

Following the development of the OS, comprehensive occupational responsibilities for each identified job title have been meticulously compiled in Tables 4.6 and 4.7. Furthermore, the occupational descriptions for the critical jobs were presented and included in Annex 6. These occupational descriptions encompass the primary responsibilities of each job title and the required knowledge, skills, and attributes needed for a candidate to excel in that role.

As an additional outcome of this study, a mapping between job titles and available National

Occupational Skills Standards (NOSS) for Division A03 was successfully achieved. This mapping provides a valuable reference and guide for the industry, policymakers, and training agencies in preparing the fishing and aquaculture sector for upcoming economic and technological challenges.

Overall, the developed OF serves as a valuable tool for the fishing and aquaculture sector, assisting in talent management, skills development, and strategic planning to navigate and thrive amidst the ever-changing landscape of the industrial revolutions. Constructing an occupational framework in the fisheries sector in Malaysia would involve establishing clear job titles, defining job responsibilities, and ensuring fair compensation and benefits for workers. This framework would provide a more structured and organised approach to employment in the sector and ensure coastal communities' long-term financial and ecological sustainability.

REFERENCES

Ahmed, N., & Turchini, G. M. (2021). Recirculating aquaculture systems (RAS): Environmental solution and climate change adaptation. *Journal of Cleaner Production*, *297*, 126604.

Arthur, R. I., Skerritt, D. J., Schuhbauer, A., Ebrahim, N., Friend, R. M., & Sumaila, U. R. (2022). Small-scale fisheries and local food systems: Transformations, threats and opportunities. *Fish and Fisheries*, *23*(1), 109-124.

Auger, P. (2017). *Information sources in grey literature.* De Gruyter Saur.

Azra, M. N., Okomoda, V. T., & Ikhwanuddin, M. (2022). Breeding technology as a tool for sustainable aquaculture production and ecosystem services. *Frontiers in Marine Science*, *9*, 679529.

Bandira, P. N. A., Mahamud, M. A., Samat, N., Tan, M. L., & Chan, N. W. (2021). GIS-Based multi-criteria evaluation for potential inland aquaculture site selection in the George Town Conurbation, Malaysia. *Land*, *10*(11), 1174.Bosma, R. H., & Verdegem, M. C. (2011). Sustainable Aquaculture in Ponds: Principles, Practices and Limits. Livestock Science, 139(1-2), 58-68.

Boyd, C. E., McNevin, A. A., & Davis, R. P. (2022). The contribution of fisheries and aquaculture to the global protein supply. *Food security*, *14*(3), 805-827.

Belton, B., & Little, D. C. (2011). Immanent and Interventionist Inland Asian Aquaculture Development and its Outcomes. Food Policy, 36(1), 123-132.

Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners.* Sage.

Brugere, C., Bansal, T., Kruijssen, F., & Williams, M. (2023). Humanizing aquaculture development: Putting social and human concerns at the center of future aquaculture development. *Journal of the World Aquaculture Society*, *54*(2), 482-526.

Card, N. A. (2018). Literature review. In N. J. Salkind (Ed.). *Encyclopaedia of research*

design (pp. 725 – 728). SAGE Publications.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed method approaches* (4th ed.). Sage.

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research.* Thousand Oaks, CA: Sage.

Dardak, R. A. (2015). Transformation of agricultural sector in Malaysia through agricultural policy. *Malaysian Agricultural Research and Development Institute (MARDI), Malaysia*, *7*.DeForge, B. R. (2018). Research design principles. In N. J. Salkind (Ed.). *Encyclopaedia of research design* (pp. 1252 – 1258). SAGE Publications.

Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods*. Praeger.Engle, C. R. (2021). The workforce needed to support future growth of aquaculture. *Journal of the World Aquaculture Society*, *52*(4), 768-771.

FAO. (2020). The State of World Fisheries and Aquaculture 2020.

FAO. (2014). Technical Guidelines on Aquaculture Certification.

FAO (2018). *The State of World Fisheries and Aquaculture.* FAO:Rome, 40–41.

FAO (2014). *The State of World Fisheries and Aquaculture.* FAO:Rome, 40–41.

FAO, & ILO. (2013). Guidance on addressing child labour in fisheries and aquaculture.Fereday, J. & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods, 5*(1), 80–92.

Funge-Smith, S., & Bennett, A. (2019). A fresh look at inland fisheries and their role in food security and livelihoods. *Fish and Fisheries*, *20*(6), 1176-1195.

Gjedrem, T., Robinson, N., & Rye, M. (2012). The importance of selective breeding in aquaculture to meet future demands for animal protein: a review. *Aquaculture*, *350*, 117-129.Gladju, J., Kamalam, B. S., & Kanagaraj, A. (2022). Applications of data mining and machine learning framework in aquaculture and fisheries: A review. *Smart Agricultural*

Technology, *2*, 100061.

Hashim, T. M. Z. T., Ariff, E. A. R. E., & Suratman, M. N. (2021). Aquaculture in Mangroves 18. *Mangroves: Ecology, Biodiversity and Management*, 419.

Hua, K., Cobcroft, J. M., Cole, A., Condon, K., Jerry, D. R., Mangott, A., ... & Strugnell, J. M. (2019). The future of aquatic protein: implications for protein sources in aquaculture diets. *One Earth*, *1*(3), 316-329.

Johnson, A. F., Lidström, S., Kelling, I., Williams, C., Niederműller, S., Poulsen, K. V., ... & Davies, W. (2021). The European Union's fishing activity outside of European waters and the Sustainable Development Goals. *Fish and Fisheries*, *22*(3), 532-545.

Kelley, K. (2018). Sample size planning. In N. J. Salkind (Ed.). *Encyclopaedia of research design* (pp. 1301 – 1302). SAGE Publications.

Kurniawan, S. B., Ahmad, A., Rahim, N. F. M., Said, N. S. M., Alnawajha, M. M., Imron, M. F., ... & Hasan, H. A. (2021). Aquaculture in Malaysia: Water-related environmental challenges and opportunities for cleaner production. *Environmental Technology & Innovation*, *24*, 101913.

Lemm, K. M. (2018). Stratified sampling. In N. J. Salkind (Ed.). *Encyclopaedia of research design* (pp. 1451– 1454). SAGE Publications.

Luna, M., Llorente, I., & Luna, L. (2023). A conceptual framework for risk management in aquaculture. *Marine Policy*, *147*, 105377.

McCausland, W. D., Mente, E., Pierce, G. J., & Theodossiou, I. (2006). A simulation model of sustainability of coastal communities: aquaculture, fishing, environment and labour markets. *Ecological Modelling*, *193*(3-4), 271-294.

Michelle, K., & Branigan, P. (2000). Using focus groups to evaluate health promotion interventions. *Health Education, 100*(6), 261 – 268.

Morgan, D. L. (2018). Focus groups. In N. J. Salkind (Ed.). *Encyclopaedia of research design* (pp. 352 – 354). SAGE Publications.

Mrug, S. (2018). Research design principles. In N. J. Salkind (Ed.). *Encyclopaedia of research design* (pp. 1472 – 1476). SAGE Publications.

Mustapha, U. F., Alhassan, A. W., Jiang, D. N., & Li, G. L. (2021). Sustainable aquaculture development: a review on the roles of cloud computing, internet of things and artificial intelligence (CIA). *Reviews in Aquaculture*, *13*(4), 2076-2091.

Padrós, F., Caggiano, M., Toffan, A., Constenla, M., Zarza, C., & Ciulli, S. (2022). Integrated Management Strategies for Viral Nervous Necrosis (VNN) Disease Control in Marine Fish Farming in the Mediterranean. *Pathogens*, *11*(3), 330.

Patton, M. Q. (2014). Qualitative research and evaluation methods: Integrating theory and practice (4th ed.). Sage.

Persaud, N. (2018). Pilot study. In N. J. Salkind (Ed.). *Encyclopaedia of research design*(pp. 1032 – 1033). SAGE Publications.

Rahman, S. (2022). 2022/102 "Malaysia's Artisanal Fishermen: Political Ecology and Survival" by Serina Rahman.

Rather, M. A., Agarwal, D., Bhat, T. A., Khan, I. A., Zafar, I., Kumar, S., ... & Qadri, T. (2023). Bioinformatics approaches and big data analytics opportunities in improving fisheries and aquaculture. *International Journal of Biological Macromolecules*, 123549.

Sampantamit, T., Ho, L., Lachat, C., Sutummawong, N., Sorgeloos, P., & Goethals, P. (2020). Aquaculture production and its environmental sustainability in Thailand: Challenges and potential solutions. *Sustainability*, *12*(5), 2010.

Schmidt, C. C. (2005). Economic drivers of illegal, unreported and unregulated (IUU) fishing. *The international journal of marine and coastal law*, *20*(3), 479-507.

Selig, E. R., Nakayama, S., Wabnitz, C. C., Österblom, H., Spijkers, J., Miller, N. A., ... & Decker Sparks, J. L. (2022). Revealing global risks of labour abuse and illegal, unreported, and unregulated fishing. *Nature Communications*, *13*(1), 1612.

Siry, H. Y. (2006). Decentralized coastal zone management in Malaysia and Indonesia: a comparative perspective. *Coastal Management*, *34*(3), 267-285.

Teh, L. S., Teh, L. C., Zeller, D., & Cabanban, A. (2009). Historical perspective of Sabah's marine fisheries. In *Fisheries catch reconstructions: Islands, Part I* (pp. 77-98). University of British Columbia.Thai-Nghe, N., Hung, T. T., & Ngon, N. C. (2020). A forecasting model for monitoring water quality in aquaculture and fisheries IoT systems. In *2020 International Conference on Advanced Computing and Applications (ACOMP)* (pp. 165-169). IEEE.Webster, D., Buttner, J., & Flimlin, G. (2008). Planning for Success in Your Aquaculture Business. *Di akses daripada http://seafood. oregonstate.edu/pdf Links/Planning for Success in Your Aquaculture Business.pdf*.

Yue, K., & Shen, Y. (2022). An overview of disruptive technologies for aquaculture. *Aquaculture and Fisheries*, *7*(2), 111-120.

ANNEX 1: MOSQF LEVEL DESCRIPTORS

Malaysian Occupational Skills Qualification Framework (MOSQF) Level Descriptor

(Source: Department of Skills Development)

Level	Level Descriptors
8	Achievement at this level reflects the ability to develop original understanding and extend a sub-area of knowledge or professional practice. It reflects the ability to address problematic situations that involve many complexes, interacting factors through initiating, designing and undertaking research, development or strategic activities. It involves the exercise of broad autonomy, judgement and leadership in sharing responsibility for the development of a field of work or knowledge, or for creating substantial professional or organisational change. It also reflects a critical understanding of relevant theoretical and methodological perspectives and how they affect the field of knowledge or work.
7	Achievement at this level reflects the ability to reformulate and use relevant understanding, methodologies and approaches to address problematic situations that involve many interacting factors. It includes taking responsibility for planning and developing courses of action that initiate or underpin substantial change or development, as well as exercising broad autonomy and judgment. It also reflects an understanding of theoretical and relevant methodological perspectives, and how they affect their sub-area of study or work.
6	Achievement at this level reflects the ability to refine and use relevant understanding, methods and skills to address complex problems that have limited definition. It includes taking responsibility for planning and developing courses of action that are able to underpin substantial change or development, as well as exercising broad autonomy and judgment. It also reflects an understanding of different perspectives, approaches of schools of thought and the theories that underpin them.
5	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address broadly-defined, complex problems. It includes taking responsibility for planning and developing courses of action as well as exercising autonomy and judgment within broad parameters. It also reflects understanding of different perspectives, approaches or schools of thought and the reasoning behind them.
4	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address problems that are well defined but complex and non-routine. It includes taking responsibility for overall courses of action as well as exercising autonomy and judgment within fairly broad parameters. It also reflects under-standing of different perspective or approaches within a sub-area of study or work.
3	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to complete task and address problems that

Level	Level Descriptors
	are well defined with a measure of complexity. It includes taking responsibility for initiating and completing tasks and procedures as well as exercising autonomy and judgments within limited parameter. It also reflects awareness of different perspectives or approaches within a sub-area of study or work.
2	Achievement at this level reflects the ability to select and use relevant knowledge, ideas, skills and procedures to complete well-defined tasks and address straightforward problem. It includes taking responsibility for completing tasks and procedures, and exercising autonomy and judgment subject to overall direction or guidance.
1	Achievement at this level reflects the ability to use relevant knowledge, skills and procedures to complete routine and predictable tasks that include responsibility for completing tasks and procedures subject to direction or guidance.

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ANNEX 3: QUESTIONNAIRE

OCCUPATIONAL FRAMEWORK SURVEY

A03 FISHING AND AQUACULTURE

QUESTIONNAIRE (VERSION 3.0)

SECTION 1: SURVEY RESPONDENT DETAILS

BAHAGIAN 1: MAKLUMAT RESPONDEN

1. Name: (Optional)
   Nama:

   _____

2. Current position (job title):
   Jawatan terkini:

   _____

3. Name of Company/Organization:
   Nama Syarikat / Organisasi:

   _____

4. Category of Organization:
   Kategori Organisasi:
   - Micro/*Mikro* (Pekerja kurang dari 5)
   - Small / *Kecil* (Pekerja antara 5 ke < 30)
   - Medium / *Sederhana* (Pekerja antara 30 ke < 75)
   - Berhad / *Public Listed* (Pekerja lebih dari 75)
   - Persendirian / Bekerja sendiri
   - Lain-lain, sila nyatakan (others, please specify):

     _____

5. Registration number/License/Vessel Number (if applicable):
   Nombor pendaftaran/lesen/nombor kapal (jika ada):

   _____

6. Age:
   Umur:
   - < 20
   - 20-29
   - 30-39

- 40-49
- 50-59
- > 60

7. Gender:
   Jantina:
   - Male / *Lelaki*
   - Female / *Perempuan*

8. Educational Status:
   Taraf Pendidikan:
   - No Formal Education (tiada pendidikan formal)
   - UPSR or equivalent (UPSR atau setaraf)
   - SRA/ LCE/ SRP/ PMR/ PT3
   - STPM/ STPH/ HSC/ Sijil SKM / Diploma
   - Universiti Level / Peringkat Universiti (Bachelor Degree & above/Ijazah dan ke atas)
   - Jika lain-lain, sila nyatakan berikut: _____

9. Location of your farms/fishing area:
   Lokasi perusahaan akuakultur/kawasan aktiviti perikanan:
   - Perlis
   - Kedah
   - Pulau Pinang
   - Perak
   - Selangor
   - Negeri Sembilan
   - Melaka
   - Johor
   - Pahang
   - Terengganu
   - Kelantan
   - Sabah
   - Sarawak
   - Wilayah Persekutuan Kuala Lumpur
   - Wilayah Persekutuan Labuan
   - Wilayah Persekutuan Putrajaya

10. Please choose your area (Select ONE only):
    *Sila pilih bidang anda (**SATU** sahaja)*:
    - Fisheries / *Perikanan (Nelayan)*
      -- SETERUSNYA, SILA JAWAB BAHAGIAN A SAHAJA

- Aquaculture / *Akuakultur (Penternakan)*
  -- SETERUSNYA, SILA JAWAB BAHAGIAN B SAHAJA

BAHAGIAN/PART A:

SURVEY FOR FISHERIES AREA / TINJAUAN UNTUK BIDANG PERIKANAN

SECTION 2: JOBS IN DEMAND

BAHAGIAN 2: PEKERJAAN TERHADAP PERMINTAAN

11. How many years of experience in the fisheries industry?
    Berapa tahun pengalaman anda di dalam industri perikanan ini?

    - Below 5 years / *Bawah 5 tahun*
    - 6 – 10 years / *6 – 10 tahun*
    - 11 – 20 years / *11 – 20 tahun*
    - 21 – 30 years / *21 – 30 tahun*
    - Above 30 years / *Atas 30 tahun*

12. Which of the following area(s) is related to your organization? You may tick more than one.
    Manakah antara bidang berikut yang berkaitan dengan organisasi anda? Anda boleh menanda lebih daripada satu.

    FISHERIES / *PERIKANAN*
    - Coastal fisheries / *Perikanan pantai*
    - Deep sea fisheries / *Perikanan laut dalam*
    - Open sea fisheries / *Perikanan laut lepas*
    - Inland fisheries / *Perikanan darat*
    - Other, please specify:
      Lain – lain, sila nyatakan:
      _____

13. What are the expertise needed in your job area? You may tick more than one:
    Apakah kepakaran yang diperlukan dalam bidang pekerjaan anda? Anda boleh tanda lebih daripada satu:

FISHERIES/*PERIKANAN*

- Management / *Pengurusan*
- Data management / *Pengurusan data*
- Research and Development / *Penyelidikan dan pembangunan*
- Quality control / *Kawalan kualiti*
- Fish Sorting / *Penyusunan ikan*
- Fishing gear handling / *Pengendalian peralatan menangkap ikan*
- Navigation / *Navigasi*
- Engine and general maintenance / *Penyelenggaraan enjin dan umum*
- Diving / *Menyelam*
- Safety and securities / *Keselamatan dan sekuriti*
- Sales and marketing / *Jualan dan pemasaran*
- Other, please specify:
  Lain – lain, sila nyatakan:
  _____

14. Which of the following job titles **are needed and required** in your organization? Please tick all that apply.
    *Manakah antara jawatan pekerjaan berikut **diperlukan** dalam organisasi anda? Sila tandakan semua yang berkenaan.*

FISHERIES / *PERIKANAN*

Job Title / *Jawatan Pekerjaan*	**Needed/*Diperlukan***
Fishing Operation Manager *Pengurus operasi tangkapan*	
Fishing Skipper/Fishing Vessel Operator/Vessel Captain/ Fishing Master *Juragan Memancing/Operator Kapal Perikanan/Kapten Kapal/ Fishing Master*	
Assistant Captain/ Fishing Master Assistant/Fishing Supervisor/First Officer *Penolong Kapten/ Pembantu Induk Perikanan/Penyelia Perikanan/Pegawai Pertama*	
Senior Crew/ Foreman/ Fishing Gear Operator/ Engineman *Krew Kanan/ Foreman/ Operator Alat Tangkapan/ Jurutera*	
Deck Hand/ Fishery Worker/ Crew/ Driver/ FAD/	

Job Title / *Jawatan Pekerjaan*	**Needed/*Diperlukan***
Operator *Tangan Dek/ Pekerja Perikanan/ Krew/ Pemandu/ FAD/ Operator*	
Fish sorter/General Worker *Pengasing ikan/pekerja am*	
Other, please specify: *Lain – lain, sila nyatakan:*	

15. Which of the following job titles **are difficult to fulfil** in your organization? Please tick all that apply.
*Manakah antara jawatan pekerjaan berikut **sukar dipenuhi** dalam organisasi anda? Sila tandakan semua yang berkenaan.*

FISHERIES / *PERIKANAN*

Job Title / *Jawatan Pekerjaan*	**Difficult to fulfil/ *Sukar dipenuhi***
Fishing Operation Manager *Pengurus operasi tangkapan*	
Fishing Skipper/Fishing Vessel Operator/Vessel Captain/ Fishing Master *Juragan Memancing/Operator Kapal Perikanan/Kapten Kapal/ Fishing Master*	
Assistant Captain/ Fishing Master Assistant/Fishing Supervisor/First Officer *Penolong Kapten/ Pembantu Induk Perikanan/Penyelia Perikanan/Pegawai Pertama*	
Senior Crew/ Foreman/ Fishing Gear Operator/ Engineman *Krew Kanan/ Foreman/ Operator Alat Tangkapan/ Jurutera*	
Deck Hand/ Fishery Worker/ Crew/ Driver/ FAD/ Operator *Tangan Dek/ Pekerja Perikanan/ Krew/ Pemandu/ FAD/ Operator*	
Fish sorter/General Worker *Pengasing ikan/pekerja am*	
Other, please specify: *Lain – lain, sila nyatakan:*	

16. Please tick at **how many of these job titles** are needed in your organization.
*Sila tandakan berapa **jumlah jawatan berikut yang diperlukan** dalam organisasi anda.*

FISHERIES / PERIKANAN

Job Title / *Pekerjaan*	**Not needed/ Tidak diperlukan**	**Number of person needed/ *Jumlah orang yang diperlukan***				
		1	**2**	**3**	**4**	**>4**
Fishing Operation Manager *Pengurus operasi memancing*						
Fishing Skipper/Fishing Vessel Operator/Vessel Captain/ Fishing Master *Juragan Memancing/Operator Kapal Perikanan/Kapten Kapal/ Fishing Master*						
Assistant Captain/ Fishing Master Assistant/Fishing Supervisor/First Officer *Penolong Kapten/ Pembantu Induk Perikanan/Penyelia Perikanan/Pegawai Pertama*						
Senior Crew/ Foreman/ Fishing Gear Operator/ Engineman *Krew Kanan/ Foreman/ Operator Alat Tangkapan/ Jurutera*						
Deck Hand/ Fishery Worker/ Crew/ Driver/ FAD/ Operator *Tangan Dek/ Pekerja Perikanan/ Krew/ Pemandu/ FAD/ Operator*						
Fish sorter/General Worker *Pengasing ikan/pekerja am*						
Other, please specify: *Lain – lain, sila nyatakan:*						

SECTION 3: COMPETENCIES IN DEMAND

BAHAGIAN 3: KOMPETENSI DALAM PERMINTAAN

17. Listed below are set of skill categories related to personnel involve in the Fishing industry. Rate the level of demand to the set of skills as below.

Disenaraikan di bawah adalah set kategori kemahiran yang berkaitan dengan kakitangan yang terlibat dalam Industri Perikanan. Nilaikan tahap permintaan kepada set kemahiran seperti di bawah.

GENERAL SKILLS / *KEMAHIRAN AM*

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/*Tanda satu kotak setiap barisan*

General Skills/ Kemahiran Am	**5**	**4**	**3**	**2**	**1**
Husbandry *Penternakan*					
Operation and maintenance *Operasi dan penyelenggaraan*					
Services operations *Operasi perkhidmatan*					
Problem solving *Penyelesaian masalah*					
Communication and Interpersonal skills *Kemahiran Komunikasi dan Interpersonal*					
Strong attitude *Sikap yang kuat*					
Technology skills *Kemahiran teknologi*					
Analytical skills *Kemahiran analitikal*					
Initiative					

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/*Tanda satu kotak setiap barisan*

General Skills/ Kemahiran Am	**5**	**4**	**3**	**2**	**1**
Inisiatif					
Risk management *Pengurusan risiko*					
Asset management *Pengurusan aset*					
Collecting and updating data *Pengumpulan dan kemaskini data*					
Record keeping *Penyimpanan rekod*					
Quality control *Kawalan kualiti*					
Staff's welfare *Kebajikan staf*					
Other, please specify: *Lain – lain, sila nyatakan:*					

FISHERIES SKILLS / *KEMAHIRAN PERIKANAN*

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/ *Tanda satu kotak setiap barisan*

List of Skills/ Senarai *Kemahiran*	**5**	**4**	**3**	**2**	**1**
Fishery market and demand monitoring *Pemantauan pasaran perikanan dan permintaan*					
Fishing operation					

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/ *Tanda satu kotak setiap barisan*

List of Skills/ Senarai *Kemahiran*	**5**	**4**	**3**	**2**	**1**
Operasi memancing					
Waste management and environmental control *Pengurusan sisa dan kawalan alam sekitar*					
Navigation *Navigasi*					
Post harvest operation *Operasi selepas tuai*					
Diving *Menyelam*					
Sorting and packing *Pengasingan dan pembungkusan*					
Fishing gears, fish aggregating device, support vessels operation *Alat menangkap ikan, alat mengagregat ikan, membantu operasi kapal*					
Other, please specify: *Lain – lain, sila nyatakan:*					

18. Please rate the following competencies/skills based on its importance (critical) in performing job related to Fisheries.
    Sila nilaikan kompetensi/kemahiran berikut berdasarkan kepentingannya (kritikal) dalam melaksanakan kerja berkaitan Perikanan.

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/ *Tanda satu kotak setiap barisan*					
Competencies/ *Kompetensi*	**5**	**4**	**3**	**2**	**1**
Technical know-how relevant to the job *Pengetahuan teknikal berkaitan dengan pekerjaan*					
Customer orientation *Orientasi pelanggan*					
Innovation orientation *Orientasi inovasi*					
Time management *Pengurusan masa*					
Networking and influencing ability *Rangkaian dan keupayaan mempengaruhi*					
Problem-solving *Menyelesaikan masalah*					
Decision-making skills *Kemahiran membuat keputusan*					
Negotiation skills *Kemahiran rundingan*					
Leadership and human resource management *Kepimpinan dan pengurusan sumber manusia*					
Marketing skills *Kemahiran pemasaran*					
Entrepreneurship skills *Kemahiran keusahawanan*					
Initiative takers *Mengambil inisiatif*					
Quality and lean management *Pengurusan kualiti terurus*					
Strategic business planning *Perancangan perniagaan strategik*					
Crisis Management *Pengurusan krisis*					
Risk management					

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/ *Tanda satu kotak setiap barisan*					
Competencies/ *Kompetensi*	**5**	**4**	**3**	**2**	**1**
Pengurusan risiko					
Adaptability and ability to change *Kebolehan untuk beradaptasi/berubah Kebolehsuaian dan keupayaan untuk berubah*					
Professionalism *Profesional*					
Working in team *Bekerja di dalam pasukan*					
Mind-set changes for lifelong learning *Perubahan pemikiran kepada pembelajaran sepanjang hayat*					
Multitasking ability *Kebolehan multitasking*					
Equipment service and maintenance *Servis peralatan dan penyelenggaraan*					
Financial management *Pengurusan kewangan*					
Writing / *Penulisan*					
Speaking / *Percakapan*					
Listening / *Pendengaran*					
Oral presentation / *Pembentangan lisan*					
Language – Bahasa Melayu *Bahasa – Bahasa Melayu*					
Language – English *Bahasa - English*					
Language – Mandarin *Bahasa - Mandarin*					
Language - Other languages *Bahasa – Bahasa lain*					
Other, please specify: *Lain – lain, sila nyatakan:*					

19. In your opinion, what are the reason(s) for skills gap in this industry? You may tick more than 1.
Pada pendapat anda, apakah punca jurang kemahiran dalam industri ini? Anda boleh menanda lebih daripada 1.

    - Unsuitable/irrelevant educational background
    Latar belakang pendidikan yang tidak sesuai/tidak relevan
    - Lack of relevant training
    Kurang latihan yang relevan
    - No knowledge transfer/Lack of knowledge sharing
    Tiada pemindahan ilmu/ Kurang perkongsian pengetahuan
    - Lack of benefits/ncentive/Salary
    Kurang faedah/Insentif/Gaji
    - Lack of Interest/Passion
    Kurang minat/Semangat
    - Major changes in standards, system and/or technologies that require new skills
    Perubahan besar dalam piawaian, sistem dan/atau teknologi yang memerlukan kemahiran baharu
    - Other, please specify:
    Lain – lain, sila nyatakan:

      _____

SECTION 4: EMERGING SKILLS & NEW TECHNOLOGIES

BAHAGIAN 4 : KEMAHIRAN DAN TEKNOLOGI BAHARU

20. Do you think Industry Revolution would give positive impact to operational activities of Fishing Industry?
Adakah anda merasakan Revolusi Industri akan memberi impak positif kepada aktiviti operasi Industri Perikanan?
    - Yes / *Ya*
    - No / *Tidak*

21. Will technology advancement assist your current job?
Adakah kemajuan teknologi akan membantu pekerjaan anda sekarang?
    - Yes / *Ya*
    - No / *Tidak*
    - Not sure / *Tidak pasti*

22. Please tick the available technologies that are being used/will be used in your industry. You may tick more than one. If you answer Yes, please also mention the related emerging skills that is related to this new technologies.
Sila tandakan teknologi yang sedia ada yang sedang digunakan/akan digunakan dalam industri anda. Anda boleh menanda lebih daripada satu. Sekiranya anda menjawab Ya, sila nyatakan kemahiran baharu yang berkaitan dengan teknologi baharu ini.

Technologies / Teknologi	**Yes** ***Ya***	**Please state the related emerging skill(s) under this new technology/** ***Sila nyatakan kemahiran baharu yang berkaitan dgn teknologi baharu ini.***	**No** ***Tidak***
Automated system/ *Sistem automatik* Combination of both software and hardware that is designed and programmed to work automatically without the need for a human operator to provide inputs and instructions for each operation, e.g. automatic feeder *Gabungan kedua-dua perisian dan perkakasan yang direka bentuk dan diprogramkan untuk berfungsi secara automatik tanpa memerlukan operator manusia untuk menyediakan input dan arahan untuk setiap operasi, cth. penyumpan automatik*			
Big Data Analytics */ Analisis Data Besar* Analysis of large volume of data, which able to supports productivity growth based on real time decision making process. *Analisis data yang besar, yang mampu menyokong pertumbuhan produktiviti berdasarkan proses membuat keputusan masa nyata.*			
Cloud computing / *Pengkomputeran awan* Storing and accessing data over the Internet. *Menyimpan dan mengakses data melalui Internet.*			

Technologies / Teknologi	Yes *Ya*	Please state the related emerging skill(s) under this new technology/ *Sila nyatakan kemahiran baharu yang berkaitan dgn teknologi baharu ini.*	No *Tidak*
Internet of Things (IoT) All machines and systems able to collect, exchange and store a huge volume of data without the need of human intervention. *Semua mesin dan sistem dapat mengumpul, menukar dan menyimpan sejumlah besar data tanpa memerlukan campur tangan manusia.*			
Additive Manufacturing (3D printing) / *Pembuatan Aditif (percetakan 3D)* Used in prototyping and small scale production to produced desired components faster and more précised. *Digunakan dalam prototaip dan pengeluaran berskala kecil untuk menghasilkan komponen yang dikehendaki dengan lebih cepat dan lebih tepat*.			
System Integration / *Integrasi Sistem* Linking together different computing systems and software to act as coordinated whole via IoT. *Menghubungkan bersama sistem pengkomputeran dan perisian yang berbeza untuk bertindak sebagai keseluruhan yang diselaraskan melalui IoT.*			
Cybersecurity / *Keselamatan Siber* Protect critical industrial systems and data collected. *Lindungi sistem dan data industri kritikal yang dikumpul*.			

Technologies / Teknologi	Yes *Ya*	Please state the related emerging skill(s) under this new technology/ *Sila nyatakan kemahiran baharu yang berkaitan dgn teknologi baharu ini.*	No *Tidak*
Simulation / *Simulasi* Leverage real time data to reflect the physical world in virtual models. Include machine and products. Allow operators to test and optimize systems virtually before physical changeover, hence save time and increase quality. *Manfaatkan data masa nyata untuk mencerminkan dunia fizikal dalam model maya. Sertakan mesin dan produk. Benarkan pengendali menguji dan mengoptimumkan sistem hampir sebelum pertukaran fizikal, justeru menjimatkan masa dan meningkatkan kualiti.*			

SECTION 5: RELATED ISSUES

BAHAGIAN 5: ISU BERKAITAN

23. Below are the current issues that need to be addressed in Fishing Industries. Do you agree?
Di bawah adalah isu semasa yang perlu ditangani dalam Industri Perikanan. Adakah anda bersetuju?

5	4	3	2	1
Strongly agree *Sangat setuju*	Agree *Setuju*	Fairly Agree *Agak setuju*	Disagree *Tidak setuju*	Strongly Disagree *Sangat tidak setuju*

Mark only one box per row/ *Tanda satu kotak setiap barisan*					
List of Issues/*Senarai Isu*	**5**	**4**	**3**	**2**	**1**
Insufficient local manpower *Kurang tenaga kerja setempat*					

5	4	3	2	1
Strongly agree *Sangat setuju*	Agree *Setuju*	Fairly Agree *Agak setuju*	Disagree *Tidak setuju*	Strongly Disagree *Sangat tidak setuju*

Mark only one box per row/ *Tanda satu kotak setiap barisan*

List of Issues/*Senarai Isu*	**5**	**4**	**3**	**2**	**1**
Less knowledgeable workforce *Kurang pekerja yang berpengetahuan*					
Underpaid wages lead to high turnover rate of employee *Bayaran gaji rendah membawa kepada kadar pusing ganti pekerja yang tinggi*					
Government policy/regulation, investment and funds *Dasar/peraturan kerajaan, pelaburan dan dana*					
Job security *Keselamatan pekerjaan*					
Labour costs *Kos tenaga buruh*					
Technological advancement *Kemajuan teknologi*					
Safety & health issues *Isu keselamatan dan kesihatan*					
Career advancement *Kemajuan kerjaya*					
Lack of youth involvement/ Lack of training of youth manpower *Kurang penglibatan orang muda/ kurang latihan di dalam tenaga kerja muda*					
Other, please specify: *Lain – lain, sila nyatakan:*					

24. Based on your experience & opinion, what are other issues / challenged that you faced in the fisheries industry? Please share.
Berdasarkan pengalaman dan pandangan anda, apakah lain-lain isu / cabaran yang anda hadapi di dalam industri perikanan? Sila kongsikan.

PART/BAHAGIAN A: FISHERIES/PERIKANAN

END OF SURVEY/TINJAUAN TAMAT

BAHAGIAN/PART B:

SURVEY FOR AQUACULTURE AREA / *TINJAUAN UNTUK BIDANG AKUAKULTUR*

SECTION 2: JOBS IN DEMAND

BAHAGIAN 2: PEKERJAAN TERHADAP PERMINTAAN

11. How many years of experience in the aquaculture industry?
Berapa tahun pengalaman anda di dalam industri akuakultur ini?

    - Below 5 years / *Bawah 5 tahun*
    - 6 – 10 years / *6 – 10 tahun*
    - 11 – 20 years / *11 – 20 tahun*
    - 21 – 30 years / *21 – 30 tahun*
    - Above 30 years / *Atas 30 tahun*

12. Which of the following area(s) is related to your organization? You may tick more than one.
Manakah antara bidang berikut yang berkaitan dengan organisasi anda? Anda boleh menanda lebih daripada satu.

    AQUACULTURE / *AKUAKULTUR*
    - Marine/Brackish (grow out) / *Marin/payau (fasa tumbesaran)*
    - Marine/Brackish (hatchery/nursery) / *Marin/payau (hatceri/asuhan)*
    - Freshwater (grow out) / *Air tawar (fasa tumbesaran)*
    - Freshwater (hatchery/nursery) / *Air tawar (hatceri/asuhan)*
    - Ornamental / *Ikan hiasan*
    - Aquatic plant / *Tumbuhan akuatik*
    - Other, please specify:
    Lain – lain, sila nyatakan:

      _____

13. What are the expertises needed in your job area? You may tick more than one:
Apakah kepakaran yang diperlukan dalam bidang pekerjaan anda? Anda boleh menanda lebih daripada satu:

AQUACULTURE / *AKUAKULTUR*

- Management / *Pengurusan*
- Data management / *Pengurusan data*
- Research and Development / *Penyelidikan dan pembangunan*
- Quality control / *Kawalan kualiti*
- Hatcheries – Nursery,Larviculture,Technician / *Hatceri – Asuhan,Larvikultur,juruteknik*
- Breeding / *Pembiakan*
- Genetic / *Genetik*
- Diseases management / *Pengurusan penyakit*
- Nutrition and Feed / *Nutrisi dan pemakanan*
- Safety and securities / *Keselamatan dan sekuriti*
- Sales and marketing / *Jualan dan pemasaran*
- Other, please specify:
  Lain – lain, sila nyatakan:_____

14. Which of the following job titles **are needed and required** in your organization? Please tick all that apply:
    *Manakah antara jawatan pekerjaan berikut **diperlukan** dalam organisasi anda? Sila tandakan semua yang berkenaan.*

AQUACULTURE / *AKUAKULTUR*

Job Title / *Jawatan Pekerjaan*	**Needed/*Diperlukan***
Aquaculture Expert / Consultant *Pakar Akuakultur / Konsultan*	
Aquaculture Division Manager *Ketua Bahagian Akuakultur*	
Farm Manager / Operation Manager *Pengurus Ladang / Pengurus Operasi*	
Head of Department: (Production, Quality Control, Maintenance, Harvesting & Packing, Biosecurity, OSHA, Water Management) *Ketua Jabatan: (Pengeluaran, Kawalan Kualiti, Penyelenggaraan, Penuaian & Pembungkusan, Biosekuriti, OSHA, Pengurusan Air)*	
Technicians (Production , Quality Control, Maintenance, Harvesting & Packing, Biosecurity, OSHA, Water Management) *Juruteknik: (Pengeluaran, Kawalan Kualiti, Penyelenggaraan, Penuaian & Pembungkusan,*	

Biosekuriti, OSHA, Pengurusan Air)*ekerja Perikanan/ Krew/ Pemandu/ FAD/ Operator*	
Supervisor/Skilled worker *Penyelia / Pekerja mahir*	
General worker / *Pekerja am*	
Other, please specify: *Lain – lain, sila nyatakan:*	

15. Which of the following job titles **are difficult to fulfill** in your organization? Please tick all that apply:
*Manakah antara jawatan pekerjaan berikut **sukar dipenuhi** dalam organisasi anda? Sila tandakan semua yang berkenaan.*

AQUACULTURE / *AKUAKULTUR*

Job Title / *Jawatan Pekerjaan*	**Needed/*Diperlukan***
Aquaculture Expert / Consultant *Pakar Akuakultur / Konsultan*	
Aquaculture Division Manager *Ketua Bahagian Akuakultur*	
Farm Manager / Operation Manager *Pengurus Ladang / Pengurus Operasi*	
Head of Department: (Production, Quality Control, Maintenance, Harvesting & Packing, Biosecurity, OSHA, Water Management) *Ketua Jabatan: (Pengeluaran, Kawalan Kualiti, Penyelenggaraan, Penuaian & Pembungkusan, Biosekuriti, OSHA, Pengurusan Air)*	
Technicians (Production , Quality Control, Maintenance, Harvesting & Packing, Biosecurity, OSHA, Water Management) *Juruteknik: (Pengeluaran, Kawalan Kualiti, Penyelenggaraan, Penuaian & Pembungkusan, Biosekuriti, OSHA, Pengurusan Air*)	
Supervisor/Skilled worker *Penyelia / Pekerja mahir*	
General worker / *Pekerja am*	
Other, please specify: *Lain – lain, sila nyatakan:*	

16. Please tick at **how many of these job titles** are needed in your organization.
*Sila tandakan berapa **ramai jawatan berikut yang diperlukan** dalam organisasi anda*

AQUACULTURE / *AKUAKULTUR*

Job Title / *Pekerjaan*	**Tidak diperlukan**	**Number of person needed/ *Jumlah orang yang diperlukan***				
		1	**2**	**3**	**4**	**>4**
Aquaculture Expert / Consultant *Pakar Akuakultur / Konsultan*						
Aquaculture Division Manager *Ketua Bahagian Akuakultur*						
Farm Manager / Operation Manager *Pengurus Ladang / Pengurus Operasi*						
Head of Department: (Production, Quality Control, Maintenance, Harvesting & Packing, Biosecurity, OSHA, Water Management) *Ketua Jabatan: (Pengeluaran, Kawalan Kualiti, Penyelenggaraan, Penuaian & Pembungkusan, Biosekuriti, OSHA, Pengurusan Air)*						
Technicians (Production, Quality Control, Maintenance, Harvesting & Packing, Biosecurity, OSHA, Water Management) *Juruteknik: (Pengeluaran, Kawalan Kualiti, Penyelenggaraan, Penuaian & Pembungkusan, Biosekuriti, OSHA, Pengurusan Air*)						
Supervisor/Skilled worker *Penyelia / Pekerja mahir*						
General worker / *Pekerja am*						
Other, please specify: *Lain – lain, sila nyatakan:*						

SECTION 3: COMPETENCIES IN DEMANDS

BAHAGIAN 3: KOMPETENSI DALAM PERMINTAAN

17. Listed below are set of skill categories related to personnel involve in Aquaculture Industry. Rate the level of demand to the set of skills as below.
Disenaraikan di bawah adalah set kategori kemahiran yang berkaitan dengan kakitangan yang terlibat dalam Industri Akuakultur. Nilaikan tahap permintaan kepada set kemahiran seperti di bawah.

GENERAL SKILLS / *KEMAHIRAN AM*

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/*Tanda satu kotak setiap barisan*

General Skills/ Kemahiran Am	5	4	3	2	1
Husbandry *Penternakan*					
Operation and maintenance *Operasi dan penyelenggaraan*					
Services operations *Operasi perkhidmatan*					
Problem solving *Penyelesaian masalah*					
Communication and interpersonal skills *Kemahiran komunikasi dan interpersonal*					
Strong attitude *Sikap yang kuat*					
Technology skills *Kemahiran teknologi*					
Analytical skills *Kemahiran analitikal*					
Initiative *Inisiatif*					

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/*Tanda satu kotak setiap barisan*					
General Skills/ Kemahiran Am	**5**	**4**	**3**	**2**	**1**
Risk management *Pengurusan risiko*					
Asset management *Pengurusan aset*					
Collecting and updating data *Pengumpulan dan kemaskini data*					
Record keeping *Penyimpanan rekod*					
Quality control *Kawalan kualiti*					
Staff's welfare *Kebajikan staf*					
Other, please specify: *Lain – lain, sila nyatakan:*					

AQUACULTURE SKILLS / *KEMAHIRAN AKUAKULTUR*

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row / *Tanda satu kotak setiap barisan*					
General Skills/ *Kemahiran Am*	**5**	**4**	**3**	**2**	**1**
Waste management *Pengurusan sisa*					
Feed management *Pengurusan pemakanan*					
Hatchery management *Pengurusan hatceri*					

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row / *Tanda satu kotak setiap barisan*					
General Skills/ *Kemahiran Am*	**5**	**4**	**3**	**2**	**1**
Brood stocks management *Pengurusan induk*					
Live feed culture *Kultur pemakanan hidup*					
Diseases management *Pengurusan penyakit*					
Production system *Sistem pengeluaran*					
Biosecurity *Biosekuriti*					
Chemicals handling *Pengendalian bahan kimia*					
Water quality management *Pengurusan kualiti air*					
Sorting and packing *Pengasingan dan pembungkusan*					
Other, please specify: *Lain – lain, sila nyatakan:*					

18. Please rate the following competencies/skills based on its importance (critical) in performing job related to Aquaculture and Fisheries.
Sila nilaikan kompetensi/kemahiran berikut berdasarkan kepentingannya (kritikal) dalam melaksanakan kerja berkaitan Akuakultur dan Perikanan.

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/ *Tanda satu kotak setiap barisan*					
Competencies/ *Kompetensi*	**5**	**4**	**3**	**2**	**1**
Technical know-how relevant to the job *Pengetahuan teknikal berkaitan dengan pekerjaan*					
Customer orientation *Orientasi pelanggan*					
Innovation orientation *Orientasi inovasi*					
Time management/ *Pengurusan masa*					
Networking and influencing ability *Rangkaian dan keupayaan mempengaruhi*					
Problem-solving *Menyelesaikan masalah*					
Decision-making skills *Kemahiran membuat keputusan*					
Negotiation skills *Kemahiran rundingan*					
Leadership and human resource management *Kepimpinan dan pengurusan sumber manusia*					
Marketing skills *Kemahiran pemasaran*					
Entrepreneurship skills *Kemahiran keusahawanan*					
Initiative takers *Mengambil inisiatif*					
Quality and lean management *Pengurusan kualiti terurus*					
Strategic business planning *Perancangan perniagaan strategik*					
Crisis Management *Pengurusan krisis*					

5	4	3	2	1
Very Important *Sangat Penting*	Important *Penting*	Fairly Important *Agak Penting*	Less Important *Kurang Penting*	Not Important *Tidak Penting*

Mark only one box per row/ *Tanda satu kotak setiap barisan*

Competencies/ *Kompetensi*	**5**	**4**	**3**	**2**	**1**
Risk management *Pengurusan risiko*					
Adaptability and ability to change *Kebolehsuaian dan keupayaan untuk berubah*					
Professionalism *Profesional*					
Working in team/*Bekerja di dalam pasukan*					
Mind-set changes for lifelong learning *Perubahan pemikiran kepada pembelajaran sepanjang hayat*					
Multitasking ability *Kebolehan multitasking*					
Equipment service and maintenance *Servis peralatan dan penyelenggaraan*					
Financial management *Pengurusan kewangan*					
Writing / *Penulisan*					
Speaking / *Percakapan*					
Listening / *Pendengaran*					
Oral presentation / *Pembentangan lisan*					
Language – Bahasa Melayu *Bahasa – Bahasa Melayu*					
Language – English *Bahasa - English*					
Language – Mandarin *Bahasa - Mandarin*					
Language - Other languages *Bahasa – Bahasa lain*					
Other, please specify: *Lain – lain, sila nyatakan:*					

19. In your opinion, what are the reason(s) for skills gap in this industry? You may tick more than 1.
    Pada pendapat anda, apakah punca jurang kemahiran dalam industri ini? Anda boleh menanda lebih daripada 1.
    - o Unsuitable/irrelevant educational background
      Latar belakang pendidikan yang tidak sesuai/tidak relevan
    - o Lack of relevant training
      Kurang latihan yang relevan
    - o No knowledge transfer/Lack of knowledge sharing
      Tiada pemindahan ilmu/ Kurang perkongsian pengetahuan
    - o Lack of benefits/Incentive/Salary
      Kurang faedah/Insentif/Gaji
    - o Lack of Interest/Passion
      Kurang minat/Semangat
    - o Major changes in standards, system and/or technologies that require new skills
      Perubahan besar dalam piawaian, sistem dan/atau teknologi yang memerlukan kemahiran baharu
    - o Other, please specify:

      Lain – lain, sila nyatakan:

      _____

SECTION 4: EMERGING SKILLS & NEW TECHNOLOGIES

BAHAGIAN 4 : KEMAHIRAN DAN TEKNOLOGI BAHARU

20. Do you think Industry Revolution would give positive impact to operational activities of Fishing and Aquaculture Industry?
    Adakah anda merasakan Revolusi Industri akan memberi impak positif kepada aktiviti operasi Industri Perikanan dan Akuakultur?
    - o Yes / *Ya*
    - o No / *Tidak*

21. Will technology advancement assist your current job?
    Adakah kemajuan teknologi akan membantu pekerjaan anda sekarang?
    - o Yes / *Ya*
    - o No / *Tidak*
    - o Not sure / *Tidak pasti*

22. Please tick the available technologies that are being used/will be used in your industry. You may tick more than one. If you answer Yes, please also mention the related emerging skills that is related to this new technologies.

Sila tandakan teknologi yang sedia ada yang sedang digunakan/akan digunakan dalam industri anda. Anda boleh menanda lebih daripada satu. Sekiranya anda menjawab Ya, sila nyatakan kemahiran baharu yang berkaitan dengan teknologi baharu ini.

Technologies / Teknologi	**Yes** ***Ya***	**Please state the related emerging skill(s) under this new technology/** ***Sila nyatakan kemahiran baharu yang berkaitan dgn teknologi baharu ini.***	**No** ***Tidak***
Automated system/ *Sistem automatik* Combination of both software and hardware that is designed and programmed to work automatically without the need for a human operator to provide inputs and instructions for each operation, e.g. automatic feeder *Gabungan kedua-dua perisian dan perkakasan yang direka bentuk dan diprogramkan untuk berfungsi secara automatik tanpa memerlukan operator manusia untuk menyediakan input dan arahan untuk setiap operasi, cth. penyumpan automatik*			
Big Data Analytics */ Analisis Data Besar* Analysis of large volume of data, which able to supports productivity growth based on real time decision making process. *Analisis data yang besar, yang mampu menyokong pertumbuhan produktiviti berdasarkan proses membuat keputusan masa nyata.*			
Cloud computing / *Pengkomputeran awan* Storing and accessing data over the Internet. *Menyimpan dan mengakses data melalui Internet*.			
Internet of Things (IoT) All machines and systems able to collect, exchange and store a huge volume of data without the need of human intervention.			

Technologies / Teknologi	Yes *Ya*	Please state the related emerging skill(s) under this new technology/ *Sila nyatakan kemahiran baharu yang berkaitan dgn teknologi baharu ini.*	No *Tidak*
Semua mesin dan sistem dapat mengumpul, menukar dan menyimpan sejumlah besar data tanpa memerlukan campur tangan manusia.			
Additive Manufacturing (3D printing) / *Pembuatan Aditif (percetakan 3D)* Used in prototyping and small scale production to produced desired components faster and more précised. *Digunakan dalam prototaip dan pengeluaran berskala kecil untuk menghasilkan komponen yang dikehendaki dengan lebih cepat dan lebih tepat*.			
System Integration / *Integrasi Sistem* Linking together different computing systems and software to act as coordinated whole via IoT. *Menghubungkan bersama sistem pengkomputeran dan perisian yang berbeza untuk bertindak sebagai keseluruhan yang diselaraskan melalui IoT.*			
Cybersecurity / *Keselamatan Siber* Protect critical industrial systems and data collected. *Lindungi sistem dan data industri kritikal yang dikumpul*.			
Simulation / *Simulasi* Leverage real time data to reflect the physical world in virtual models. Include machine and products. Allow operators to test and optimize systems virtually before physical changeover, hence save time and increase quality. *Manfaatkan data masa nyata untuk mencerminkan dunia fizikal dalam model maya. Sertakan mesin dan produk. Benarkan pengendali menguji dan mengoptimumkan sistem hampir sebelum pertukaran fizikal, justeru menjimatkan masa dan meningkatkan kualiti*.			

SECTION 5: RELATED ISSUES

BAHAGIAN 5: ISU BERKAITAN

23. Below are the current issues that need to be addressed in the Aquaculture Industry. Do you agree?
Di bawah adalah isu semasa yang perlu ditangani dalam industri Akuakultur. Adakah anda bersetuju?

5	4	3	2	1
Strongly agree *Sangat setuju*	Agree *Setuju*	Fairly Agree *Agak setuju*	Disagree *Tidak setuju*	Strongly Disagree *Sangat tidak setuju*

Mark only one box per row/ *Tanda satu kotak setiap barisan*

List of Issues/*Senarai Isu*	**5**	**4**	**3**	**2**	**1**
Insufficient local manpower *Kurang tenaga kerja setempat*					
Less knowledgeable workforce *Kurang pekerja yang berpengetahuan*					
Underpaid wages lead to high turnover rate of employee *Bayaran gaji rendah membawa kepada kadar pusing ganti pekerja yang tinggi*					
Government policy/regulation, investment and funds *Dasar/peraturan kerajaan, pelaburan dan dana*					
Job security *Keselamatan pekerjaan*					
Labour costs *Kos tenaga buruh*					
Technological advancement *Kemajuan teknologi*					
Safety & health issues *Isu keselamatan dan kesihatan*					
Career advancement *Kemajuan kerjaya*					
Lack of youth involvement/ Lack of training of youth manpower					

5	4	3	2	1
Strongly agree *Sangat setuju*	Agree *Setuju*	Fairly Agree *Agak setuju*	Disagree *Tidak setuju*	Strongly Disagree *Sangat tidak setuju*

Mark only one box per row/ *Tanda satu kotak setiap barisan*					
List of Issues/*Senarai Isu*	**5**	**4**	**3**	**2**	**1**
Kurang penglibatan orang muda/ kurang latihan di dalam tenaga kerja muda					
Other, please specify: *Lain – lain, sila nyatakan:*					

25. Based on your experience & opinion, what are other issues / challenged that you faced in the Aquaculture industry? Please share.
Berdasarkan pengalaman dan pandangan anda, apakah lain-lain isu / cabaran yang anda hadapi di dalam industri Akuakultur? Sila kongsikan.

PART/BAHAGIAN B: AQUACULTURE / AKUAKULTUR

END OF SURVEY/TINJAUAN TAMAT

ANNEX 4: LIST OF CRITICAL JOB TITLES

No.	Area	Critical Job Title	Level
1.	**Coastal Fisheries**	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
2.	**Deep Sea**	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
3.	**Open Sea**	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
4.	**Marine Grow-Out**	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Executive	4
		c) General Worker	1
5.	**Marine Hatchery**	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Executive	4
		c) General Worker	1
6.	**Freshwater Grow-Out**	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Executive	4
		c) General Worker	1
7.	**Freshwater Hatchery**	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Executive	4
		c) General Worker	1
8.	**Ornamental**	a) Aquaculture Expert / Consultant	7
		b) Technical Executive	4
		c) General Worker	1
9.	**Aquatic Plant (Micro and Macro**	a) Aquaculture Expert / Consultant	7
		b) Aquatic Plant Technical Executive	4
		c) General Worker	1

ANNEX 5: JOB TITLES RELEVANT TO INDUSTRIAL REVOLUTION

No.	Area	Job Title Relevant to IR	Level
1.	Coastal Fisheries	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer	4
		c) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
2.	Deep Sea	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer	4
		c) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
3.	Open Sea	a) Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master	5
		b) Assistant Captain / Fishing Master Assistant / Fishing Supervisor / First Officer	4
		c) Senior Crew / Foreman / Fishing Gear Operator / Engineman	3
4.	Marine Grow-Out	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Division Manager	6
		c) Farm Manager	5
		d) Aquaculture Executive	4
		e) Farm Technician	3
5.	Marine Hatchery	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Division Manager	6
		c) Hatchery Manager	5
		d) Aquaculture Executive	4
		e) Hatchery Technician	3
6.	Freshwater Grow-Out	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Division Manage	6
		c) Farm Manager	5
		d) Aquaculture Executive	4
		e) Farm Technician	3
7.	Freshwater Hatchery	a) Aquaculture Expert / Consultant	7
		b) Aquaculture Division Manager	6
		c) Hatchery Manager	5
		d) Aquaculture Executive	4
		e) Hatchery Technician	3
8.	Ornamental	a) Aquaculture Expert / Consultant	7

No.	Area	Job Title Relevant to IR	Level
		b) Farm Manager	6
		c) Operation Head	5
		d) Technical Executive	4
		e) Ornamental Culturist	3
9.	**Aquatic Plant (Micro and Macro**	a) Aquaculture Expert / Consultant	7
		b) Farm Manager	6
		c) Operation Head	5
		d) Aquatic Plant Technical Executive	4
		e) Aquatic Botanist	3

ANNEX 6: OCCUPATIONAL DESCRIPTION (OD)

SECTION : (A) AGRICULTURE, FORESTRY AND FISHING

DIVISION : (03) FISHING AND AQUACULTURE

GROUP : (031) FISHING

MSIC GROUP : (031) Fishing
AREA : Coastal Fisheries
JOB TITLE : Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master
LEVEL : 5

Responsibilities:
The Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master is responsible for complying with domestic and international regulations and legislation, managing the fishing vessel and ensuring equipment are inspected, functioning and seaworthy before sailing, navigating and operating the fishing activities, training and assigning specific tasks to crew members, monitor crew members job performance, ensure crew members welfare onboard, instruct fishing operations and supervise crew members, record daily activities in the captain's ship log and daily catch in catch logbook and comply with safety and hygiene on board including waste management.

Knowledge:
- Code of Conduct for Responsible Fisheries.
- Global maritime distress and safety system.
- International Convention for the prevention of pollution from ships.
- International regulations for preventing collisions at sea.
- Fisheries management and legislation.
- Fishing vessels and gear.
- Maritime meteorology.
- Deterioration of fish products.
- Quality assurance procedures of fish products.
- Operation of different engines.
- Mechanics of vessels.
- Engineering processes.
- Electromechanics.
- Engine components.
- Preparing and repairing nets and other fishing gear and equipment
- Operating and maintaining the fishing boat to, from and at fishing grounds
- Gathering different forms of aquatic life from shores and shallow waters.

Skills:
- Communication using the global maritime distress and safety system.
- Apply geographic information system (gis) and route navigation software.
- Apply meteorological information.
- Ensure vessel compliance with regulations.
- Schedule fishing.
- Apply fishing manoeuvres.
- Assess trim and stability of vessels.
- Support vessel manoeuvres.
- Conduct water navigation.
- Coordinate fish handling operations.
- Coordinate cargo handling.
- Secure cargo in stowage.

- Undertake navigation safety actions.
- Utilize water navigation devices.
- Maintain safe navigation watches.
- Operate ship rescue machinery.
- Recognise abnormalities on board.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Adapt to changes on a vessel.
- Brace work conditions challenge.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.

MSIC GROUP : (031) Fishing
AREA : Coastal Fisheries
JOB TITLE : Senior Crew / Foreman / Fishing Gear Operator / Engineman
LEVEL : 3

Responsibilities:
Senior Crew / Foreman / Fishing Gear Operator / Engineman is responsible for leading fishing activities, coordinating the worker/crew, identifying catch to ensure compliance with legal size and recording the catchment product information (species, weight, pieces, endangered species), managing the fishery, catch loading and storage for on-vessel post-harvest activities, oversee vessel maintenance (engine and fishing gears) and overcoming technical problems (obstacles) and ensure the safety and hygiene on board compliance during fishing operation.

Knowledge:
- Fishing vessels and gear.
- Various aquatic life from shores and shallow waters.
- Quality assurance procedures of fish products.
- Operation of engines.
- Mechanics of vessels.
- Basic electromechanics.
- Engine components.

Skills:
- Baiting, setting and hauling in fishing gear.
- Performing fishing manoeuvres.
- Maintaining nets and other fishing gear and equipment.
- Fish handling operations.
- Evaluate engine performance.
- Diagnose defective engines.
- Perform test run.
- Record test data.
- Utilise testing equipment.
- Utilise technical documentation.

Attributes (Attitude/Safety/Environmental):
- Adapt to changes on a vessel.
- Brace work conditions challenge.
- Critical thinking and problem-solving.
- Attention to details.
- Excellent communication.

MSIC GROUP : (031) Fishing
AREA : Deep Sea
JOB TITLE : Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master
LEVEL : 5

Responsibilities:
Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master is responsible to comply with the domestic and international regulations and legislation, manage the fishing vessel and ensure equipments are inspected, functioning and seaworthy before sailing, navigate and operate the fishing activities, train and assign specific jobs to crew members, monitor crew members job performance, ensure crew members welfare onboard, instruct fishing operating and supervise crew members, record daily activities in the captain's ship log and daily catch in catch logbook and comply with safety and hygiene on board including waste management.

Knowledge:
- Code of Conduct for responsible fisheries.
- Global maritime distress and safety system.
- International convention for the prevention of pollution from ships.
- International regulations for preventing collisions at sea.
- Fisheries management and legislation.
- Fishing vessels and gear.
- Maritime meteorology.
- Deterioration of fish products.
- Quality assurance procedures of fish products.
- Operation of different engines.
- Mechanics of vessels.
- Engineering processes.
- Electromechanics.
- Engine components.

Skills:
- Communication using the global maritime distress and safety system.
- Apply Geographic Information System (GIS) and route navigation software.
- Apply meteorological information.
- Ensure vessel compliance with regulations.
- Schedule fishing.
- Apply fishing manoeuvres.
- Assess trim and stability of vessels.
- Support vessel manoeuvres.
- Conduct water navigation.
- Coordinate fish handling operations.
- Coordinate cargo handling.
- Secure cargo in stowage.
- Undertake navigation safety actions.
- Utilize water navigation devices.
- Maintain safe navigation watches.

- Operate ship rescue machinery.
- Recognise abnormalities on board.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Adapt to changes on a vessel.
- Brace work conditions challenge.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.

MSIC GROUP : (031) Fishing
AREA : Deep Sea
JOB TITLE : Senior Crew / Foreman / Fishing Gear Operator / Engineman
LEVEL : 3

Responsibilities:
Senior Crew / Foreman / Fishing Gear Operator / Engineman is responsible to lead fishing activities, coordinate the worker/crew, identify catch to ensure compliance with legal size and record the catchment product information (species, weight, pieces, endangered species), manage the fishery, catch loading and storage for on-vessel post-harvest activities, oversee vessel maintenance (engine and fishing gears) and overcoming technical problems (obstacles) and ensure the safety and hygiene on board compliance during fishing operations.

Knowledge:
- Fishing vessels and gear.
- Selecting areas for fishing, plotting courses and computing navigational positions.
- Quality assurance procedures of fish products.
- Operation of engines.
- Mechanics of vessels.
- Basic electromechanics.
- Engine components.

Skills:
- Baiting, setting, operating and hauling in fishing gear by hand or using hoisting equipment.
- Performing fishing manoeuvres.
- Fish handling operations.
- Evaluate engine performance.
- Diagnose defective engines.
- Perform test run.
- Record test data.
- Utilize testing equipment.
- Utilize technical documentation.
- Maintaining nets and other fishing gear and equipment.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Adapt to changes on a vessel.
- Brace work conditions challenge.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.

MSIC GROUP : (031) Fishing
AREA : Open Sea
JOB TITLE : Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master
LEVEL : 5

Responsibilities:
Fishing Skipper / Fishing Vessel Operator / Vessel Captain /Fishing Master is responsible to comply with the domestic and international regulations and legislation, manage the fishing vessel and ensure equipments are inspected, functioning and seaworthy before sailing, navigate and operate the fishing activities, train and assign specific jobs to crew members, monitor crew members job performance, ensure crew members welfare onboard, instruct fishing operating and supervise crew members, record daily activities in the captain's ship log and daily catch in catch logbook and comply with safety and hygiene on board including waste management.

Knowledge:
- Code of Conduct for responsible fisheries.
- Global maritime distress and safety system.
- International convention for the prevention of pollution from ships.
- International regulations for preventing collisions at sea.
- Fisheries management and legislation.
- Fishing vessels and gear.
- Maritime meteorology.
- Deterioration of fish products.
- Quality assurance procedures of fish products.
- Operation of different engines.
- Mechanics of vessels.
- Engineering processes.
- Electromechanics.
- Engine components.

Skills:
- Communication using the global maritime distress and safety system.
- Apply geographic information system (gis) and route navigation software.
- Apply meteorological information.
- Ensure vessel compliance with regulations.
- Schedule fishing.
- Apply fishing manoeuvres.
- Assess trim and stability of vessels.
- Support vessel manoeuvres.
- Conduct water navigation.
- Coordinate fish handling operations.
- Coordinate cargo handling.
- Secure cargo in stowage.
- Undertake navigation safety actions.
- Utilize water navigation devices.
- Maintain safe navigation watches.

- Operate ship rescue machinery.
- Recognise abnormalities on board.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Adapt to changes on a vessel.
- Brace work conditions challenge.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.

MSIC GROUP : (031) Fishing
AREA : Open Sea
JOB TITLE : Senior Crew / Foreman / Fishing Gear Operator /Engineman
LEVEL : 3

Responsibilities:
Senior Crew / Foreman / Fishing Gear Operator / Engineman is responsible for leading fishing activities, coordinating the worker/crew, identifying catch to ensure compliance with legal size and recording the catch product information (species, weight, pieces, endangered species), managing the fishery, catch loading and storage for on-vessel post-harvest activities, oversee vessel maintenance (engine and fishing gears) and overcoming technical problems (obstacles) and ensure the safety and hygiene on board compliance during fishing operations.

Knowledge:
- Fishing vessels and gear.
- Selecting areas for fishing, plotting courses and computing navigational positions.
- Quality assurance procedures of fish products.
- Operation of engines.
- Mechanics of vessels.
- Basic electromechanics.
- Engine components.

Skills:
- Baiting, setting, operating and hauling in fishing gear by hand or using hoisting equipment.
- Performing fishing manoeuvres.
- Fish handling operations.
- Evaluate engine performance.
- Diagnose defective engines.
- Perform test run.
- Record test data.
- Utilize testing equipment.
- Utilize technical documentation.
- Maintaining nets and other fishing gear and equipment.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Adapt to changes on a vessel.
- Brace work conditions challenge.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.

SECTION : (A) AGRICULTURE, FORESTRY AND FISHING

DIVISION : (03) FISHING AND AQUACULTURE

GROUP : (032) AQUACULTURE

MSIC GROUP : (032) Aquaculture
AREA : Marine Grow-Out
JOB TITLE : Aquaculture Expert / Consultant
LEVEL : 7

Responsibilities:
The Aquaculture Expert / Consultant is responsible for developing and implementing feasible aquaculture technology, problem-solving and mitigating issues overall in the culture system and transferring knowledge and technologies.

Knowledge:
- Marine biology, applied zoology, ecology, botany, molecular biology, microbiology-bacteriology and virology.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse and prepare visual data and information.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Control aquatic production environment.
- Manage aquaculture breeding and harvesting schedules.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Abstract thinking.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Marine Grow-Out
JOB TITLE : Aquaculture Executive
LEVEL : 4

Responsibilities:
The Aquaculture Executive is responsible for ensuring and reviewing the achievement of the company policies, objectives, and KPI; establishing and reviewing department SOP; implementing compliance with regulatory bodies, standards and legislation; handling and resolving operational problems; managing culturing performance; managing disease outbreak, enforce farm safety and biosecurity, report progress and issue to management, evaluate workforce performance, competency program management and training programs, responsible livestock quality management, coordinate and communicate with stakeholders to ensure smooth operation and ensure employee welfare.

Knowledge:
- Marine biology, applied zoology, ecology, and botany.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement of policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conducting scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse and prepare visual data and information.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Controlling aquatic production environment.
- Manage aquaculture breeding and harvesting schedules.
- Management plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Collect and record growth, production and environmental data.
- Supervise aquaculture and fish hatchery support workers.
- Trapping and spawning of fish, egg incubation, and fry rearing.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.
- Work ethics and integrity.

MSIC GROUP : (032) Aquaculture
AREA : Marine Grow-Out
JOB TITLE : General Worker
LEVEL : 1

Responsibilities:
The General Worker is responsible for performing all general duties and routine work as per SOP and following instructions from the superior to perform manual labour tasks (e.g. repairing farm fencing, digging, stacking up goods, cutting grass, cleaning tanks and ponds, liming and disinfection, following feeding regime).

Knowledge:
- Production processes.
- Working safety standards.
- Machines and tools maintenance.
- Aquatic species, fish identification and fish classification.
- Fish culturing techniques.

Skills:
- Maintaining tanks, boats, machinery, tools and other aquaculture equipment.
- Transport fish and other aquatic stock to new tanks.
- Inspect fish eggs.
- Identity aquaculture species.
- Grading the fish.
- Maintaining optimum conditions for aquatic life.
- Hygienic practices and safety precautions in fishery operations.

Attributes (Attitude/Safety/Environmental):
- Attention to detail.
- Good communication.
- Work ethics and integrity.

MSIC GROUP : (032) Aquaculture
AREA : Marine Hatchery
JOB TITLE : Aquaculture Expert / Consultant
LEVEL : 7

Responsibilities:
Aquaculture Expert / Consultant is responsible for developing and implementing feasible hatchery technology, problem-solving and mitigating issues overall in the culture system and transferring knowledge and marine hatchery technologies.

Knowledge:
- Marine biology, applied zoology, ecology, botany, molecular biology, microbiology-bacteriology and virology.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement of policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.
- Hatchery or production industries.
- Sanitation measures for aquaculture hatchery production.
- Hatchery design.
- Aquaculture production planning software.
- Genetic selection programme.
- Plankton production.

Skills:
- Plan and implement new programmes and protocols and oversee new product development.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse, and prepare visual data and information.
- Evaluate potential end-user conflicts.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Control aquatic production environment.
- Manage aquaculture breeding and harvesting schedules.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Develop an aquaculture hatchery business plan.
- Induce spawning of cultured aquaculture species.
- Manage aquatic resources stock production.
- Assess the feeding behaviours of larvae.
- Schedule hatchery supplies.
- Enforce sanitation procedures.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Encourage teambuilding.
- Small-to-medium business management.
- Abstract thinking.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Marine Hatchery
JOB TITLE : Aquaculture Executive
LEVEL : 4

Responsibilities:
The Aquaculture Executive is responsible for ensuring and reviewing the achievement of the company policies, objectives, and KPI; establishing and reviewing department SOP; implementing compliance with regulatory bodies, standards and legislation; reviewing the department activities in accordance with the hatchery operation; responsible for troubleshooting and resolving problems; handle and resolve operational problems, manage hatchery production, manage disease outbreak; enforce hatchery safety and biosecurity, planning spawning program for livestock, evaluate workforce performance, competency program management and training programs, coordinate and communicate with stakeholders to ensure smooth hatchery operation, ensure and manage employee welfare.

Knowledge:
- Marine biology, applied zoology, ecology, and botany.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement of policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.
- Hatchery or production industries.

Skills:
- Plan and implement new programmes and protocols and oversee new product development.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse, and prepare visual data and information.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Control aquatic production environment.
- Manage aquaculture breeding and harvesting schedules.
- Management plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Collect and record growth, production, and environmental data.
- Supervise aquaculture and fish hatchery support workers.
- Trap and spawn fish, incubate eggs, and rear fry.
- Carry out feeding operations.
- Cultivate plankton.
- Enforce sanitation procedures.
- Induce spawning of cultured aquaculture species.
- Monitor hatchery production processes and maintain hatchery records.

- Operate hatchery recirculation system.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Marine Hatchery
JOB TITLE : General Worker
LEVEL : 1

Responsibilities:
The General Worker is responsible for performing all general duties and routine work as per standard operating procedure (SOP) and following instructions from the superior to perform manual labour tasks (e.g. repairing hatchery fencing, disposing, stacking up goods, cutting grass, cleaning tanks and ponds, and disinfection, following feeding regime).

Knowledge:
- Production processes.
- Working safety standards.
- Machines and tools maintenance.
- Aquatic species, fish identification and fish classification.
- Fish culturing techniques.

Skills:
- Maintaining tanks, boats, machinery, tools and other aquaculture equipment.
- Transport fish and other aquatic stock to new tanks.
- Inspect fish eggs.
- Identity aquaculture species.
- Grading the fish.
- Cultivate plankton.
- Maintaining optimum conditions for aquatic life.
- Hygienic practices and safety precautions in fishery operations.
- Hatchery production processes.
- Culture aquaculture hatchery stocks.
- Operate hatchery trays.
- Maintain hatchery facilities and equipment.

Attributes (Attitude/Safety/Environmental):
- Attention to detail.
- Good communication.
- Work ethics and integrity.

MSIC GROUP : (032) Aquaculture
AREA : Freshwater Grow-Out
JOB TITLE : Aquaculture Expert / Consultant
LEVEL : 7

Responsibilities:
The Aquaculture Expert / Consultant is responsible for developing and implementing feasible aquaculture technology, problem-solving and mitigating issues overall in the culture system and transferring knowledge and technologies.

Knowledge:
- Marine biology, applied zoology, ecology, botany, molecular biology, microbiology-bacteriology and virology.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement of policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.

Skills:
- Plan and implement new programmes and protocols and oversee new product development.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse and prepare visual data and information.
- Write research proposals and work-related reports.
- Diagnosis aquatic animals' health and treatment.
- Controlling aquatic production environment.
- Manage aquaculture breeding and harvesting schedules.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Abstract thinking.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Freshwater Grow-Out
JOB TITLE : Aquaculture Executive
LEVEL : 4

Responsibilities:
The Aquaculture Executive is responsible for ensuring and reviewing the achievement of the company policies, objectives, and KPI; establishing and reviewing department SOP; implementing compliance with regulatory bodies, standards and legislation; handling and resolving operational problems; managing culturing performance; managing disease outbreak, enforce farm safety and biosecurity, report progress and issue to management, evaluate workforce performance, competency programme management and training programmes, responsible livestock quality management, coordinate and communicate with stakeholders to ensure smooth operation and ensure employee welfare.

Knowledge:
- Marine biology, applied zoology, ecology, and botany.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement of policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.

Skills:
- Plan and implement new programmes or protocols and oversee product development.
- Conduct scientific research and field research methodologies and laboratory techniques.
- Collect, synthesize, analyse, and prepare visual data and information.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Control aquatic production environment.
- Manage aquaculture breeding and harvesting schedules.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Collect and record growth, production, and environmental data.
- Supervise aquaculture and fish hatchery support workers.
- Trap and spawn fish, incubate eggs, and rear fry.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.
- Work ethics and integrity.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Freshwater Grow-Out
JOB TITLE : General Worker
LEVEL : 1

Responsibilities:
The General Worker is responsible for performing all general duties and routine work as per SOP and following instructions from the superior to perform manual labour tasks (e.g. repairing farm fencing, digging, stacking up goods, cutting grass, cleaning tanks and ponds, liming and disinfection, following feeding regime).

Knowledge:
- Production processes.
- Working safety standards.
- Machines and tools maintenance.
- Aquatic species, fish identification and fish classification.
- Fish culturing techniques.

Skills:
- Maintaining tanks, boats, machinery, tools and other aquaculture equipment.
- Transport fish and other aquatic stock to new tanks.
- Inspect fish eggs.
- Identity aquaculture species.
- Grading the fish.
- Maintaining optimum conditions for aquatic life.
- Hygienic practices and safety precautions in fishery operations.

Attributes (Attitude/Safety/Environmental):
- Attention to detail.
- Good communication.
- Work ethics and integrity.

MSIC GROUP : (032) Aquaculture
AREA : Freshwater Hatchery
JOB TITLE : Aquaculture Expert / Consultant
LEVEL : 7

Responsibilities:
Aquaculture Expert / Consultant is responsible for developing and implementing feasible hatchery technology, problem-solving and mitigating issues overall in the culture system and transferring knowledge and technologies.

Knowledge:
- Marine biology, applied zoology, ecology, botany, molecular biology, microbiology-bacteriology and virology.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implement and enforce policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.
- Hatchery or production industries.
- Sanitation measures for aquaculture hatchery production.
- Hatchery design.
- Aquaculture production planning software.
- Genetic selection programme.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse, and prepare visual data and information.
- Evaluate potential end-user conflicts.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Control aquatic production environment.
- Manage aquaculture breeding and harvesting schedules.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Develop an aquaculture hatchery business plan.
- Induce spawning of cultured aquaculture species.
- Manage aquatic resources stock production.
- Assess the feeding behaviours of larvae.
- Schedule hatchery supplies.
- Enforce sanitation procedures.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Encourage teambuilding.
- Small-to-medium business management.
- Abstract thinking.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Freshwater Hatchery
JOB TITLE : Aquaculture Executive
LEVEL : 4

Responsibilities:
The Aquaculture Executive is responsible for ensuring and reviewing the achievement of the company policies, objectives, and KPI; establishing and reviewing department SOP; implementing compliance with regulatory bodies, standards and legislation; reviewing department activities per the hatchery operation; responsible for troubleshooting problem and resolve, handle & resolve operational problem, manage hatchery production, manage disease outbreak, enforce hatchery safety and biosecurity, plan spawning program for livestock, evaluate workforce performance, competency program management and training programs, coordinate and communicate with stakeholders to ensure smooth hatchery operation and ensure employee welfare.

Knowledge:
- Marine biology, applied zoology, ecology, and botany.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Policies related to operations and safety standards.
- Water quality standards and aquatic animal health standards.
- Hatchery or production industries.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conducting scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse, and prepare visual data and information.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Controlling aquatic production environment.
- Managing aquaculture breeding and harvesting schedules.
- Management plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Collect and record growth, production and environmental data.
- Supervise aquaculture and fish hatchery support workers.
- Trap and spawn fish, incubate eggs, and rear fry.
- Carry out feeding operations.
- Enforce sanitation procedures.
- Induce spawning of cultured aquaculture species.
- Monitor hatchery production processes and maintain hatchery records.
- Operate hatchery recirculation system.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Freshwater Hatchery
JOB TITLE : General Worker
LEVEL : 1

Responsibilities:
The General Worker is responsible for performing all general duties and routine work as per SOP and following instructions from the superior to perform manual labour tasks (e.g. repairing hatchery fencing, digging, stacking up goods, cutting grass, cleaning tanks and ponds, disinfection, following feeding regime).

Knowledge:
- Production processes.
- Working safety standards.
- Machines and tools maintenance.
- Aquatic species, fish identification and fish classification.
- Fish culturing techniques.

Skills:
- Maintaining tanks, boats, machinery, tools and other aquaculture equipment.
- Transport fish and other aquatic stock to new tanks.
- Inspect fish eggs.
- Identity aquaculture species.
- Grading the fish.
- Maintaining optimum conditions for aquatic life.
- Hygienic practices and safety precautions in fishery operations.
- Hatchery production processes.
- Culture aquaculture hatchery stocks.
- Operate hatchery trays.
- Maintain hatchery facilities and equipment.

Attributes (Attitude/Safety/Environmental):

- Attention to detail.
- Good communication.
- Work ethics and integrity.

MSIC GROUP : (032) Aquaculture
AREA : Ornamental
JOB TITLE : Aquaculture Expert / Consultant
LEVEL : 7

Responsibilities:
Aquaculture Expert / Consultant is responsible for developing and implementing feasible ornamental fish operation technology, developing new varieties e.g., cross breeding, problem-solving and mitigating issues in ornamental industry and transferring knowledge and technologies.

Knowledge:
- Marine biology, applied zoology, ecology, botany, molecular biology, microbiology-bacteriology and virology.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.
- Hatchery or production industries.
- Sanitation measures for aquaculture hatchery production.
- Hatchery design.
- Aquaculture production planning software.
- Genetic selection, breeding, raising and tending fish.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse, and prepare visual data and information.
- Evaluate potential end-user conflicts.
- Write research proposals and work-related reports.
- Diagnose aquatic animals' health and treatment.
- Control aquatic production environment.
- Identify toxins and environmental diseases.
- Manage aquaculture breeding and harvesting schedules.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Develop an aquaculture hatchery business plan.
- Induce spawning of cultured aquaculture species.
- Manage aquatic resources stock production.
- Assess the feeding behaviours of larvae.
- Schedule hatchery supplies.
- Enforce sanitation procedures.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Encourage teambuilding.
- Small-to-medium business management.
- Abstract thinking.
- Critical thinking and problem solving.
- Attention to details.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Ornamental
JOB TITLE : Technical Executive
LEVEL : 4

Responsibilities:
Technical Executive is responsible for ensuring and reviewing the achievement of the company policies, objectives, and KPI, managing ornamental husbandry activities, establishing and reviewing department SOP, implementing compliance with regulatory bodies, standards and legislation, reviewing the department activities following the operation strategy, responsible to troubleshooting problems and execute solution, report progress and issue to management, evaluate workforce performance, competency program management and training programs, manage broodstock and species selection as per production planned, preparation of export and import documentation, coordinate and communicate with stakeholders to ensure smooth operation and ensure and manage employee welfare.

Knowledge:
- Marine biology, applied zoology, ecology, and botany.
- Aquatic species, fish anatomy (identification and classification) and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Animal welfare legislation and regulations, pollution legislation.
- Management and fish culturing techniques.
- Raw materials, production processes, quality control and quality assurance.
- Policies relating to operations and safety standards.
- Water quality standards and aquatic animal health standards.
- Hatchery or production industries.
- Genetic selection, breeding, raising and tending fish.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse and prepare visual data and information.
- Write research proposals and work-related reports.
- Diagnose animals' health and treatment.
- Manage aquaculture breeding and harvesting schedules.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Collect and record growth, production and environmental data.
- Trapping and spawning of fish, egg incubation, and fry rearing.
- Carry out feeding operations.
- Enforce sanitation procedures.
- Induce spawning of cultured aquaculture species.
- Monitor hatchery production processes and maintain hatchery records.
- Operate hatchery recirculation system.

Attributes (Attitude/Safety/Environmental):

- Leadership.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Ornamental
JOB TITLE : General Worker
LEVEL : 1

Responsibilities:
The General Worker is responsible for performing all general duties and routine work and following instructions from superior to perform manual labour tasks (e.g., repair farm fencing, digging, stacking up goods, cutting grass, cleaning tanks and ponds, pond liming and disinfection, following feeding regime).

Knowledge:
- Production processes.
- Working safety standards.
- Machines and tools maintenance.
- Aquatic species, fish identification and fish classification.
- Fish culturing techniques.

Skills:
- Maintain tanks, machinery, tools and other aquaculture equipment.
- Transport fish and other aquatic stock to new tanks.
- Inspect fish eggs.
- Identity aquaculture species.
- Grade the fish.
- Maintain optimum conditions for aquatic life.
- Implement hygienic practices and safety precautions in fishery operations.
- Hatchery production processes.
- Culture aquaculture hatchery stocks.
- Operate hatchery trays.
- Maintain hatchery facilities and equipment.

Attributes (Attitude/Safety/Environmental):
- Attention to detail.
- Good communication.
- Work ethics and integrity.

MSIC GROUP : (032) Aquaculture
AREA : Aquatic Plant (Micro and Macro)
JOB TITLE : Aquaculture Expert / Consultant
LEVEL : 7

Responsibilities:
Aquaculture Expert / Consultant is responsible to develop and implement feasible aquatic plant technology, introduce new varieties, develop cell culture technology, problem solving and mitigate issues in aquatic plant industry and transfer knowledge and technologies.

Knowledge:
- Marine biology, ecology, botany, and molecular biology.
- Aquatic species, and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Pollution legislation.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement policies relating to operations and safety standards.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse and prepare visual data and information.
- Evaluate potential end-user conflicts.
- Write research proposals and work-related reports.
- Control aquatic production environment.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Enforce sanitation procedures.
- Determine the kinds and amounts of ornamental aquatic plants to be grown.
- Produce saplings, bulbs and seeds.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Encourage teambuilding.
- Small-to-medium business management.
- Abstract thinking.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Aquatic Plant (Micro and Macro)
JOB TITLE : Aquatic Plant Technical Executive
LEVEL : 4

Responsibilities:
The aquatic Plant Technical Executive is responsible for ensuring and reviewing the achievement of the company policies, objectives, and KPI; establishing and reviewing department SOP; implementing compliance with regulatory bodies, standards and legislation; reviewing the department activities in accordance with the operation strategy, responsible for troubleshooting and problem-solving, report progress and issue to management, manage plant tissue culture and seeding process, evaluate workforce performance, competency program management and training programs, coordinate and communicate with stakeholders to ensure smooth operation and ensure and manage employee welfare.

Knowledge:
- Marine biology, ecology, and botany.
- Aquatic species and aquaponics.
- Biology, biosecurity and biotechnology in aquaculture.
- Pollution legislation.
- Raw materials, production processes, quality control and quality assurance.
- Implementation and enforcement of policies relating to operations and safety standards.

Skills:
- Plan and implement new programmes and protocols and oversee the development of new products.
- Conduct scientific research methodology, field research methodology and laboratory techniques.
- Collect, synthesize, analyse and prepare visual data and information.
- Write research proposals and work-related reports.
- Control aquatic production environment.
- Manage plans to reduce risks in aquaculture facilities.
- Perform project management and coordinate operational activities.
- Assess environmental impact in aquaculture operations.
- Collect and record growth, production, and environmental data.
- Enforce sanitation procedures.
- Perform operations such as soil preparation, sowing, planting and harvesting of crops.
- Cultivate flowers, trees, shrubs and other plants.

Attributes (Attitude/Safety/Environmental):
- Leadership.
- Critical thinking and problem-solving.
- Attention to detail.
- Excellent communication.
- Good relationships with animal welfare establishments.
- Research ethics and scientific integrity principles in research activities.
- Interact professionally in research and professional environments.

MSIC GROUP : (032) Aquaculture
AREA : Aquatic Plant (Micro and Macro)
JOB TITLE : General Worker
LEVEL : 1

Responsibilities:
The General Worker is responsible for performing all general duties and routine work, following instructions from superior to perform manual labour tasks (e.g. cleaning and preparation of culture system) and performing fertilising regime as per SOP.

Knowledge:
- Production processes.
- Working safety standards.
- Machinery or tools maintenance.
- Aquatic plant species, identification and classification.

Skills:
- Maintain tanks, machinery, tools and other aquaculture equipment.
- Identify aquaculture species.
- Maintain optimum conditions for aquatic life.
- Harvest aquatic crops.
- Implement hygienic practices and safety precautions.

Attributes (Attitude/Safety/Environmental):
- Attention to detail.
- Good communication.
- Work ethics and integrity.

ANNEX 7: GRAPH

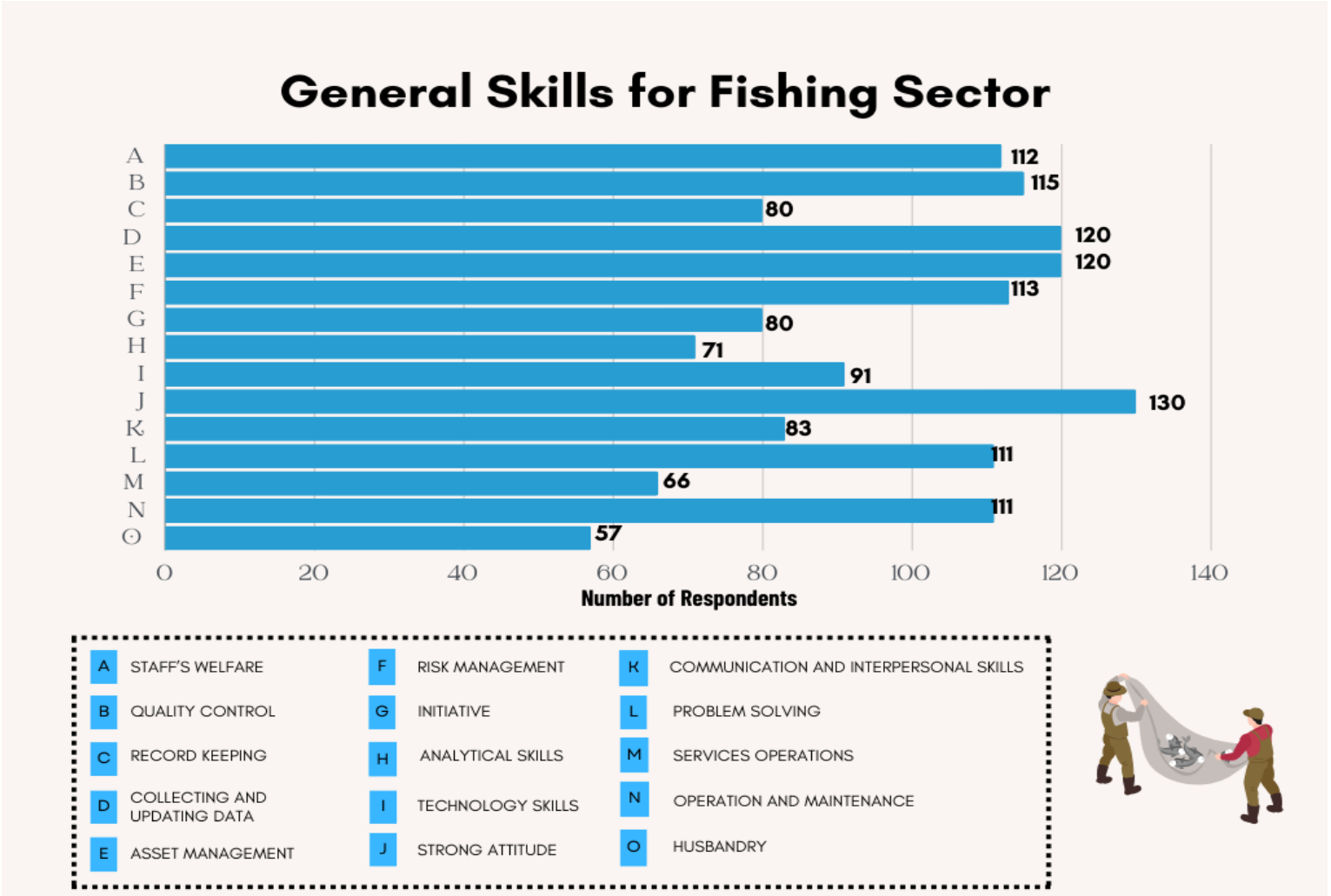

Figure 1: General Skills for Fishing Sector

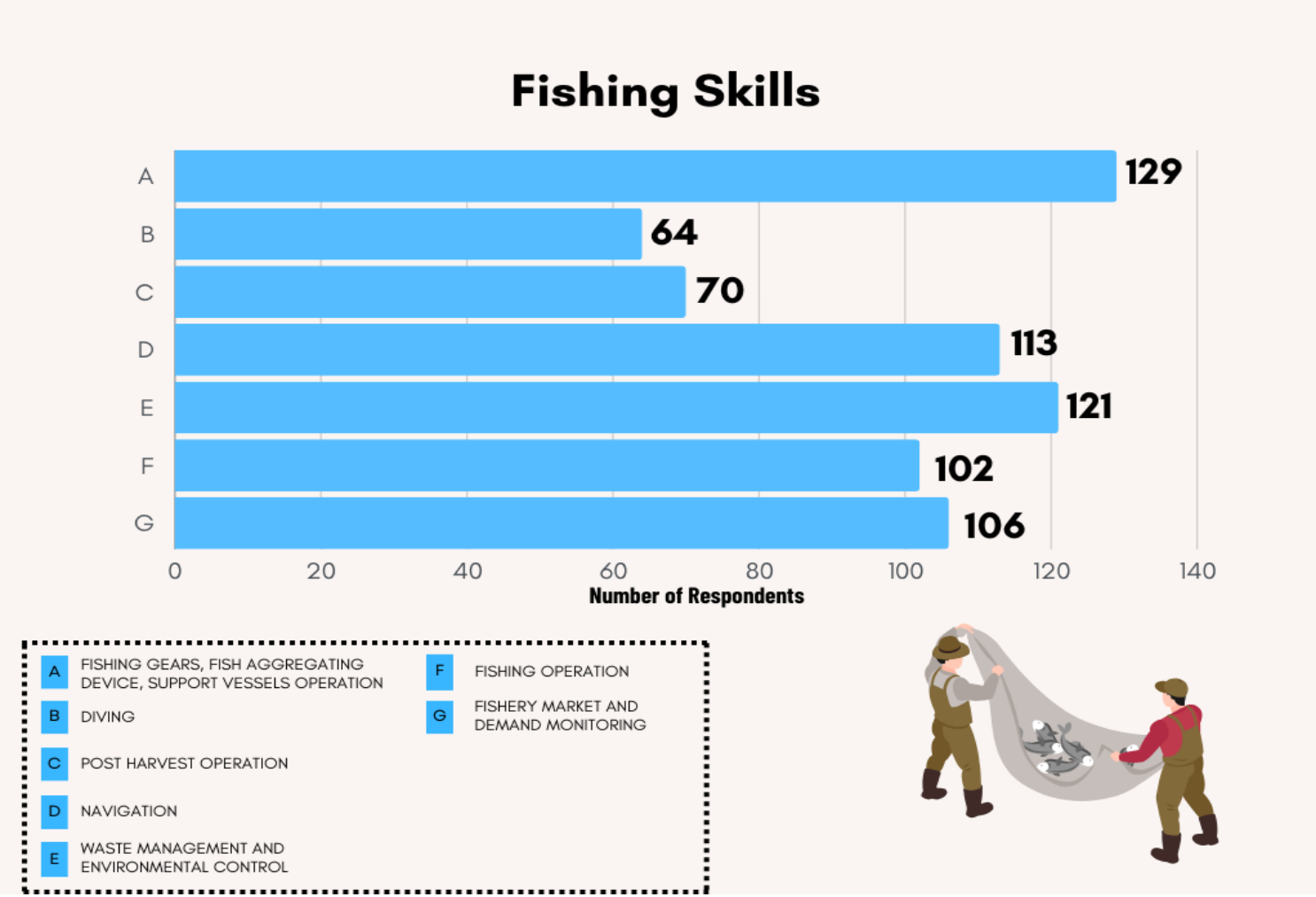

Figure 2: Fishing Skills

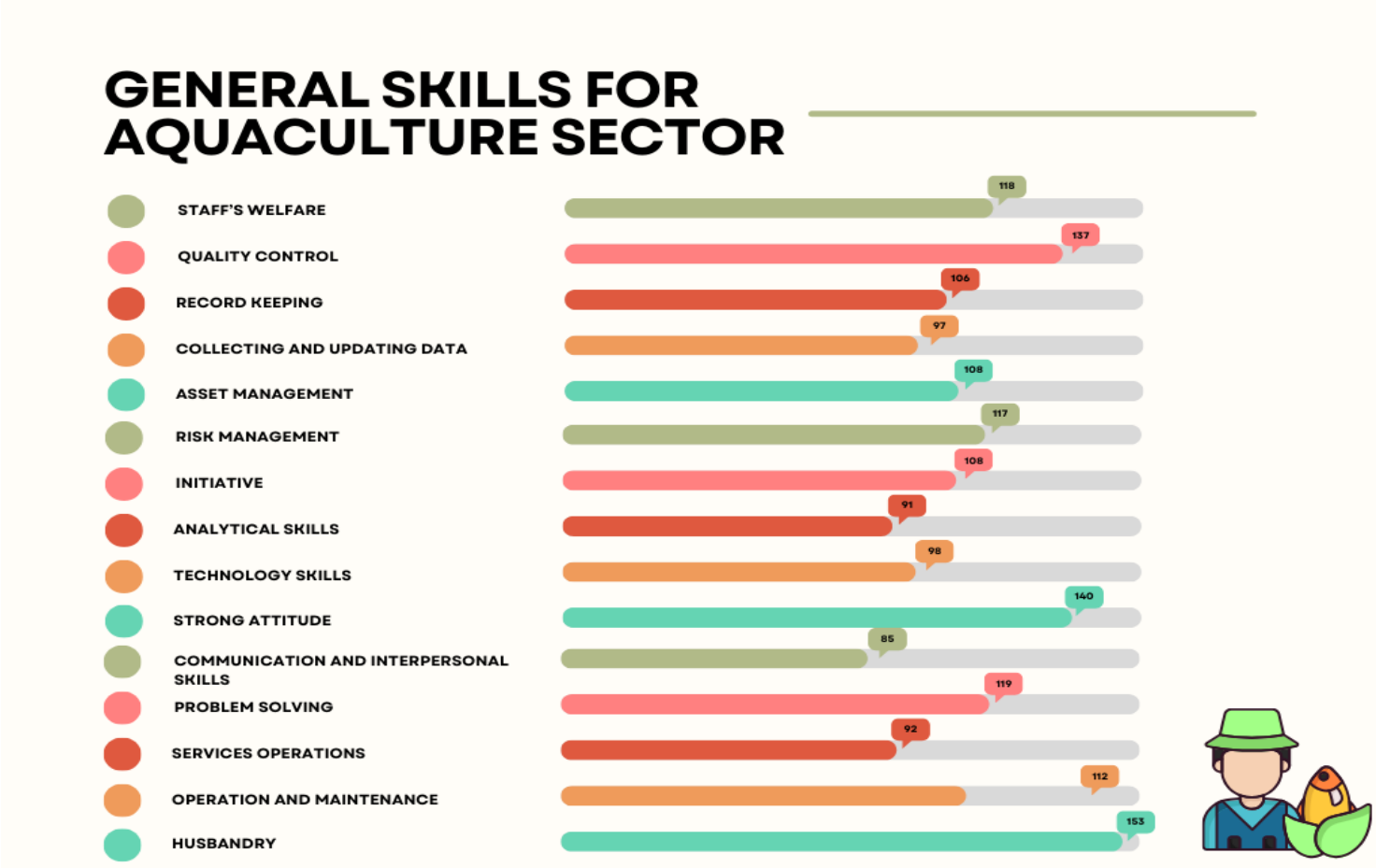

Figure 3: General Skills for Aquaculture Sector

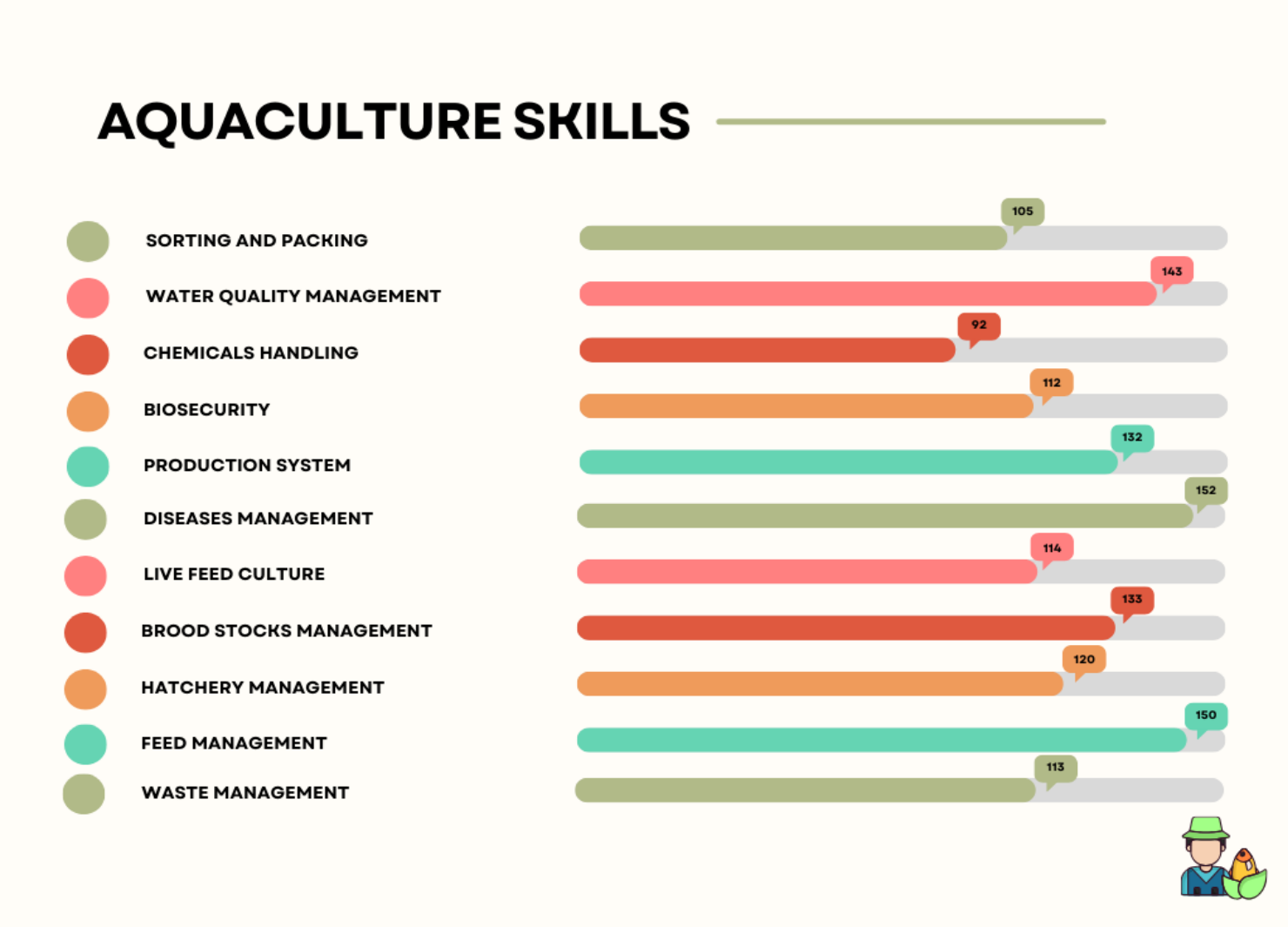

Figure 4: Aquaculture Skills

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