Aquaculture Skills Inventory & Needs Analysis 2017

Operation Phakisa Aquaculture Skills Working Group Report

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SAIMI
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Foreword

Aquaculture has been identified as a potential growth area of the oceans economy by the South African government through Operation Phakisa. However, little information is available not only on the skills needed to grow this subsector of the maritime industry, but also on the skills employed in the aquaculture industry in South Africa.

The South African International Maritime Institute (SAIMI), as advised by its Aquaculture Skills Working Group (ASWG), recognised the need for a thorough Aquaculture Skills Audit and Needs Analysis. The ASWG created terms of reference for a skills audit analysis in the aquaculture industry, and Chrysalis Training and Skills Development was appointed as the provider to conduct the research.

The research was funded by SAIMI and the Agriculture Sector Education and Training Authority.

Services commissioned by the study included gathering data and analysis through desk-based research, comprehensive online surveys and conducting face-to-face interviews of a sub-sample of each species farmed in the aquaculture sector, as well as vital sector ancillary services.

Outcomes set out by the service agreement included determining the educational level and skills employed in the aquaculture sector from entry to management level; essential education and skills required by the sector; barriers to acquiring these skills; preferred learning styles of employees at the different levels; scarce and critical skills within the industry; current educational and training skills development available and the extent to which it meets the needs of the industry.

The service agreement also required information on the degree of participation with the SETAs by the aquaculture industry, as well as public sector capacity in the sector. The skills analysis report therefore reflects on the current employment in terms of youth, women and people with disabilities as well as various South African population groups.

A strong outcome of the research was to determine the proposed educational and skills development programmes required for the sector to meet Operation Phakisa aspirations in the future, including recommendations for interventions and mitigating strategies to achieve exponential growth in this subsector of the oceans economy.

SAIMI recognises the exploratory nature of this research, which should function as a baseline study to inform future research applicable to the aquaculture industry.

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Abbreviations and Acronyms

AET	Adult Education and Training
AGRISETA	Agricultural Sector Education and Training Authority
ASNA	Aquaculture Skills Needs Analysis
ASWG	Aquaculture Skills Working Group
ATR	Annual Training Report
DAFF	Department of Agriculture Forestry and Fisheries
FET	Further Education and Training
ELSA	English Language Skills Assessment
DHET	Department of Higher Education and Training
GET	General Education and Training
HACCP	Hazard Analysis and Critical Control Point
HET	Higher Education and Training
NQF	National Qualifications Framework
OFO	Organisational Framework of Occupations
RPL	Recognition of Prior Learning
SAIMI	South African International Maritime Association
SCUBA	Self-Contained Under Water Breathing Apparatus
SDL	Skills Development Levy
SETA	Sector Education and Training Authority
Stats SA	Statistics South Africa
TVET	Technical and Vocational Education and Training
WESGRO	Western Cape Investment and Trade and Promotion Agency
WSP	Workplace Skills Plan

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Acknowledgements

Many thanks to all who have assisted in the gathering of data and the contacting of stakeholders. The relationships that those on the Operation Phakisa Aquaculture Skills Working Group have with stakeholders, assisted immensely with getting buy-in from stakeholders within the aquaculture industry.

Thank you to all organisations and individuals who agreed to take part in this study.

Background

During Operation Phakisa, the various aquaculture stakeholders committed to ambitious aspirations in terms of job creation, production, Gross Domestic Product (GDP) contribution and inclusivity. In order to reach these aspirations, it was acknowledged that it is imperative that skills requirement of the existing and future aquaculture sector is addressed.

Skills were identified as a constraint in the economic growth across all the Operation Phakisa oceans economy labs and therefore the Department of Higher Education and Training (DHET) was tasked with leading the skills development aspects across the sectors. The DHET subsequently appointed the South African International Maritime Institute (SAIMI) to facilitate and co-ordinate the various skills working groups for the labs. The Aquaculture Skills Working Group (ASWG) came to the realisation that a thorough skills audit and needs analysis was required to further inform the work of the ASWG.

The ASWG created terms of reference for a skills audit analysis in the aquaculture industry, and Chrysalis Training and Skills Development was appointed as the provider to conduct the skills audit.

Aims and Objectives

- Create a baseline to measure the impact of interventions on the sector.
- Identify critical and scarce skills required for the sector.
- Prioritise and guide the development of the qualifications that are required for the sector.
- Inform the interventions required to grow the skills base of the sector to meet current and future demands.

Skills Inventory and Needs Analysis to investigate the following:

1. Current level of education and skills employed in the aquaculture sector from entry to management level.
2. Essential education and skills required by the sector from entry to management level.
3. Barriers to acquiring required level of education and skills in the industry.
4. Preferred learning styles of employees at the different levels e.g. distance, face-to-face, college/ technically-based, on-the-job, etc.
5. Scarce and critical skills within the industry.
6. Current educational, infrastructure (who offers what) and training skills development available and the extent to which it meets the needs of the sector.
7. The extent to which South Africa's current unit standards learning programmes and qualifications meet the educational and skills needs of the industry.
8. The level of registration or participation with the Sector Education and Training Authorities (SETAs), which SETA is used, and the support provided by the SETA.
9. Public sector capacity.

10. Quantify the need and status for Recognition of Prior Learning (RPL) at various levels in line with existing aquaculture standards.

The following sub-sectors of the aquaculture industry should be targeted:

A minimum of two farms/service providers in each sub-sector should be interviewed, either directly or telephonically when situated in remote locations. Where possible the same species farmed should be interviewed for different provinces (i.e. trout farm in Western Cape and trout farm in Mpumalanga).

Farms in sub-sectors that should be targeted:

Abalone, Oysters, Mussels, Trout, Ornamental Farms; Tilapia, and Koi Carp Farms; Tilapia, Trout and Koi Carp Farms; Finfish (Eastern Cape/KZN) and Marron (Eastern Cape).

Two of each of the following service providers should be targeted:

Veterinary, aquaculture feed manufacturer and aquaculture engineering/system design services.

Other:

Aquaculture product marketing and distribution services; and Food safety and quality assurance.

Education and Training Providers:

Public sector; private institutions, independent service providers and academia.

The skills inventory and needs analysis report should also attempt to include:

- Baseline assessment of level of education and skills employed in the sector from entry level to senior management.
- A breakdown of current employment in terms of youth, women and people with disabilities.
- Assessment of the representation of the various population groups from entrance to senior management level in the sector, and perceived constraints in addressing transformation.
- The current level of education and skills development required by the sector.
- The proposed educational and skills development programmes required for the sector to meet Operation Phakisa's aspirations in the future.
- Recommended interventions required to address the educational and skills needs of the sector.
- Scarce and critical skills for the sector and provide mitigation strategies.

1. Methodology

1.1 Data collection

The initial step was to do a desktop review to establish the best practice for other aquaculture skills inventory and needs analyses previously conducted in South Africa, Africa and Worldwide. The desktop review was also expected to determine what educational, training and skills initiatives are being advertised on the internet, via public sector providers, private providers and educational institutions.

Questionnaires were designed to meet the requirements to be investigated. The questionnaires were structured to elicit demographic data (gender, age, educational and work experience in the aquaculture industry), and included 11 questions relating to skills, level of education and training in the aquaculture industry. Individual questions are shown in Appendix I (Einarsson, 2013). The questionnaires made provision for focus group interviews with Aquaculture Farm Assistants and Aquaculture Farmers on farms; Middle and Senior managers to complete and return to Chrysalis Training and Skills Development (Chrysalis) (Appendix II); a Human Resource focussed questionnaire to be completed by Human Resources practitioners at the farms (Appendix III) and returned to Chrysalis. A questionnaire for experts, educational providers and others was designed and sent to the relevant stakeholders (See Appendix IV).

Potential stakeholders were identified through channels such as the Department of Agriculture, Forestry and Fisheries (DAFF) database; internet searches for organisations and contact details; referrals and introductions through people who have an established relationship with potential stakeholders; and aquaculture-related associations.

Associations were contacted and the project was presented to members at association meetings.

A one-page document was drafted (Appendix V), explaining the project. All potential stakeholders were initially contacted via email, with the explanation document attached. Later in the project an introductory letter was drafted and sent with the initial contact (Appendix VI). This was later followed up with a phone call, where possible.

All stakeholders who showed an initial interest were then contacted and sent the appropriate questionnaire. Farms were sent the Senior and Middle Management Questionnaire and the Human Resources Questionnaire. Arrangements were then made to visit the farm and conduct interviews with Aquaculture Farm Assistants and Aquaculture Farmers.

Farms were visited and focus group interviews were conducted. Each focus group interview consisted of a group of 4 – 12 participants. The participants were as far as possible interviewed as groups from the specific area of the farm on which they work These areas consisted of hatchery, grow-out, processing, technical, and maintenance work groups. Where possible, Aquaculture Farmers / Forepersons were interviewed as a separate group. A total of 36 focus group interviews were conducted with Aquaculture Farmers and Aquaculture Farm Assistants. Table 1 indicates the number of focus group interviews per sub-sector and occupational category.

Table 1: Number of Focus Group interviews per sub-sector of aquaculture and occupational category

Occupational group	Abalone	Other Mariculture	Freshwater	Total
Aquaculture Farm Assistant	15	5	4	24
Aquaculture Farmer	6	3	3	12
Total	**21**	**8**	**7**	**36**

Each focus group interview lasted approximately 45 minutes to an hour. Between two and five focus groups were interviewed per farm, depending on the number of employees per farm.

Professionals not directly working on farms but working within the aquaculture industry and stakeholders in educational, training and skills development fields related to aquaculture were sent the Experts/Others questionnaire to complete and return via email.

The overall approach was influenced by the desktop review followed by an appraisal that was dependent on interviews with groups and individuals representing different sub-sectors of the aquaculture industry, guided by checklists of key questions. The overall approach provided a holistic understanding of the needs of the aquaculture industry (Nyandat & Owiti, 2013).

1.2 Data Collation

Focus group interview data and data from completed questionnaires were entered into Excel Spreadsheets, providing quantitative data, but also included the findings for qualitative analysis.

Data from spreadsheets were used to create graphs to assist with data analysis.

Collated data was included in this report under the appropriate sections, tailored to meet the requirements of the study.

2. Desktop review

The desktop review was conducted via internet searches and keywords included: “Aquaculture skills needs analysis South Africa”; “Aquaculture skills needs analysis”; “Aquaculture courses”; and “Aquaculture training”.
Documents received from members of the Aquaculture Skills Working Group and experts associated with publications were also reviewed for relevant information and guidance.

The following documents were reviewed and used as a guide to complete this survey:

Aquaculture needs analyses conducted in Africa:

- *Benchmarking Survey of the South African Aquaculture Sector* (Botes, Louw & Thompson, 2006)
- *Benchmarking Survey of The South African Aquaculture (Marine & Freshwater) Sector* (Botes, Louw and Thompson, 2009)
- *Sector Analysis Agriculture* (AgriSETA, 2010)
- *Aquaculture and fisheries in Mpumalanga Province* (Department: Agriculture, Rural Development and Land Administration, 2010)
- *Aquaculture Development and Enhancement Programme* (Department of Trade and Industry, 2013)
- *Operation Phakisa: unlocking the potential of the aquaculture sector in South Africa- Aquaculture Lab discussion* (Operation Phakisa, 2014)
- *AgriSETA Strategic plan: 2016-2017* (AgriSETA, 2015)

Aquaculture needs analyses conducted internationally:

- *National Aquaculture Sector Overview* (Semoli & Halley, 2010)
- *Skills Needs Analysis for the NT Fishing and Seafood Industry- 2014* (C-AID Consultants, 2014)
- *Fishfarm project- Needs Analysis Report* (Einarsson, 2013)
- *Aquaculture needs assessment mission report* (Nyandat & Owiti, 2013)
- *A Study on the Status of Aquaculture Production and Trade in South Africa. Volume 1: Industry Status and Diagnostic Report* (Shipton & Britz)
- *Project Red Velvet: Market Study on the Aquaculture Sector in East Africa* (Deloitte Consulting Ltd, 2015)
- *Training needs analysis of ACP II Fish countries in East Africa* (ACP fish II)

Education, training and skills-related documents:

- *Introduction to aquaculture in the Eastern Cape* (Hinrichsen, 2008)
- *Introduction to Aquaculture in the Western Cape*: *Edition 1. (*Hinrichsen, E. 2007)
- *Aquaculture skills development and training programme (STP) for the Western Cape aquaculture farmers – conducted by Henk Stander* (Stellenbosch University; Lizeth Botes-AISA)
- Qualification in progress

3. Representation of sub-sectors

Contact was made with over 100 potential respondents, comprising of aquaculture farms, industry specialists, government departments, training providers and aquaculture member associations across various sectors of aquaculture.
A total response rate of 39% was received, with a response rate of 44% being from industry specialists in different areas of aquaculture, 36% from freshwater and marine farms and 30% from member organisations and government departments, providing generic information required.

3.1. Stakeholder Engagement

Freshwater and marine farmers:
A total of 65 farms from the freshwater (45) and marine (20) sectors were contacted to take part in the survey. Farmers from the marine sector were more open and willing to participate in the survey, with the abalone industry being most willing to participate, followed by oyster and mussel farmers. However, those in freshwater sub-sectors needed much convincing to agree to participate in the survey.

The marine aquaculture sector represented 69% of farms visited (Figure 1) consisting of abalone; dusky cob; mussels; mussels and oysters farms and a salmon processing factory. The abalone sector was the most representative, with 55% of farms visited being from the abalone industry, 27% represented by offshore oysters and mussels, 18% represented by dusky cob and a salmon processing factory (Figure 2).

Freshwater farms visited where workers were interviewed, represented 31% of the total number of farms visited. The freshwater sector was represented by koi, tilapia, trout and catfish, and each sector had equal representation (Figure 3).

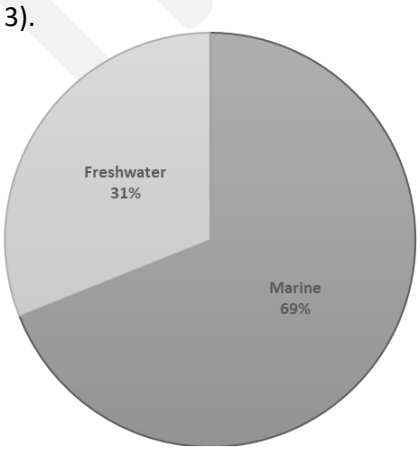

Figure 1: Percentage representation of freshwater and marine farm participation

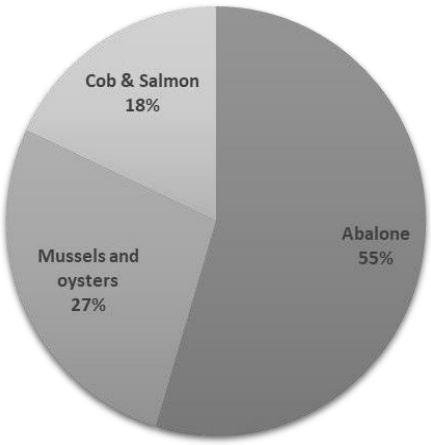

Figure 2: Marine sector representation of interviews conducted at farms

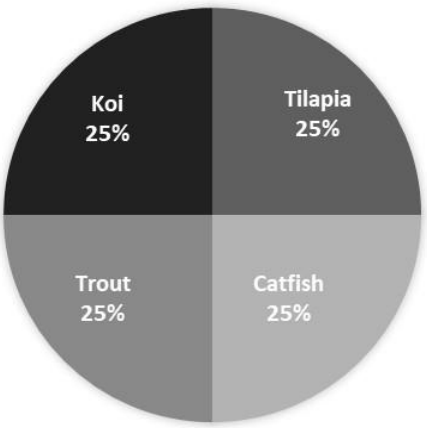

Figure 3: Freshwater representation of interviews conducted at farms

Farmers in the freshwater sector of the aquaculture industry were very sceptical about the research, which showed a lack of trust. As a result, no data was collected from crocodile farmers; and workers from one trout farm were interviewed, with a second trout farm initially showing a willingness to participate but ending up postponing.

A total of 20 trout farms from the Western Cape, Gauteng, Mpumalanga and KwaZulu-Natal were contacted, four responses were received, with one trout farmers association offering to assist with distributing questionnaires to their members. No farmers participated and therefore the results of a recent similar study have been included as part of this study. A total of three trout farms (one in the Western Cape and two in Mpumalanga) indicated a willingness to participate. The workers from the farm in the Western Cape were interviewed. An initial positive response from the Mpumalanga farmers did not convert to interviews, as one farm closed, and the second farm postponed twice and then cancelled, indicating a willingness to participate only in 2018. The fourth respondent very clearly indicated that he was not willing to participate.

A total of six tilapia farmers were also contacted. Only one farm was visited where interviews were conducted. Another farmer initially showed interest but later became very sceptical, and eventually chose not to allow interviews, but completed an Expert/Other questionnaire. Catfish (four) and koi (three3) farmers were also contacted - interviews were conducted at one of each of these species' farms.

In an attempt to better represent the freshwater aquaculture industry, individuals who are considered specialists in this field were contacted and requested to complete an Expert/Other questionnaire. Among these were farmers who were not willing to have their workers interviewed but were willing to give their input. Responses from a total of seven freshwater industry specialists were received. The specialists represented the following sub-sectors: trout (two); tilapia (two); koi (one); and ornamentals (two).

With the inclusion of industry specialists, there was better representation of the freshwater sector of the aquaculture industry, as seen in Figure 4.

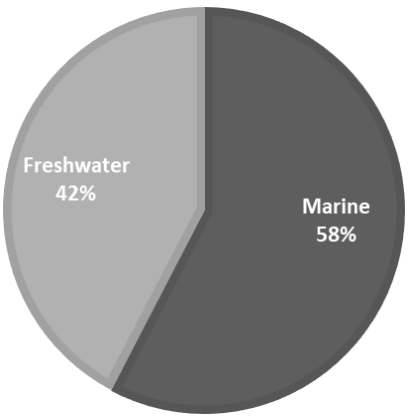

Figure 4: Industry representation combined with industry specialists

4. Demographic data per employment category (as per the OFO)

The following data is reported in line with the norms of reporting as per the Department of Agriculture, Forestry and Fisheries (DAFF) requirements relating to the Organisational Framework of Occupations (OFO). Table 2 below represents the specific occupations targeted and reported on in this survey. The table includes the broad group of occupations, the occupation with the relevant OFO code, specialisations where relevant and a short description of the associated occupation.

Table 2: OFO occupations reported on in the survey

Broad Group	Occupation	Specialisations	Description
MANAGERS	Aquaculture Farm Manager (131201)	Factory Manager Abalone Farm Manager Aquaculture Hatchery Manager Fresh Water Aquaculture Farm Manager Mariculture Farm Manager (sea based)	For the purpose of this survey, managers have been grouped together and reporting is based on the occupation Aquaculture Farm Manager. (131201) Where relevant, specialist knowledge and skills have been dealt with separately. An Aquaculture farm manager, with OFO code 2015-131201, is described as performing the following duties: • Plans, organises, directs, controls and coordinates the operations of a small manufacturing establishment. • Plans, directs and controls farming operations to breed and raise fresh and saltwater fish and other aquatic stock.
PROFESIONALS	Agriculture Scientist (213202)	Animal Husbandry Scientist, Animal Nutritionist,	Studies commercial plants, animals and cultivation techniques to enhance the productivity of farms and agriculture.
	Marine Biologist (213107)	Aquatic Biologist	Studies the anatomy, physiology, functions, characteristics, behaviour and environments of all forms of life living in the sea and connected water bodies.
	General Aquaculture Scientist (R&D)	No OFO code	
	Veterinarian (225101)	Animal Doctor Veterinary Epidemiologist Veterinary Parasitologist	Diagnoses, treats and prevents animal diseases, ailments and injuries.

Broad Group	Occupation	Specialisations	Description
		Veterinary Pathologist Veterinary Surgeon	
	Agriculture Consultant (213201)	Agriculture Extension Officer (213201)	Advises farmers, businesses, rural industries and government on the production, processing and distribution of farm products.
TECHNICIANS AND ASSOCIATE PROFESSIONALS	Aquaculture Produce Manager (325704)		Analyse aquaculture produce for quality and conformance with technical produce standards and regulatory provisions.
SKILLED IN AGRICULTURAL, FORESTRY, FISHERY, CRAFT AND RELATED TRADES	Aquaculture Farmer (622101)	Aquaculture Farm Foreperson	Plans, organises and performs farming operations to breed and raise freshwater fish and other aquatic stock.
		Aquaculture Production Supervisor	
		Fish Production Foreperson	
		Hatchery Foreperson	
		Hatchery Manager (Freshwater Fish)	
	Mariculture Farmer (622102)	Hatchery Manager (Marine Fish / Aquatic Stock)	Plans, organises and performs farming operations to breed and raise saltwater fish and other aquatic stock such as abalone, crayfish, mussels, oysters and prawns.
		Mariculture Farm Foreperson	
		Mariculture Production Supervisor	
ELEMENTARY OCCUPATIONS	Aquaculture Farm Assistant (821602)	Aquaculture Farm Worker	Performs routine tasks in breeding and raising freshwater fish and other aquatic stock.
		Fresh Fish Farm / Hatchery Worker	
		Fresh Fish Hatchery Worker	
Other Occupations / categories	Education	Education and Training Service Provider	Provides education and training to the aquaculture industry, this can be an individual or an organisation.
		Aquaculture engineering / system design Consultant	Provides advice to aquaculture farmers on the design, building and maintenance of aquaculture systems.

4.1. Occupation representation

A total of 171 interviews were conducted across the 16 farms visited. The interviews in Figures 5 and 6 represent the number of interviews conducted as per the Organisation Framework of Occupations (OFO) in the marine and freshwater sectors, respectively. (See attached Appendix VIII for further explanation on the OFO.) Figure 7 represents the sample of managers from the marine and freshwater sectors. A total of 21 managers in the marine and freshwater sectors combined, were either interviewed or completed the Middle/Senior Management questionnaire. Figure 7 includes those who were interviewed and those who completed questionnaires.

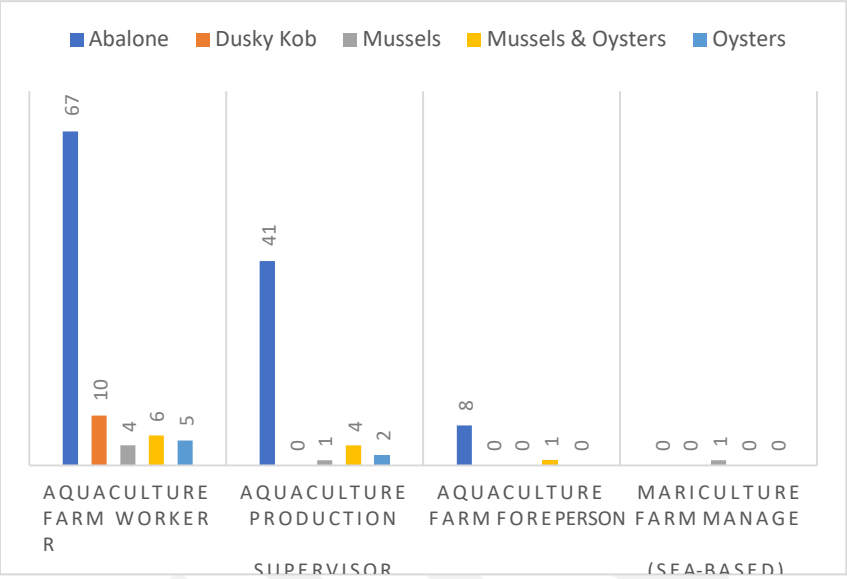

Figure 5: Interviews conducted in the marine sector

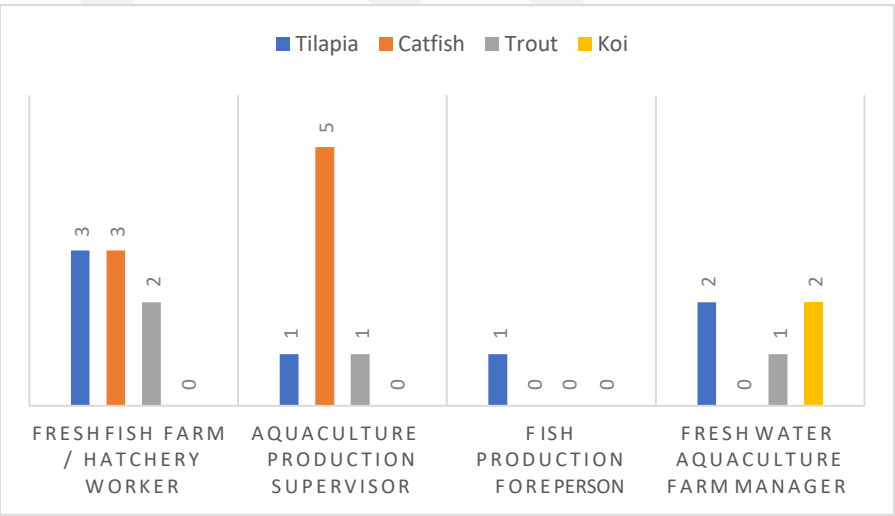

Figure 6: Interviews conducted in the freshwater sector

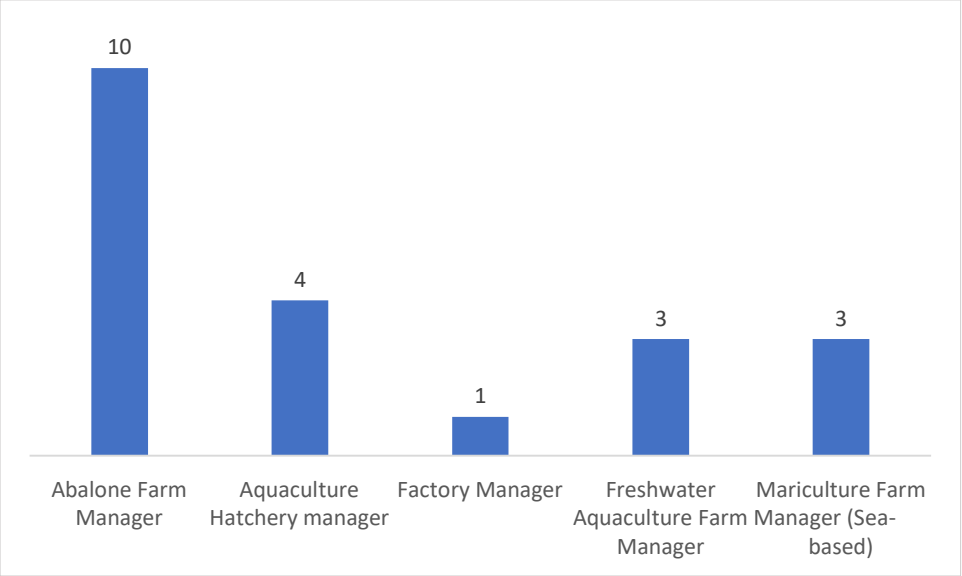

Figure 7: Representation of Aquaculture Farm Managers (OFO 131201)

Professionals and service providers:

As part of this survey, service providers and industry specialists were also targeted. Table 3 represents industry service providers and industry specialists contacted, and the response rate.

Table 3: Service Providers and industry specialists contacted and response rate

Service Provider Representation	Group	Area	OFO Code (Specialisation)	Institutions /Farms contacted	Industry specialist contacted	Institutions /Farms visited	Industry specialist responses	Total representation
Veterinary	Professionals	Extension support	Veterinarian (225101)	0	3	0	1	1
Specialist Scientist (Animal Health)	Professionals	Research	Agriculture Scientist (213202)		3		3	3
Feed manufacturers	Technicians and associate professionals	Aquaculture Produce Manager (325704)		0	5	0	0	0
Education and training providers	Not listed			1	7	1	5	6
Aquaculture Engineering / System design services	Not listed			0	3	0	1	1
Extension officer	Professionals	Extension support	Agriculture consultant (Extension Officer) (213201)				1	1
Totals:				**1**	**22**	**1**	**11**	**12**

4.2. Data representation

The largest number of respondents were represented by the abalone industry, this being the largest producer in the South African aquaculture industry, with a reported tonnage of 1469.78 in 2013 (Department of Agriculture, Forestry and Fisheries, 2014). Abalone farms willing to take part in this survey also made their Annual Training Report (ATR) and Workplace Skills Plans (WSP) data available. The reported data in the abalone industry represents the combined data of these five participating farms. This data was not available for other mariculture farms, nor for the freshwater fish farms, as these do not belong to AgriSETA and do not complete WSPs and ATRs.

Where available, statistics for the aquaculture industry and the agriculture industry are included. Further to this, demographic data is reported on as follows:

Mariculture:

Abalone farms are reported on separately. The reasons for this, are:

1. The abalone industry represents the highest number of employees in the aquaculture industry; and
2. Abalone farms are predominantly found in the Western Cape.

The occupational levels reported on are according to the occupation with the associated OFO code. These are:

- Aquaculture Farm Manager (131201)
    - Abalone
    - Other mariculture (Oysters, mussels and kob)
- Mariculture Farmer (622102)
    - Abalone
    - Other mariculture (Oysters, mussels and kob)
- Aquaculture Farm Assistant (821602)
    - Abalone
    - Other mariculture (Oysters, mussels and kob)

Freshwater:

The freshwater sectors of aquaculture are represented as follows:

- Aquaculture Farm Manager (131201)
- Aquaculture Farmer (622101)
- Aquaculture Farm Assistant (821602)

4.2.1. Gender representation

4.2.1.1. Aquaculture and agriculture as a whole:

Data from a snapshot of the Employment breakdown (Figure 8) from 10 Operation Phakisa farms in 2015 shows that 78% of the workforce in the aquaculture industry was male and 22% female. Data representing all respondents in this survey indicates 64% male and 36% female representation (Figure 9). According to AgriSETA, the male-to-female ratio for agricultural labour is fairly consistently found to be 2:1. This StatsSA data is corroborated by Workplace Skills Plan (WSP) data submitted by employers in 2016, which shows that 62.8% of employees engaged in various occupations within the sector, were male. The data further shows that no current AgriSETA initiatives focused on encouraging more women to enter the agricultural industry (AgriSETA, 2016). The male-to-female ratio in this survey thus closely resembles the data from AgriSETA and StatsSA.

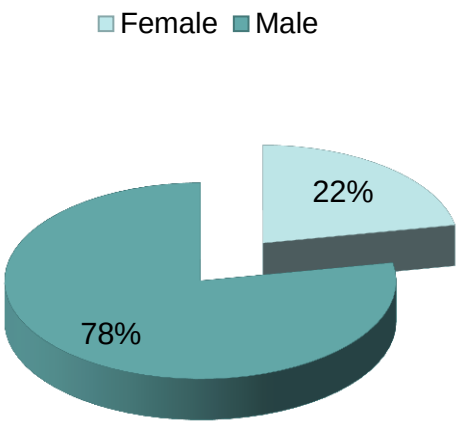

Figure 8: Aquaculture gender representation from a snapshot of the Employment breakdown of 10 Operation Phakisa farms in 2015, provided by DAFF

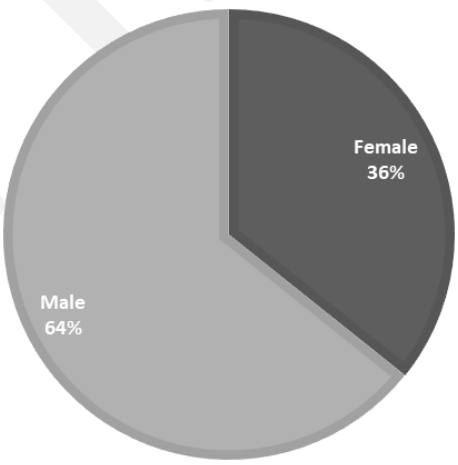

Figure 9: Interview and questionnaire gender representation of all respondents

4.2.1.2. Aquaculture Farm Managers' gender representation:

Abalone:

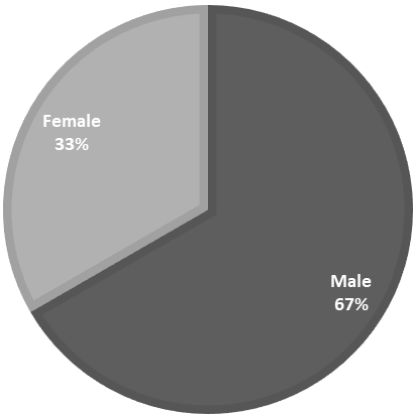

Figure 10: Reported gender representation of managers combined for abalone farms visited

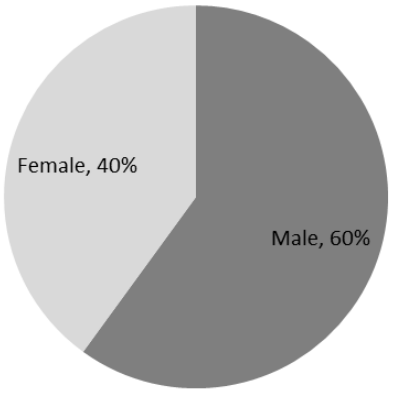

Figure 11: Gender representation of managers combined for abalone farms reported

Figure 10 shows the reported gender representation of managers from abalone farms visited. When compared with Figure 11 representing those interviewed or questionnaires received, it is noted that there were 7% more female managers than male managers represented from the abalone farms visited, but the number of females represented was closer to that of the agricultural industry, with 37% being female.

This indicates a slight difference in the trend for there to be more males than females in management positions. The male-to-female ratios among managers in the abalone industry suggest that gender transformation is taking place in the abalone industry.

Other Mariculture:

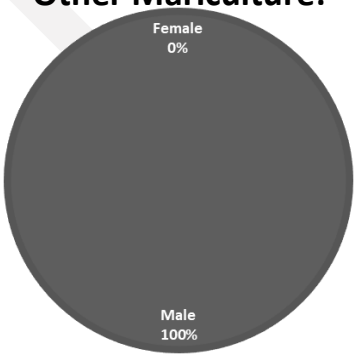

Figure 12: Gender representation of other marine aquaculture farm managers interviewed

Figure 12 represents the gender representation of other mariculture organisations (Kob, oysters and mussels) and shows a 100% male representation. This ratio suggests that gender transformation is not taking place or is extremely slow in the kob, mussel and oyster industries. This presents an opportunity to attract females to take up management positions in these industries.

Freshwater:

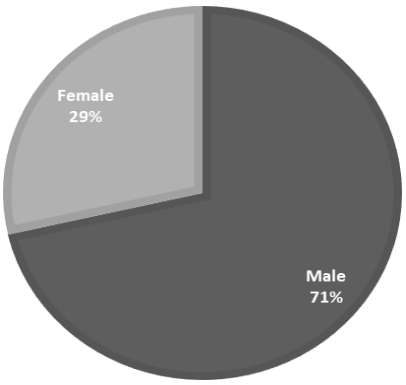

Figure 13: Gender breakdown of freshwater farm managers interviewed

The gender ratio in the freshwater sector shows a 71% male representation and a 29% female representation of farm managers interviewed (Figure 13). This figure also represents the ratio for the organisations, as all managers on freshwater farms were interviewed. These ratios suggest that gender transformation is slow in the freshwater industry. This presents an opportunity to attract females to take up management positions in these industries.

4.2.1.3. Mariculture Farmer gender representation:

Abalone:

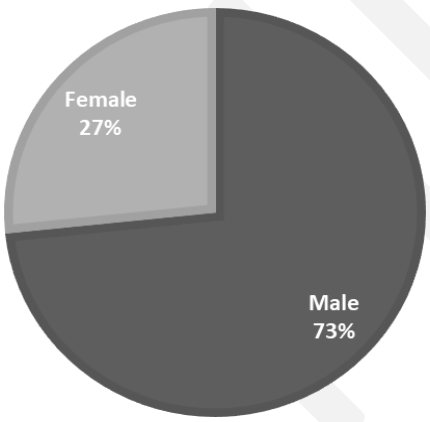

Figure 14: Reported gender breakdown of aquaculture farmers, combined for abalone farms visited

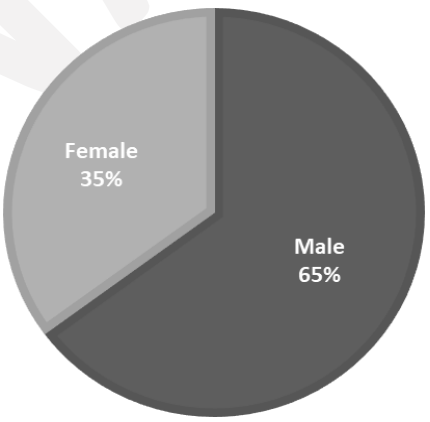

Figure 15: Gender breakdown of aquaculture farmers interviewed, combined for abalone farms visited

Figure 14 shows the reported gender representation of aquaculture farmers from abalone farms visited. When compared with Figure 15 representing those interviewed, it is noted that there were 8% more female aquaculture farmers than male aquaculture farmers represented from the abalone farms visited. However, the female aquaculture farmers interviewed, were once again closer to that of the agricultural industry, with 37% being female in the agricultural industry. These ratios suggest that gender transformation among abalone farmers is slow and present an opportunity to attract more female aquaculture farmers to the abalone industry.

Other Mariculture:

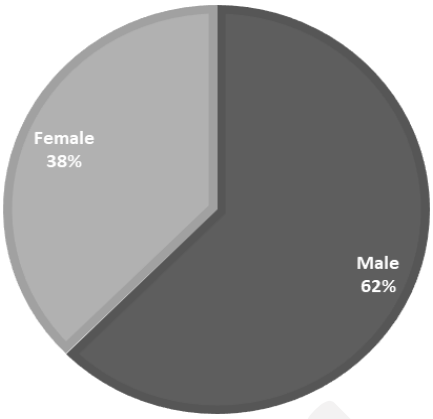

Figure 15: Gender breakdown of other marine aquaculture farmers interviewed

Figure 16 shows the gender representation of aquaculture farmers interviewed at other mariculture farms (Kob, mussels and oysters). The data shows that 62% of aquaculture farmers interviewed were male and 38% female. This representation of male-to-female is closely linked to the male-to-female ratio of the agricultural industry, with 37% being female and 63% being male. This ratio suggests that opportunities as aquaculture farmers are being offered to females, but there is still room for further transformation in the kob, mussel and oyster industries.

Aquaculture farmer (Freshwater):

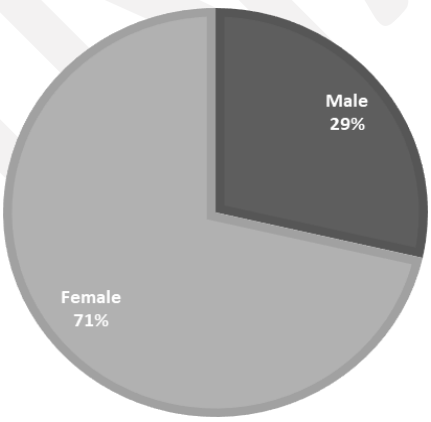

Figure 17: Gender breakdown of freshwater aquaculture farmers interviewed

Figure 17 shows the gender representation of aquaculture farmers interviewed at freshwater farms. The data shows that 29% of aquaculture farmers interviewed were male and 71% female. This indicates a significant difference when compared to the marine aquaculture sector. The reason for this is that at one freshwater aquaculture farm, women represented 72% of the employees in the organisation, with 90% of the aquaculture farmers in the organisation being women. Males represented 100% of aquaculture farmers interviewed on other freshwater farms. Data for the freshwater industry as a whole would need to be collected and analysed to give a better indication of the male-to-female representation of aquaculture farmers in the freshwater sector.

4.2.1.4. Aquaculture Farm Assistant Gender:

Abalone

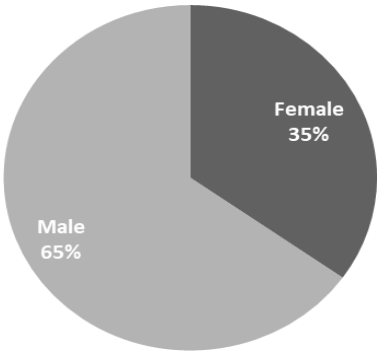

Figure 18: Gender aquaculture farm assistant (abalone) interviewed

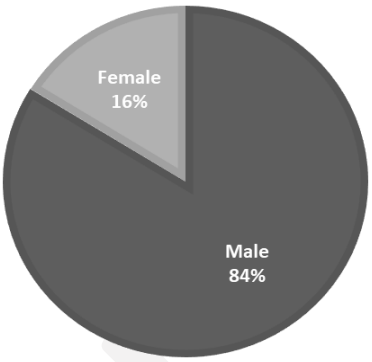

Figure 19: Gender aquaculture farm assistant (abalone) reported

Figure 18 shows the reported gender representation of Aquaculture farm assistants from abalone farms visited. When compared with Figure 19, representing those interviewed, it is noted that 19% more males were interviewed than females represented by the figures reported. The reported figures are more closely representative of the agricultural industry with 37% female and 63% male representation. These ratios suggest that gender transformation among abalone farm assistants is slow, and this presents an opportunity to attract more female abalone farm assistants to the abalone industry.

Other Mariculture:

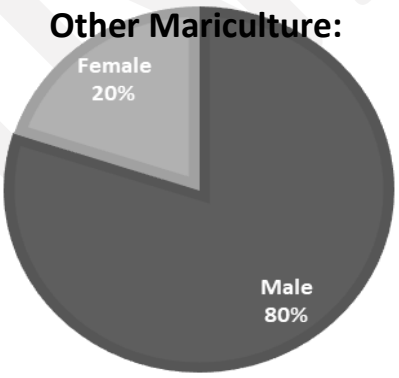

Figure 20: Gender breakdown of other marine aquaculture farm assistants interviewed

Figure 20 shows the gender representation of aquaculture farmer assistants interviewed at other mariculture farms (Kob, mussels and oysters). The data shows that 80% of aquaculture farm assistants interviewed were male, and 20% female. This representation of male-to-female is not closely linked to the male-to-female ratio of the agricultural industry, with 37% being female and 63% being male - the percentage of males interviewed being 17% more than what is represented by the agricultural industry as a whole. These ratios suggest that gender transformation is slow in the kob, mussel and oyster industries. This presents an opportunity to attract females to take up management positions in these industries.

Freshwater:

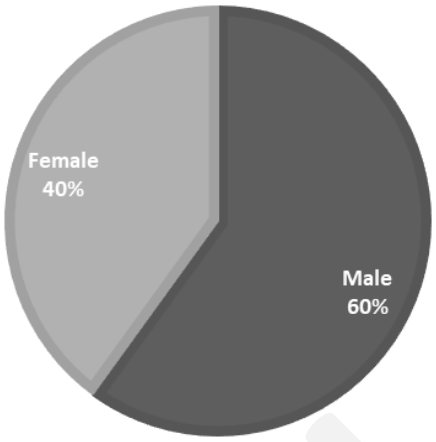

Figure 21: Gender breakdown of freshwater aquaculture farm assistants interviewed

Figure 21 shows the gender representation of aquaculture farm assistants interviewed in the freshwater sector. This shows that 60% interviewed were male and 40% interviewed were female. This percentage closely resembles that of the agricultural industry, with 63% being male and 40% being female. (AgriSETA, 2016)

4.2.1.5. Conclusion:

The total percentage of male-to-female respondents in this survey, and those reported on in the aquaculture industry, shows that there is a 2:1 ratio of male to female employees in the aquaculture industry, which corroborates with the AgriSETA Sector Skills Plans data. This ratio presents an opportunity for initiatives to attract more females to both the marine and freshwater sectors of the aquaculture industry in South Africa.

4.3. Age Representation

According to the AgriSETA Sector Skills Plan for 2017-2018, half of the people employed in the agricultural sector by employers submitting WSPs, were between the ages of 35 and 55. Young people below the age of 35 constituted 42% of people employed whilst 8% were above the age of 55. In total, 92% of the workers were below the age of 55 (AgriSETA, 2016). A snapshot of 10 Operation Phakisa farms in 2015 (Figure 22) indicated 65% of those people employed in the aquaculture industry were below the age of 65% and 35% were older than 35. The data from those represented in this survey (Figure 23), is more closely related to the data from the agricultural sector, with 54% being under 35 years old, 45% being 35-55 years old and 1% being over the age of 55

This data is further broken down into the ages of the different employment categories in the abalone industry, other mariculture industries and the freshwater industries represented in this survey.

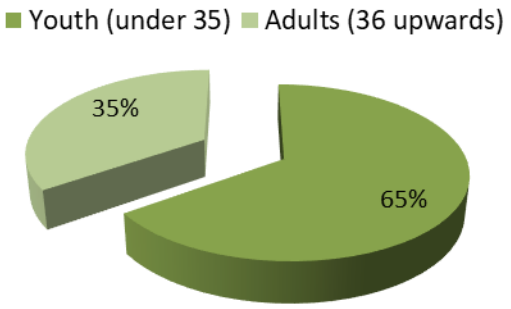

Figure 22: Youth Employment breakdown of 10 Operation Phakisa farms in 2015

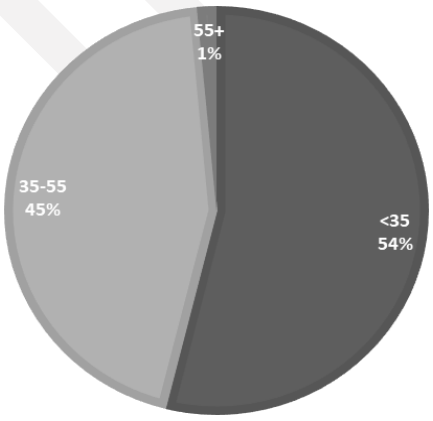

Figure 23: Gender breakdown of freshwater aquaculture farm assistants interviewed

4.3.1. Aquaculture Farm Managers:

Abalone:

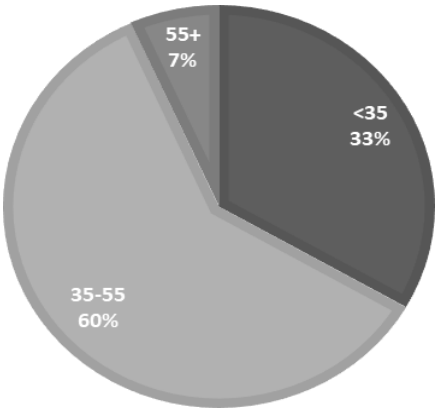

Figure 24: Reported age group demographics of abalone farm managers

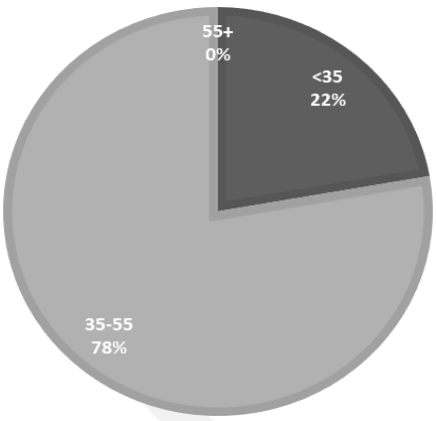

Figure 25: Age group demographics of abalone farm managers interviewed, and questionnaires received

Figure 24 shows the reported age group demographics of aquaculture farm managers from reported figures on five abalone farms. This shows that 33% were less than 35 years old, 60% were 35-55 years old and 7% were over the age of 55. Figure 25 shows the age group demographics of questionnaires received from aquaculture managers: 22% were less than 35 years old, 78% were 35-55 years old and none were older than 55 years. These percentages show a difference of 17% and 28% for younger than 35 years, in relation to the 50% reported for the agricultural sector (AgriSETA, 2016) and a 10 and 22 higher percentage for those reported and surveyed in the 35-55% age-group, as opposed to 50% reported in the AgriSETA Sector Skills Plan (AgriSETA, 2016).

Other Mariculture:

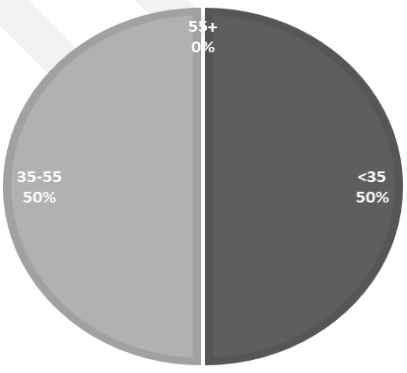

Figure 26: Age group demographics of other mariculture managers interviewed, and questionnaires received

Figure 26 shows the age group demographics of aquaculture farm managers interviewed, or questionnaires received in other mariculture sectors (kob, mussels and oysters). This shows that those who took part in the survey were represented half each in the younger than 35-year category and the 35–55-year age group, with none over 55. These percentages are the same as those reported for the agricultural sector in the AgriSETA Sector Skills Plan (AgriSETA, 2016).

Freshwater:

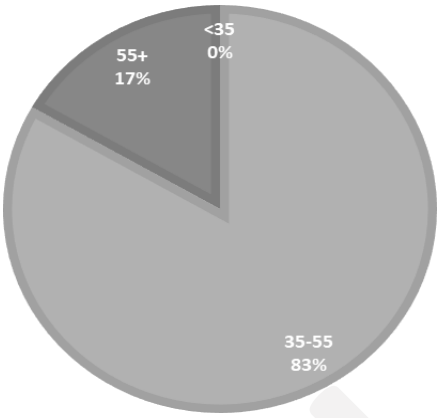

Figure 27: Age group demographics of aquaculture managers surveyed in the freshwater sector

Figure 27 shows that 0% of aquaculture managers in the younger than 35-year age group in the freshwater sector were represented, 85% of freshwater aquaculture managers surveyed were in the age group 35-55, and 17% were over the age of 55. This demographic needs further investigation, as a larger portion of the freshwater aquaculture sector may show a different result.

Aquaculture Professionals:

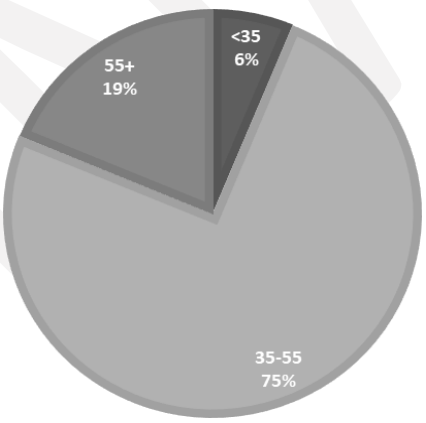

Figure 28: Age group demographics of professionals, questionnaires received

Figure 28 shows that 6% of professionals who took part in the survey were less than 35 years old, 75% were in the 35-55-year age group and 19% were over 55 years of age.

4.3.2. Aquaculture Farmers:

Abalone:

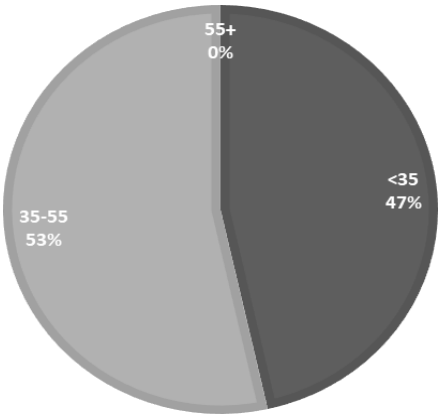

Figure 29: Reported age group demographics of aquaculture farmers in the abalone sector

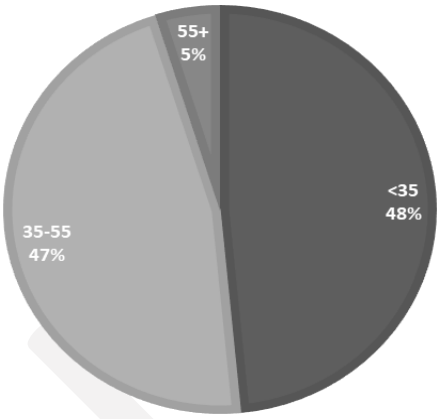

Figure 30: Age group demographics of aquaculture farmers interviewed in the abalone sector

Figure 29 shows the reported age group demographics of aquaculture farmers from reported figures on five abalone farms. This shows that 47% were less than 35 years old, 53% were 35-55 years old and 0% were over the age of 55. Figure 30 shows the age group demographics of aquaculture farmers interviewed, with a total of 48% less than 35 years old, 47% were 35-55 years old and 5% were older than 55. These percentages differ slightly from the 50% younger than 35 and 50% 35–55-year-olds reported in the AgriSETA Sector Skills Plan (AgriSETA, 2016).

Other Mariculture:

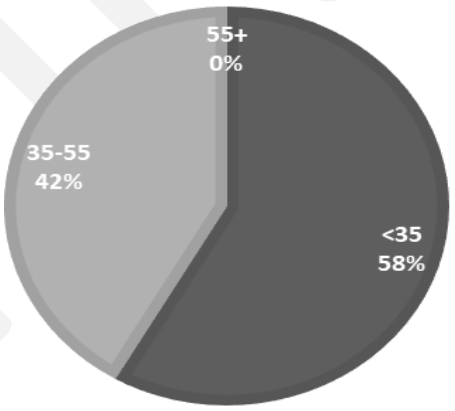

Figure 31: Age group demographics of other marine sector aquaculture farmers

Figure 31 shows the age group demographics of aquaculture farmers interviewed in other mariculture sectors (kob, mussels and oysters). This shows that those who took part in the survey were 58% younger than 35 years and 42% were in the 35-55-year age group, with none over 55 years of age. These percentages are 8% higher for the less than 35-year age group and 8% higher for the 35--55-year age group when compared with those reported for the agricultural sector in the AgriSETA Sector Skills Plan (AgriSETA, 2016).

Freshwater:

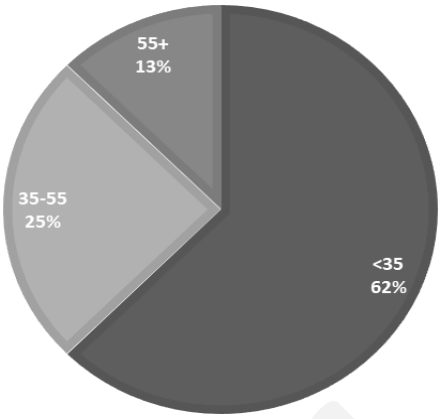

Figure 32: Age group demographics of aquaculture farmers interviewed in the freshwater sector

Figure 32 shows that 63% of aquaculture farmers interviewed were in the younger than 35-year age group in the freshwater sector, with 25% of the farmers surveyed in the age group 35-55, and 13% over the age of 55. This demographic needs further investigation, as a larger portion of the freshwater aquaculture sector may show a different result.

4.3.3. Aquaculture Farm Assistants:

Abalone:

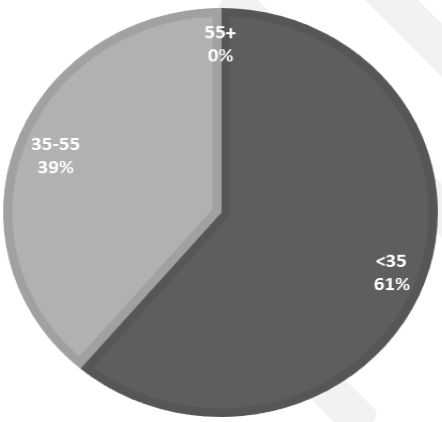

Figure 33: Reported age group demographics of aquaculture farm assistants in the abalone sector

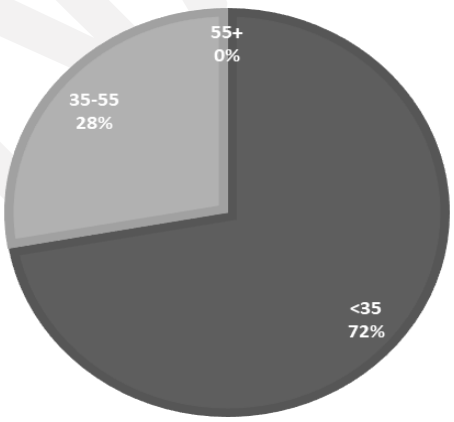

Figure 34: Age group demographics of aquaculture farm assistants interviewed in the abalone sector

Figure 33 shows the age group demographics of aquaculture farm assistants from reported figures on five abalone farms. This shows that 61% were less than 35-years old, 39% were 35-55 years old and 0% were over the age of 55. Figure 34 shows the age group demographics of aquaculture farm assistants interviewed, with 72% less than 35years old, 28% were 35-55 years old and 0% were older than 55. These percentages differ from the 50% younger than 35 and 50% 35-55 years old reported in the AgriSETA Sector Skills Plan (AgriSETA, 2016), indicating that more than 50% of farm assistants employed in the abalone industry were less than 35 years old.

Other Mariculture:

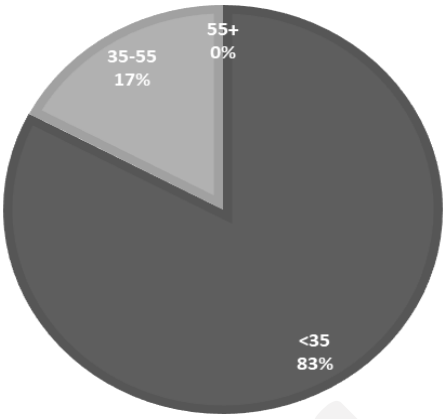

Figure 35: Age group demographics of aquaculture farm assistants interviewed in other sectors of mariculture

Figure 35 shows the age group demographics of aquaculture farm assistants interviewed in other mariculture sectors (kob, mussels and oysters). This shows that those who took part in the survey were 83% younger than 35-years' old, 17% in the 35-55-year age group, and none over 55. These percentages are 33% higher for the less than 35-year age group and 33% higher for the 35-55-year age group when compared with those reported for the agricultural sector in the AgriSETA Sector Skills Plan (AgriSETA, 2016).

Freshwater:

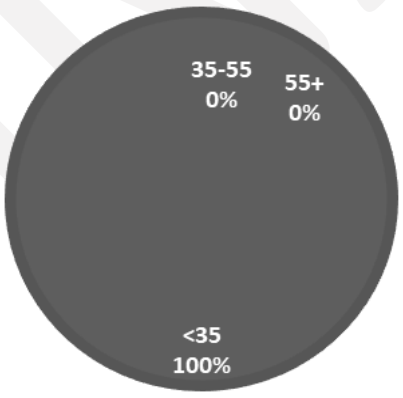

Figure 36: Age group demographics of aquaculture farm assistants interviewed in the freshwater sector of aquaculture

Figure 36 shows that all of aquaculture farm assistants were in the younger than 35-year age group in the freshwater sector. This demographic needs further investigation, as a larger portion of the freshwater aquaculture sector may show a different result.

4.3.4. Conclusion

The age groups of the different aquaculture occupations and sectors differ from those in the agricultural sector.

Stakeholders commented on the need for skills transfer from those exiting the workforce, to those coming up the ranks. The issue of unskilled youth presents a difficulty for skills transfer because some base-level qualification is needed to enter the skilled workforce in the first place. This presents challenges for skills development, because of the double hurdle of experienced employees exiting at a rate not able to be matched by the bigger youth demographic (AgriSETA, 2016).

4.4. Level of education attained

Educational level of employees is not reported on when a WSP or ATR is completed. This data is thus not available from data received from abalone farms, nor is it shown in the AgriSETA Sector Skills Plan. The educational levels reported for the different occupational groups and aquaculture sectors were collected during this survey. Education level attained is reported in the same way as StatsSA's education reporting. General Education and Training (GET) indicates education attained from Grade R to Grade 9. Further Education and Training (FET) indicates education attained from Grade 10 to Grade 12 and any Further Education and Training attained. Higher Education and Training (HET) indicates education attained at a tertiary institution.

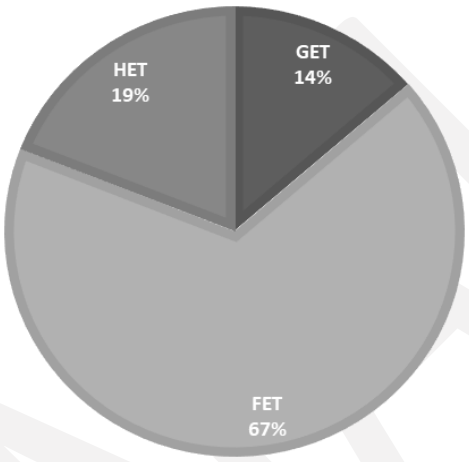

Figure 37: Educational level of those all surveyed in the marine and freshwater aquaculture sectors

Figure 37 shows that of 14% of those surveyed had attended General Education and Training (GET); of these, 64% had completed Grade 9, with 36% having completed Grade 8 or less. Those having attended Further Education and Training (FET) represent 67%, with 57% having completed Grade 12 or a Further Education and Training qualification. Those who attended Higher Education and Training represent 19%, with 33% having achieved a Masters or higher degree.

4.4.1. Aquaculture Farm Managers:

Abalone:

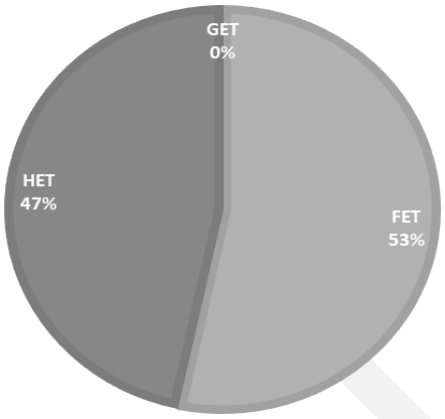

Figure 38: Level of education attained for aquaculture farm managers in the abalone sector from interviews and questionnaires received

Figure 38 shows that 53% of abalone farm managers had attended Further Education and Training; of these, 88% had completed Grade 12 and 12% had completed Grade 11. However, no farm managers surveyed had completed a Further Education and Training Certificate. This suggests a gap in the skills and educational level of abalone farm managers and presents an opportunity to offer Further Education and Training programmes to abalone farm managers. Of the aquaculture farm manger questionnaires received, 47% had a HET qualification. When taking into account that of the 53% of abalone farm mangers' questionnaires received, none had a Further Education and Training certificate, the implication is that less than half of abalone farm managers have a formal qualification.

Other Mariculture:

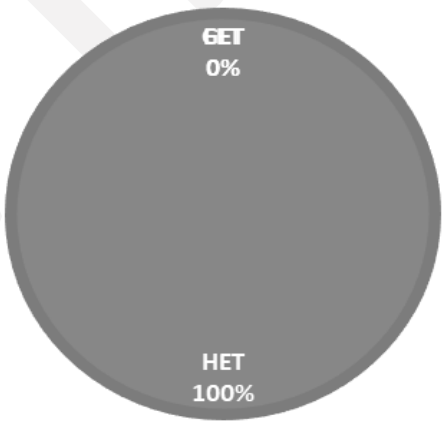

Figure 39: Level of education attained for aquaculture farm managers in other marine sectors from interviews and questionnaires received

Figure 39 shows that 100% of other mariculture farm managers surveyed had a HET qualification. It is to be noted that these respondents were all farm owners or partners in the business.

Freshwater:

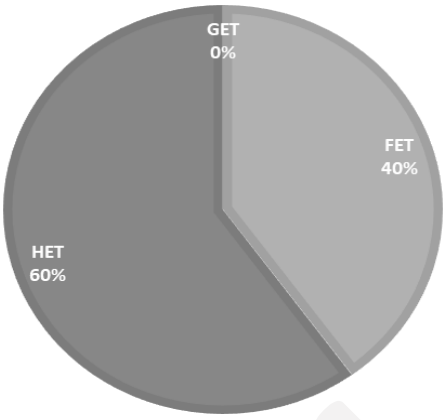

Figure 40: Level of education attained for aquaculture farm managers in the freshwater sector from interviews and questionnaires received

Figure 40 shows that 40% of freshwater farm managers had a FET qualification, with 60% having a HET qualification.

Aquaculture Professionals:

All aquaculture professionals surveyed had attained a Higher Education and Training (HET) qualification, with 69% of these having attained a Masters' degree or higher.

4.4.2. Aquaculture Farmers:

Abalone:

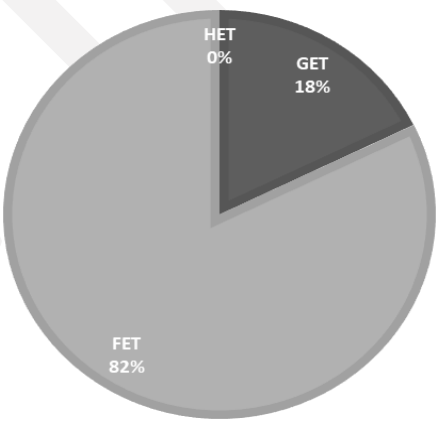

Figure 41: Level of education attained for aquaculture farmers interviewed in the abalone sector

Figure 41 shows that 18% of aquaculture farmers had attended General Education and Training; of these, 21% had completed GET. Of the 82% of Aquaculture farmers who attended Further Education and Training, 85% completed Grade 12 or higher.

Other Mariculture:

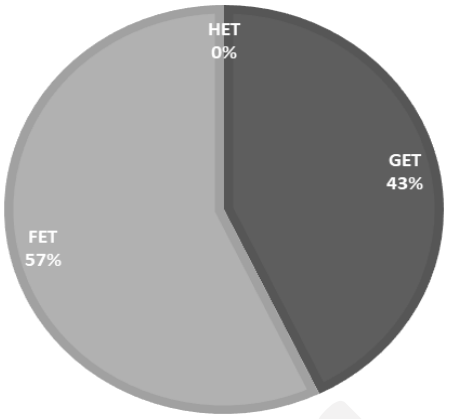

Figure 42: Level of education attained for aquaculture farmers interviewed in other marine sectors

Figure 42 shows that 57% of aquaculture farmers interviewed in the other mariculture sectors attended General Education and Training, with 94% of these completing General Education and Training. Of the 57% of Aquaculture farmers who attended Further Education and Training, 44% had completed Grade 12. This suggests that the kob, oyster and mussel industries are employing a high percentage of unskilled labour, with a low level of education attained. This suggests that there is a need for adult education and training in these sectors of the aquaculture industry.

Freshwater:

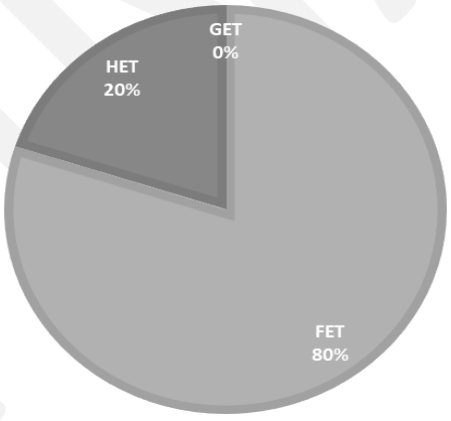

Figure 43: Level of education attained for aquaculture farmers interviewed in the freshwater sector

Figure 43 shows that 80% of aquaculture farmers interviewed in the freshwater sector had attended Further Education and Training; of these, 50% had completed Grade 12. Of the 20% who had completed a Higher Education and Training qualification, all had an Honours degree, suggesting that the freshwater sector seeks to employ educated staff.

4.4.3. Aquaculture Farm Assistants:

Abalone:

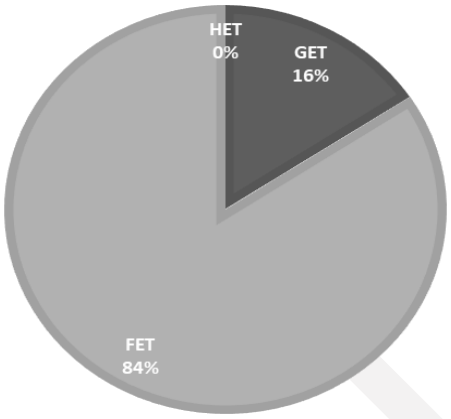

Figure 44: Level of education attained for aquaculture farm assistants interviewed in the abalone sector

Figure 44 shows that 16% of abalone farm assistants had attended General Education and Training; of these, 50% had completed Grade 9. 84% of abalone farm assistants interviewed had attended Further Education and Training, with 36% having attained Grade 12. This suggests that there is a need for adult education and training in the abalone industry.

Other Mariculture:

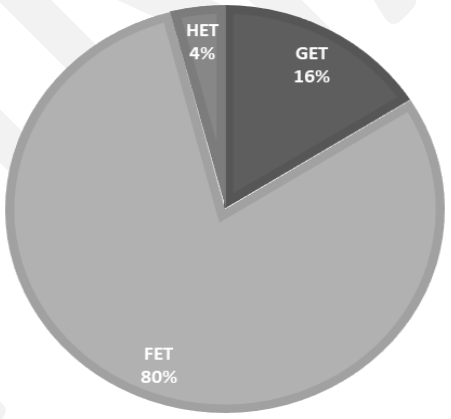

Figure 45: Level of education attained for aquaculture farmers interviewed in other marine sectors

Figure 45 shows that 80% of farm assistants in the kob, mussel and oyster sectors had attended Further Education and Training; of these, 44% had completed Grade 12. Even though a very small percentage (4%) of aquaculture farm assistants had completed a higher education and training qualification, the majority of these had not completed General or Further Education and Training. This suggests that there is a need for adult education and training in these sectors of the aquaculture industry.

Freshwater:

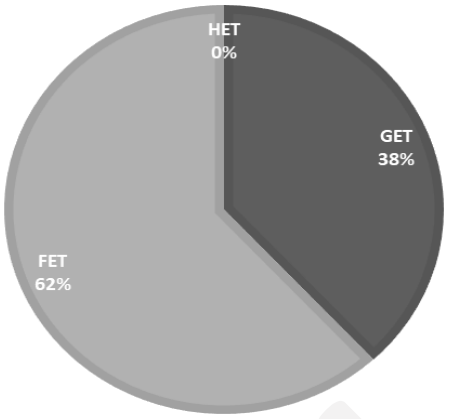

Figure 46: Level of education attained for aquaculture farmers interviewed in the freshwater sector

Figure 46 shows that 38% and 62% of freshwater aquaculture farm assistants interviewed had General and Further Education and Training respectively. Of those attending Further Education and Training, 78% had attained Grade 12. Of those attending General Education and Training, 10% had completed GET.

4.5. Race Participation

Figure 47 shows the race demographic of 10 Operation Phakisa Aquaculture farms in 2015, while Figure 48 shows the race demographic of the agricultural sector, derived from Workplace Skills Plans submitted in 2016. Figure 49 shows the race demographic of all participants in this study. Each of these figures indicates that the largest number of employees is African, followed by Coloured, and then White, with little to no Indian participation in the aquaculture and agriculture industries in South Africa. In this survey, the Coloured proportion is indicated as higher than in the other two graphs, this is due to the higher number of participants taking place from the Western Cape, with a large Coloured labour force.

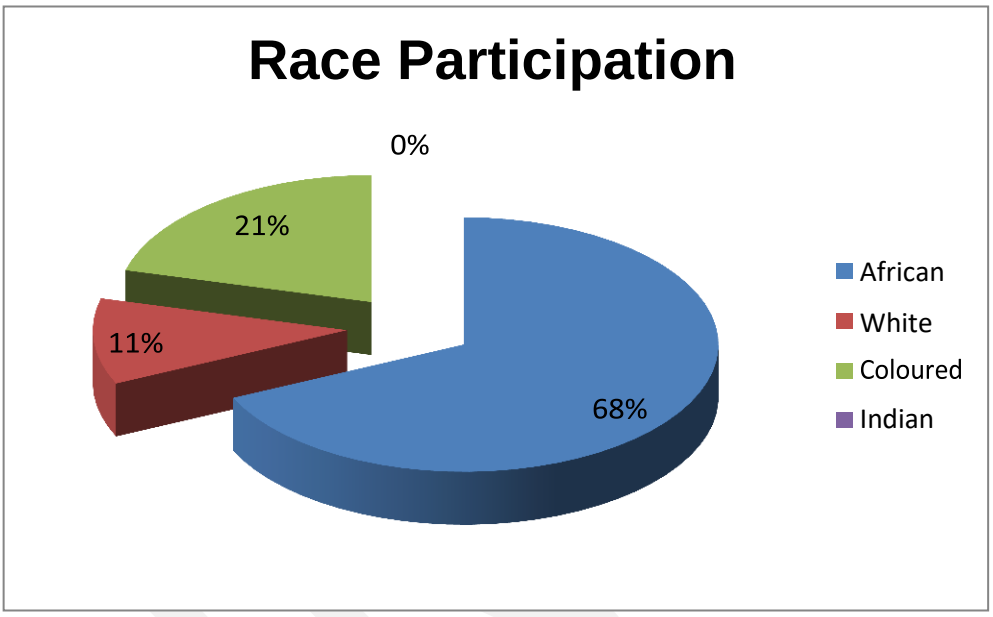

Figure 47: Race demographic of 10 Operation Phakisa farms in 2015

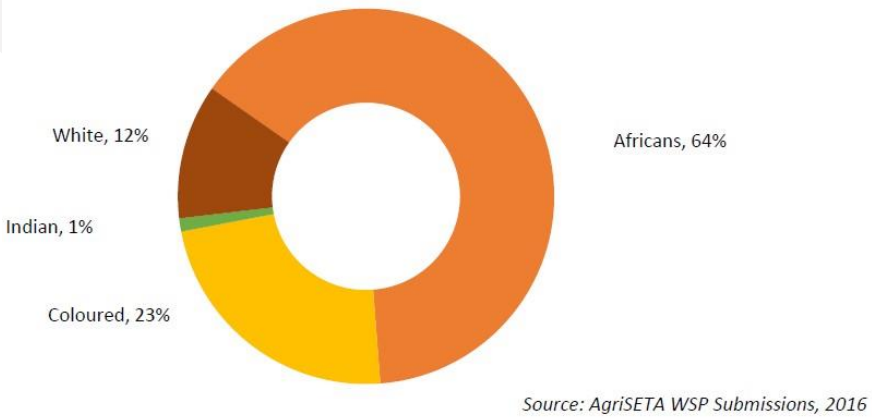

Figure 48: Race demographic of the agricultural sector, from Workplace Skills Plans submitted in 2016

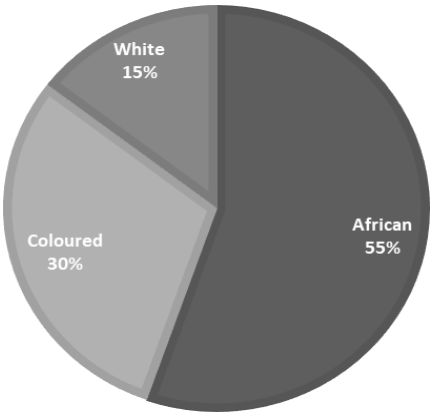

Figure 49: Race demographic of those all surveyed in the marine and freshwater aquaculture sectors

4.5.1. Aquaculture Farm Manager:

Abalone:

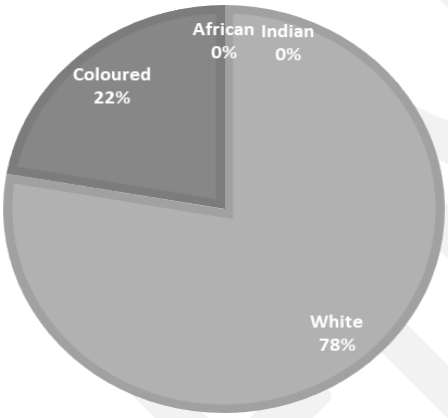

Figure 50: Reported race demographics of aquaculture farm managers in the abalone sector

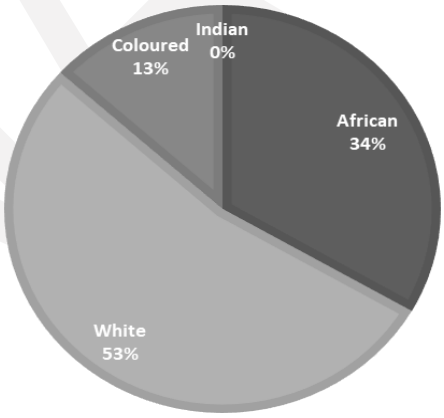

Figure 51: Race demographic of questionnaires received from aquaculture farm mangers in the abalone industry

Figures 50 and 51 show the reported and participant aquaculture farm managers' race demographic for the abalone industry. These graphs indicated a higher percentage of White farm managers, compared to African and Coloured farm managers. The reported data from abalone farms shows 0% African managers, but there were 34% African manager participants, from farms whose data had not been reported. This data suggests that there was a higher percentage of White farm managers than African or Coloured managers, which is converse to the overall race demographic of the aquaculture industry. This suggests that racial transformation in the area of Management in the abalone industry is happening at a slow rate.

Other Mariculture:

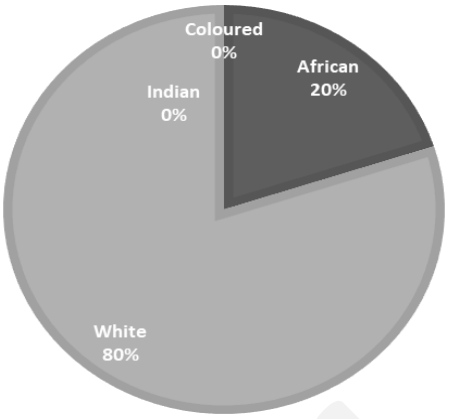

Figure 52: Race demographics of aquaculture farm manager participants in the kob, oyster and mussel sectors of aquaculture

Figure 52 shows that aquaculture managers made up 80% of participants in this survey, with 20% being African and 0% Coloured or Indian. This suggests that racial transformation among managers in the kob, oyster and mussel sectors of aquaculture is slow.

Freshwater:

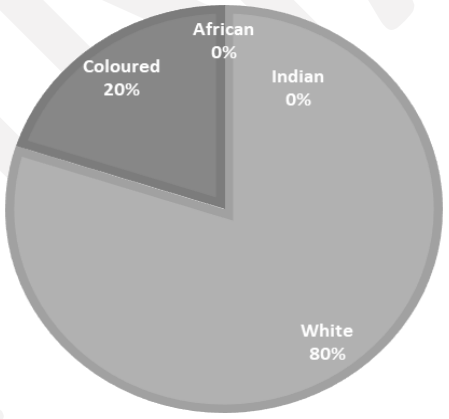

Figure 53: Race demographics of aquaculture farm manager participants in the freshwater sectors of aquaculture

Figure 53 shows that aquaculture managers made up 80% of participants in this survey, with 20% being African and 0% Coloured or Indian. This suggests that racial transformation among managers in freshwater sector of aquaculture is slow.

Aquaculture Professionals:

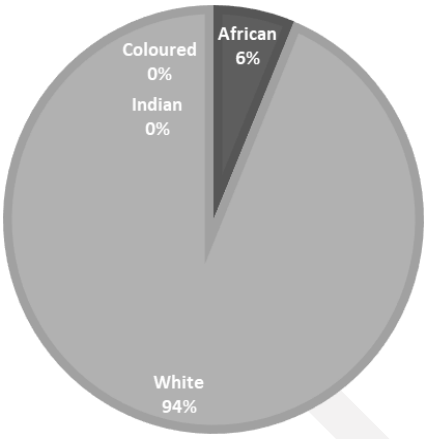

Figure 54: Race demographics of aquaculture professionals participating in this survey

Figure 54 shows the race demographic of aquaculture professionals participating in this survey. This show that 94% of professionals were White, 6% African and 0% Coloured and Indian. These ratios suggest that racial transformation in the professional sector of the aquaculture industry is happening at a very slow pace. These figures present an opportunity to attract more African, Coloured and Indian professionals to the aquaculture industry.

4.5.2. Aquaculture Farmer:

Abalone:

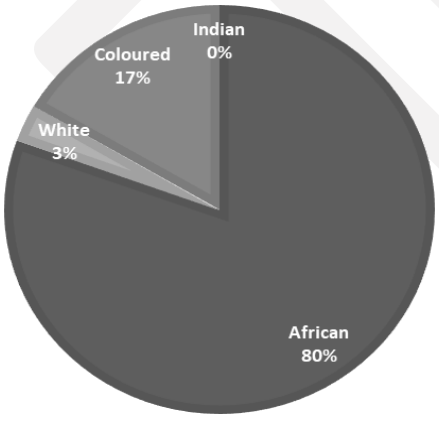

Figure 55: Reported race demographics of aquaculture farmers in the abalone sector

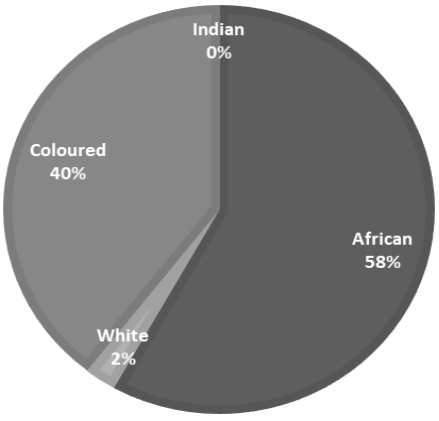

Figure 56: Race demographic of aquaculture farmers interviewed in the abalone industry

Figure 55 shows the reported race demographic of aquaculture farmers from participating aquaculture farms. This figure shows that 80% of aquaculture farmers on abalone farms were African, 17% Coloured and 3% White, with no Indian representation. Figure 56 shows the race demographic of aquaculture farmers interviewed on abalone farms. This also shows that the majority were African, but the percentage is lower than the reported figures. Whereas the percentage of Coloured aquaculture farmers interviewed was higher than the percentages from those reported. The above suggests that the majority of aquaculture farmers in the abalone industry are African, followed by Coloured farmers. This would suggest that racial transformation is taking place among aquaculture farmers in the abalone industry. The implication is that African aquaculture farmers could potentially be available to move up to management level, in the future, thus assisting in addressing racial transformation.

Other Mariculture:

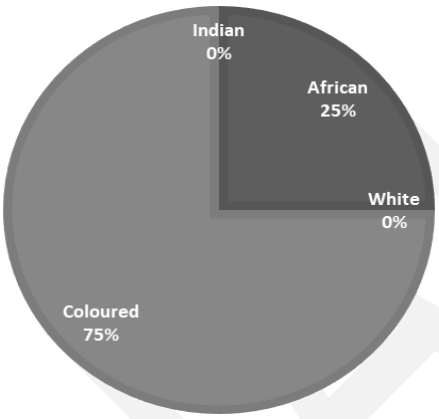

Figure 57: Race demographic of aquaculture farmers interviewed in the kob, mussel and oyster sector

Figure 57 shows that 75% of aquaculture farmers interviewed in the oyster, mussel and kob sectors were Coloured and 25% African. This suggests that there is transformation taking place in the other mariculture sectors. The mussel and oyster sectors employ a higher percentage of Coloureds, and this may be an explanation for the higher percentage of Coloured aquaculture farmers.

Freshwater:

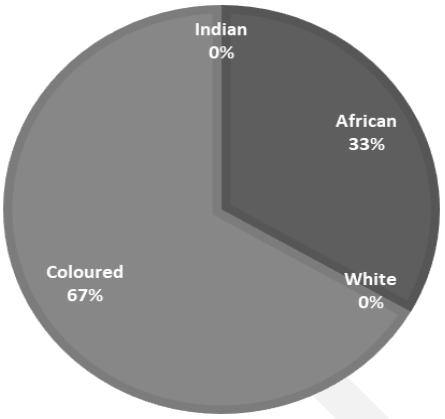

Figure 58: Race demographic of aquaculture farmers interviewed in the freshwater sector

Figure 58 shows that 67% of aquaculture farmers interviewed in the freshwater sector were Coloured and 33% African. This suggests that there is transformation taking place in the freshwater sector. An explanation for the higher number of Coloured compared to African aquaculture farmers could be that the largest number of freshwater participants came from the Southern part of the Eastern Cape, where there is a higher percentage of Coloured employees.

4.5.3. Aquaculture Farm Assistant:

Abalone:

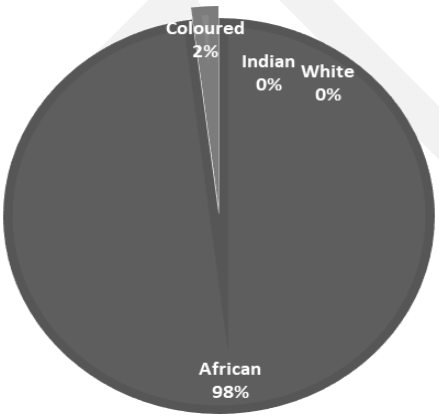

Figure 59: Reported race demographics of aquaculture farm assistants in the abalone sector

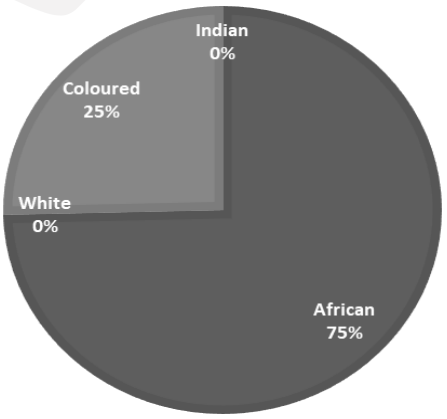

Figure 60: Race demographic of aquaculture farm assistants interviewed in the abalone industry

Figure 59 shows the reported race demographic of aquaculture farm assistants from participating aquaculture farms. This figure shows that 98% of aquaculture farm assistants on abalone farms were African, 17% Coloured and 3% White, with no Indian representation. Figure 60 shows the race demographic of aquaculture farm assistants interviewed on abalone farms. This also shows that the majority were African, but the percentage is 23% lower than the reported figures. The percentage of Coloured aquaculture farm assistants interviewed was 23% higher than the percentages from those reported. This suggests that the majority of aquaculture farm assistants in the abalone industry are African, followed by Coloured. This would suggest that racial transformation is taking place among aquaculture farm assistants in the abalone industry.

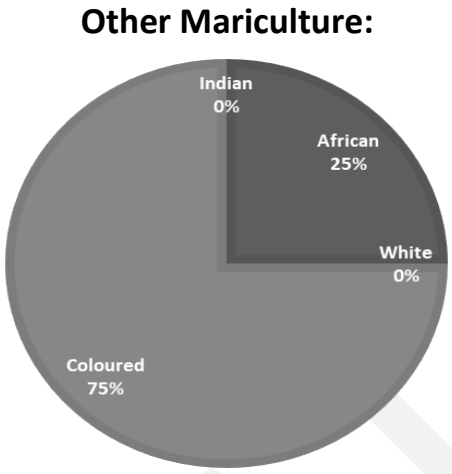

Figure 61: Race demographic of aquaculture farm assistants interviewed in the kob, mussel and oyster sector

Figure 61 shows that 75% of aquaculture farm assistants interviewed in the oyster, mussel and kob sectors were Coloured and 25% African. This suggests that there is transformation taking place in the other mariculture sectors. The mussel and oyster sectors employ a higher percentage of Coloureds, due to geographical location and this may be an explanation for the higher percentage of Coloured aquaculture farm assistants.

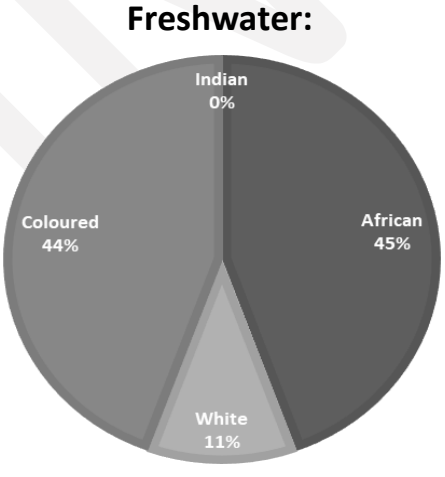

Figure 62: Race demographic of aquaculture farm assistants interviewed in the freshwater sector

Figure 62 shows that 44% of aquaculture farm assistants interviewed in the freshwater sector were Coloured, 45% African and 11% white. This suggests that there is transformation taking place in the freshwater sector.

4.5.4. Conclusion:

When comparing the overall race figures, there is a correlation between those interviewed and data from the AgriSETA 2016 Sector Skills Plan. When the race figures are split into the various occupational categories - namely aquaculture managers, aquaculture professionals, aquaculture farmers and aquaculture farm assistants - the figures suggest that racial transformation is slow in the categories of aquaculture farm managers and aquaculture professionals across all sectors of the aquaculture industry, with mostly Whites occupying these positions. Racial transformation appears to be taking place at a more rapid pace among aquaculture farmers and aquaculture farm assistants, with mostly Africans or Coloureds in these positions. The ratio of African to Coloured varies, depending on the specific sub-sector of the industry, and is believed to be largely influenced by the geographic location of farms.

5. Education, Training and Skills Development

Of the organisations contacted and positive responses received, the majority do not pay a Skills Development Levy (SDL) and are not affiliated with a Sector Education and Training Authority (SETA). When asked what their understanding of the SDL and SETAs were, most were aware of the SDL but not of the requirements to pay and access the SETAs. The reason given for this was the perception that it is only for large organisations. There is very little to no training occurring in these smaller organisations. It was noted that most training taking place was what was needed to comply to legislation, in particular to meet with Occupational Health and Safety standards.

Larger organisations, particularly in the abalone industry, pay SDL and belong to AgriSETA. These organisations also complete Workplace Skills Plans (WSPs) and Annual Training Reports (ATRs). These organisations offer training opportunities to employees. Some are SETA-accredited, some are offering training in-house and some make use of external providers, who are not accredited. Organisations affiliated with a SETA have indicated approximately 55% of training interventions on offer are accredited. Table 5 summarises the type of training offered by these organisations. Table 4 summarises education and training offered by private institutions, universities and TVET or agricultural training institutes. The table shows that there are four private institutions, one non-profit institution, four government institutions, ten universities and four agricultural training institutes offering various forms of training in aquaculture.

During focus group interviews, aquaculture farm assistants and aquaculture farmers were asked about their awareness of training interventions offered by their organisations. Their level of awareness was largely dependent on the emphasis that each organisation places on training and skills development. When comparing what the interviewees listed, to what the organisations listed as training interventions, there was, however, a general trend with aquaculture farm assistants having the understanding that far fewer training opportunities were available than what was offered. Aquaculture farmers were better informed, particularly with regard to training that was relevant to them. Aquaculture farm managers had the highest level of awareness of training interventions available.

Table 4: Training and education offered by private institutions and universities

Institution / Provider	Type of Institution	Programme/s on offer	Location
Aquaculture innovations (Aquaafrica)	Private	• 2-day Tilapia Hatchery Specialist Course • 3-day Aquaculture System Management Course • 7-day Practical Fish Farmer Course • 2-day Commercial Aquaponics Course	Grahamstown, Eastern Cape
Rydawi fish farm	Private	• Farm in a box • Tilapia farming	Mulderdrift, Gauteng
Sound Interaxions	Private	• Animal Production NQF Level 1	Cape Town, Western Cape
Icthyaquaponics	Private	• 1-day introduction to aquaponics course • 2- day advanced course	Midrand, Gauteng
Agri Academy	Non-profit Organisation	• Provides various export-related courses and HACCP training. • (FAO Fisheries and Aquaculture Department, 2017)	Stellenbosch, Western Cape
Agricultural Technology Demonstration Centre	Government	• 5-day course in Aquaculture Training and Practical Work	Gariep, Free State
Agricultural Research Council	Government	• 2-day Aquaculture System Management Course • 9-day Practical Fish Farmer Course • 1-day Commercial Aquaponics Course	Pretoria, Gauteng
Western Cape Investment and Trade and Promotion Agency (WESGRO)	Government	• Beginners and advanced export training • courses. (FAO Fisheries and Aquaculture Department, 2017)	Cape Town, Western Cape
Agri-Seta	Government	• Fund general skills development and training in aquaculture, and are currently developing specific unit standards for	Pretoria, Gauteng

			key aquaculture skills i.e. hatchery skills, grow-out operations, farm management and project management skills etc. (FAO Fisheries and Aquaculture Department, 2017)	
Rhodes University	University	•	Short courses in aquaculture for agriculture extension officers and veterinarians with the support from the Department of Agriculture, Forestry and Fisheries (DAFF). • Department of Ichthyology and Fisheries Science offers undergraduate and postgraduate course in aquaculture. • An aquaculture module is offered at Rhodes University if one majors in Ichthyology and Fisheries Science within the undergraduate Bachelor of Science degree.	• Grahamstown, Eastern Cape
Stellenbosch University in collaboration with Louisiana State University's Agricultural	University	•	Provides a 3-day course in Stellenbosch. • (FAO Fisheries and Aquaculture Department, 2017) • Department of Animal Science –offer a Bachelor of Science degree (Bsc Agric) with majors in Aquaculture and • Conservation or Aquaculture and Animal Science. The Department of genetics (Division of Aquaculture) at Stellenbosch University also offers short modules And training in	• Stellenbosch, Western Cape

		aquaculture.	
University of Cape Town	University	• Botany and Zoology Departments –provides a post graduate course in aquaculture.	Cape Town, Western Cape
University of the Western Cape	University	• Botany and Zoology Departments – University offers post graduate courses in aquaculture.	Cape Town, Western Cape
University of Kwa-Zulu Natal	University	• Microbiology Department – offers post graduate courses in microbiological aspects related to aquaculture.	Durban, KZN
University of the Free State	University	• Undergraduate courses as part of freshwater ecology and post graduate courses specializing in aquatic parasitology.	Bloemfontein, Free State
Nelson Mandela University	University	• Zoology Department – Undergraduate courses as part of Aquatic Ecology and Applied Aquatic Science. Oceans University has just been launched and this is likely to change	Port Elizabeth, Eastern Cape
University of Limpopo Science Faculty	University	• Aquaculture Research Unit – offers aquaculture courses at a postgraduate level, focusing on freshwater finfish.	Mankweng, Limpopo
University of Zululand Zoology Department	University	• Offers courses with aquaculture components at undergraduate and postgraduate level.	Richards Bay, KZN
Cape Peninsula University of Technology	University	• Department of Biodiversity and Conservation – offers courses with aquaculture components at Undergraduate and postgraduate level. • (FAO Fisheries and Aquaculture Department, 2017)	Cape Town, Western Cape
Elsenburg Agricultural Training Institute	Agricultural Training Institute	• B Agric (NQF 6) Elsenburg offers Animal production 361 (5 credits) in Aquaculture production. • Higher Certificate (NQF 5) Elsenburg offers Animal	Stellenbosch, Western Cape

		• Production 215 (10 credits) in Aquaculture production. • Learnership (Animal production) - NQF 4	
Glen Agricultural Training Institute	Agricultural Training Institute	• Ad-hoc informal training in partnership with the Xhariep Fish Hatchery project and private training providers	Bloemfontein, Free State
Madzivhandila Agricultural Training Institute	Agricultural Training Institute	• Module in aquaculture (Animal production) • 4 weeks Certificate in aquaculture (Accredited)	Limpopo
Tsolo Agriculture and Rural Development Institute (TARDI)	Agricultural Training Institute	• Offers aquaculture as a module • The Institute trains advisors and educators on aquaculture	Tsolo, Eastern Cape

Table 5: Training offered by organisations:

Abalone farm 1				
Training intervention / programme	**SETA Accredited?**	**Type of programme**	**Internal or external**	**Format**
AET training	Yes	AET level 1-4	Skills	External
Food safety	Yes	Unit Standard based skills	progra	External
		programme	mme	External External External
Learnerships	Yes	Learnership		
Management skills	No	Soft skills		Internal
First Aid	No			Internal Internal
Abalone farm 2				
Animal Production	Yes	Learnership 18.1		Internal External External
				Internal
Animal Production	Yes	Skills		Internal Internal Internal
AET	Yes	Programme		
		Skills		
Health & Safety	Yes			
Animal Production	Yes	Skills		
Electricians Diploma	Yes	Diploma		
Business Finance	No	Diploma 3 yrs.		
Job Skills	No	Skills programme		
Induction	No	Skills programme		
	No	Skills programme		

Classroom	C	m	F	ssroom (Abet Centre)
Classroom & on-the-job	l	Classroom	o	Formal Classroom
	a		r	1 Year distance learning
	s	Formal	m	Classroom & on-the-job
	s	Classro	a	Formal Classroom
Classroom	r	om &	l	On-the-
& on-the-	o	on-the-	C	job Formal
job	o	job	l	Formal
		Formal Classroom	a	

Procedures				
Abalone Farm 3				
Induction/Orientation	No	New employee induction	Internal	Classroom, Verbal
Safety Training	No	Skills – On-the-job safety for operations & technical	Internal	Classroom, practical & toolbox talks
Health & Safety Rep	Yes	Skills - Safety	External	Classroom
First Aid	Yes	Skills - Safety	External	Classroom
Basic Fire Fighting	Yes	Skills - Safety	External	Classroom
NQF level 1 Animal Production: Aquaculture (Core & Electives)	Yes	Skills - Aquaculture	External	Classroom & Practical
NQF level 1 Animal Production: Aquaculture (Fundamentals)	Yes	Skills - Aquaculture	External	Classroom
Safety Familiarisation	No	Skills - Safety	External	Classroom & Practical
HACCP Awareness	No	Food Safety	External	Classroom
Pastel Accounting Training	Yes	Skills - Bookkeeping Fundamentals	External	Classroom & Practical
Payroll Basic & Pro	Yes	Skills – Computer VIP Payroll	External	
Tilapia farm				
Wet hand	No	In House	Internal	Practical
Basic aquaculture	No	Short Course	Internal	Mostly informal and practical, with a little (20%) theory included
Catfish Farm				
Interview with AET Placement Assessment	No	Adult Education and Training Placement assessment	Internal	Theory
Preparing for the classroom	No	Cognitive Development and Soft Skills	Internal	Classroom
Adult Education and Training	Yes	AET – Numeracy and literacy	External	Classroom
Animal Production	Yes	Learnership	External	Classroom & Practical
Preparing for the workplace	No	Soft Skills	Internal	Classroom

Continuous Professional Development	Both	Soft Skills and NQF 4 Supervisory Skills Development Programme	Internal and External	Classroom and Practical

The tilapia farm mentioned in table 5 has conducted 70 external workshops in Tanzania and trained 30 local entrepreneurs using material developed by Aquaculture Innovations. The organisation has also conducted aquaculture workshops in the Democratic Republic of Congo.

The organisation (Rydawi) is currently working to build a training facility for Tilapia farmers and has indicated a willingness to offer accredited training. Their vision is to have a facility where farmers attend practical training on aquaculture. They are also interested in initiating a 'train the trainer' course, with an apprenticeship system, and training centres throughout South Africa.

Of all the farms visited and interviews conducted, the catfish farm mentioned in Table 5 was the only farm with a structured education, training and skills development programme for employees - from pre-employment to employment. This organisation has structured training programmes, and all employees are aware of the training process and what present and future training they have access to. The education, training and skills development model is one that could be adapted and used across various sectors of the aquaculture industry.

Other training offered by organisations:

- Fire fighting
- Dealing with dangerous animals- for example: snakes and spiders
- Bio-security

Sub-sector with offshore activities such as mussel and oyster farming taking place:

- Pre-sea
- Skipper's licence
- First aid at sea
- Survival skills at sea

6. How skills and knowledge are gained

All aquaculture farm assistants and aquaculture farmers indicated that they had initially gained the knowledge and skills to do their work through on-the-job training. In the aquaculture farm assistant and aquaculture farmer category, employees had learnt mostly by being shown how to do the job by colleagues, aquaculture farmers and managers. Many also indicated that they had learnt to do the job through observing others and by trial and error.

Aquaculture farmers and those leading teams indicated that they had been placed in the position and learnt the skills from their managers and through trial and error. Supervisory training is offered at three of the organisations where interviews were conducted. This is notably for larger organisations paying Skills Development Levy and associated with a SETA, mainly AgriSETA.

Aquaculture farm managers have gained theoretical knowledge of aquaculture farming through attending courses or completing an aquaculture-related diploma or degree offered at the various universities. Practical skills have mostly been gained through on-the-job training and learning from colleagues, line mangers and through trial and error. Knowledge is also gained through the internet.

7. Skills employed in different areas of aquaculture

Tables 6-9 below indicate the skills employed in the aquaculture industry; included in this is the perceived difficulty to gain the skill, and the sub-sectors that each skill is relevant to. During interviews and on the questionnaires distributed, respondents were asked to explain their jobs. These were then listed as different skills employed for the different job types. These skills give a baseline of skills that are currently employed in the industry, as well as giving an indication as to the perceived difficulty to gain the skill. Having an understanding of the perceived difficulty to gain a particular skill or skill set, can assist in determining National Qualifications Framework (NQF)-level, and credits that may be associated with the various skills sets when industry-focused qualifications are being developed. Table 6 shows Skills employed in factories preparing abalone for export. Table 7 shows Skills employed in the hatchery area of various aquaculture sectors. Table 8 shows Skills employed in the grow out/ production area of different aquaculture sectors. Table 9 shows Skills employed in the technical and maintenance areas of various aquaculture sectors.

Table 6: Skills employed in factories preparing abalone for export

Skill area	Employment Level (Broad)	Perceived Difficulty to learn	Abalone
Preparing animals for canning			
Bleeding	Elementary Occupations	Very Easy	Y
Sorting	Elementary Occupations	Very Easy	Y
Weighing	Elementary Occupations	Very Easy	Y
Salting	Elementary Occupations	Easy	Y
Chilling	Elementary Occupations	Easy	Y
Cut beaks	Elementary Occupations	Easy	Y
Washing	Elementary Occupations	Medium	Y
Shucking / gutting	Elementary Occupations	Difficult	Y
Recipes			
Cooling	Elementary Occupations	Very Easy	Y
Packing cans into boxes	Elementary Occupations	Very Easy	Y
Cooking	Elementary Occupations	Easy	Y
Labelling	Elementary Occupations	Easy	Y
Health & Safety	Elementary Occupations	Easy	Y
Pre-cook	Elementary Occupations	Easy	Y
Pre-sort	Elementary Occupations	Easy	Y
Canning	Elementary Occupations	Easy	Y
Closing cans	Elementary Occupations	Easy	Y

Select correct ingredients & Quantities	Elementary Occupations	Difficult	Y
Printing labels (Using the machine)	Elementary Occupations	Difficult	Y
Retort	Elementary Occupations	Difficult	Y
Quality checks at critical points	Technicians and Associate Professionals	Medium	Y
Drying			
Sending to stores	Elementary Occupations	Very Easy	Y
Grading / sorting	Elementary Occupations	Easy	Y
Boxing	Elementary Occupations	Easy	Y
Using a recipe	Elementary Occupations	Medium	Y
Live Packing			
Ice	Elementary Occupations	Very Easy	Y
Labelling	Elementary Occupations	Very Easy	Y
Correct packing	Elementary Occupations	Easy	Y
Oxygen in packaging	Elementary Occupations	Difficult	Y

Table 7: Skills employed in the hatchery area of various aquaculture sectors

Skill area	Employment Level (Broad)	Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow	Catfish
Larvae										
Checking eggs	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Air quality checks	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Checking air flow	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Tank maintenance	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
General housekeeping	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Cleaning tanks	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y	Y
Water quality checks	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y	Y
Temperature checks	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y	Y
Recording mortalities	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y	Y
Cleaning hapas	Elementary Occupations	Medium	N	Y	N	N	N	N	Y	Y
Moving larvae	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y

Skill area	Employment Level (Broad)	Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow	Catfish
Moving hatchlings	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Check for disease	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Changing screens	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Cleaning screens	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Taking care of eggs	Elementary Occupations	Very Difficult	Y	Y	Y	N	N	N	Y	Y
Treating disease	Managers	Very Difficult	Y	Y	Y	N	N	N	Y	Y
Identifying diseases	Professionals	Very Difficult	Y	Y	Y	N	N	N	Y	Y
Diatoms	Technicians and Associate Professionals	Very Easy	Y	Y	N	N	N	N	Y	N
Record data	Technicians and Associate Professionals	Medium	Y	Y	Y	N	N	N	Y	Y
Algal cultures	Technicians and Associate Professionals	Medium	Y	Y	N	N	N	N	N	N
Health check sampling	Technicians and Associate Professionals	Medium	Y	Y	Y	N	N	N	Y	Y
Reporting	Technicians and Associate Professionals	Medium	Y	Y	Y	N	N	N	Y	Y
Weaning										

Skill area	Employment Level (Broad)	Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow	Catfish
Chemical wash of tanks	Elementary Occupations	Easy	Y	N	N	N	N	N	Y	Y
Air quality checks	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Cleaning tanks	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y	Y
Water quality checks	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y	Y
Checking air flow	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y	Y
Sizing/ Grading/ Splitting/ Sorting	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Separating mortalities	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Feeding	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Checking for sick animals	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y
Loading fish for live transport	Elementary Occupations	Difficult	N	N	N	N	N	N	Y	Y
Deplating	Elementary Occupations	Difficult	Y	N	N	N	N	N	N	N
Handling animals correctly	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y	Y

Table 8: Skills Employed in the Grow out / Production area

Skill area	Employment Level (Broad)	Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow	Catfish
Grow Out / Production										
Cleaning Tanks	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Feeding	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Checking air flow	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Removing mortalities	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y	Y
Counting mortalities	Elementary Occupations	Easy	Y	N	Y	N	N	N	Y	Y
Recording mortalities	Elementary Occupations	Easy	Y	N	Y	N	N	N	Y	Y
Cleaning baskets	Elementary Occupations	Medium	Y	N	N	N	N	N	N	N
Acid wash	Elementary Occupations	Medium	Y	N	N	N	N	N	N	N
Correct animal handling	Elementary Occupations	Medium	Y	Y	Y	Y	Y	Y	Y	Y
Weighing	Elementary Occupations	Difficult	Y	N	Y	N	N	N	Y	Y
Grading / Sorting	Elementary Occupations	Very Difficult	Y	Y	Y	N	N	N	Y	Y
Splitting	Elementary Occupations	Very Difficult	Y	Y	Y	N	N	N	Y	Y

Table 9: Skills employed in the technical and maintenance areas of various aquaculture sectors

Skill area	Employment Level (Broad)	Perceived Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow
Technical and Maintenance									
Repair fibreglass tanks	Elementary Occupations	Easy	Y	N	N	N	N	N	N
Fibre glassing	Elementary Occupations	Easy		N	N	N	N	N	N
Building tanks	Elementary Occupations	Easy	Y	N	Y	N	N	N	Y
Laying new pipes	Elementary Occupations	Easy	Y	Y	N	N	N	N	Y
Build and prepare racks	Elementary Occupations	Easy		N	N	N	N	N	N
Cleaning filters	Elementary Occupations	Easy	Y	Y	Y	N	N	N	Y
Fix pipes	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y
Fix leaks	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y
Fix sieves	Elementary Occupations	Medium	Y	Y	N	N	N	N	Y
Fix valves on pumps	Elementary Occupations	Medium	Y	Y	Y	Y	Y	Y	Y
Building	Elementary Occupations	Medium	Y	Y	N	N	N	N	Y
Making basket frames	Elementary Occupations	Medium	Y	Y	N	Y	Y	Y	N
Changing filters	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y
Changing faulty motors	Elementary Occupations	Medium	Y	Y	Y	N	N	N	Y
Fix pumps	Elementary Occupations	Difficult	Y	Y	Y	Y	N	N	Y
Changing screens	Elementary Occupations	Difficult	Y	Y	N	N	N	N	N
Fix tools (electrical)	Elementary Occupations	Difficult	Y	Y	N	N	N	N	Y
Maintain pumps	Elementary Occupations	Difficult	Y	Y	Y	Y	Y	Y	Y

Skill area	Employment Level (Broad)	Perceived Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow
				Blowers					
Painting	Elementary Occupations	Easy	Y	Y	N	N	N	N	Y
Maintaining blowers	Elementary Occupations	Medium	Y	N	N	N	N	N	N
Plumbing	Elementary Occupations	Medium	Y	Y	Y	N	Y	N	Y
Carpentry	Elementary Occupations	Medium	Y	Y	N	N	N	N	Y
Fixing blowers	Elementary Occupations	Difficult	Y	N	N	N	N	N	N
Welding	Elementary Occupations	Difficult	Y	Y	N	N	N	N	N
Electrical	Elementary Occupations	Difficult	Y	Y	Y	N	Y	N	Y
				Maintenance checks					
Make baths	Elementary Occupations	Easy	Y	N	N	N	N	N	N
Line maintenance	Elementary Occupations	Easy	N	N	N	Y	Y	Y	N
Fixing stacks	Elementary Occupations	Easy	N	N	N	N	Y	Y	N
Fixing cages	Elementary Occupations	Easy	N	N	N	N	Y	Y	N
Pumping up floats	Elementary Occupations	Easy	N	N	N	N	Y	Y	N
Building ready-made systems	Elementary Occupations	Medium	N	N	Y	N	N	N	N
Pond repair	Elementary Occupations	Medium	N	Y	N	N	N	N	N
Rope Maintenance	Elementary Occupations	Medium	N	N	N	Y	Y	Y	N
General maintenance	Elementary Occupations	Difficult	Y	Y	Y	Y	Y	Y	Y
Generators	Elementary Occupations	Difficult	Y	Y	N	N	N	N	N
Blowers	Elementary Occupations	Difficult	Y	N	N	N	N	N	N
Water levels	Elementary Occupations	Difficult	Y	Y	Y	N	N	N	Y

Skill area	Employment Level (Broad)	Perceived Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow
Vehicle maintenance	Elementary Occupations	Difficult	Y	Y	N	N	N	N	N
Check tool condition	Elementary Occupations	Difficult	Y	N	N	N	N	N	Y
Rope Splicing	Elementary Occupations	Difficult	N	N	N	Y	Y	Y	N
Knot tying	Elementary Occupations	Difficult	N	N	N	Y	Y	Y	N
Build and repair rafts	Elementary Occupations	Difficult	N	N	N	Y	Y	Y	N
Plastic welding	Elementary Occupations	Very Difficult	Y	Y	N	N	N	N	N
Whipping	Elementary Occupations	Very Difficult	Y	N	N	N	Y	Y	N
General boat maintenance	Technicians and Associate Professionals	Medium	N	N	N	Y	Y	Y	N
Check sea worthiness of boats	Technicians and Associate Professionals	Medium	N	N	N	Y	Y	Y	N
Electrician	Technicians and Associate Professionals	Difficult	Y	N	Y	N	N	N	N
Millwright	Technicians and Associate Professionals	Difficult	Y	N	N	N	N	N	N
Fix breakdowns	Technicians and Associate Professionals	Difficult	Y	Y	N	N	N	N	N
Maintain and repair aerators	Technicians and Associate Professionals	Difficult	N	N	N	N	N	N	Y
Maintain boat motors	Technicians and Associate Professionals	Difficult	N	N	N	Y	Y	Y	N
Technical diving	Technicians and	Difficult	N	N	N	Y	Y	Y	N

Skill area	Employment Level (Broad)	Perceived Difficulty to learn	Abalone	Dusky Kob	Tilapia	Mussels	Oysters	Mussels & Oysters	Trout Rainbow
Machinery maintenance	Associate Professionals								
	Technicians and Associate Professionals	Very Difficult	N	N	N	Y	Y	Y	N

8. Skills and knowledge needed to do the job better and gain a better position in the future as indicated by the different occupations

Most aquaculture farm assistants interviewed indicated a high level of proficiency in terms of practical skills required to do their work. Aquaculture and Mariculture farmers indicated that they are proficient at doing the work relating to practical skills but lack skills and knowledge in dealing with people. Aquaculture farm managers mostly indicated that they were proficient in doing their work relating to the practical day-to-day aspect of their jobs but required development of skills relating to people.

The skills and knowledge required, are indicated by respondents in Tables 10 – 15. The skills required by each of the occupation groups are listed in order of the frequency that each of these were indicated - in either focus group interviews (Aquaculture farmers and aquaculture farm assistants) or from questionnaires completed (Aquaculture farm managers and professionals). The skills and knowledge that were most frequently mentioned, have been expanded on. The skills have further been categorised into types of competencies. The competencies fall in three groups, namely:

Behavioural (or Life Skills) Competencies
Life skills are problem-solving behaviours used appropriately and responsibly in the management of personal affairs. They are a set of human skills acquired via teaching or direct experience that are used to handle problems and questions commonly encountered in daily human life. Examples are Communication, Analytical Ability, Problem Solving, Initiative, etc.

Functional (or Technical) Competencies
Functional competencies relate to functions, processes, and roles within the organisation and include the knowledge of, and skill in, the exercise of practices required for the successful accomplishment of a specific job or task. Examples are Application Systems Development, Networking and Communication, Database Analysis and Design, etc.

Professional Competencies
Professional competencies are competencies that allow for success in an organisational context. They are the accelerators of performance or – if lacking in sufficient strength and quality – are the reason people fail to excel in jobs. Examples are Business Environment, Industry and Professional Standards, Negotiation, People Management, etc. (Sturgess, 2012)

Skills and knowledge required have been divided into skills required by different areas of an aquaculture business; namely hatchery, grow out, processing factory and export. Aquaculture farmer- and aquaculture farm manager-required skills are listed separately.

Aquaculture farm assistant and aquaculture farmer skills and knowledge required:

An understanding of the whole farm or business:

Most farmers and farm assistants indicated a need to understand how an aquaculture farm works, and how the work that the individual is doing, contributes to the business as a whole. This was indicated as a need by aquaculture farmers and farm assistants who have as yet not had the opportunity to attend an aquaculture related course. In many cases farmers and farm assistants mentioned that they would like to have the opportunity to have a "farm tour" so that they can understand how the work they are doing fits into the rest of the business.

More than 70% of people in focus groups indicated that they would like to learn how the whole business works, to better understand why their work is important, and more often to allow them the opportunity to work in different areas on the farm. For example, a worker in grow out, would like to know about working in a hatchery so that if a position becomes available s/he can apply for the position.

Another reason that was often given for the need to be multi-skilled or know the whole business was so that if a worker or several workers in a different area of the farm are absent, an available person from a different division could fill in for him/ her. This was mostly mentioned regarding working over weekends when there are fewer staff on duty.

Table 10: Skills and knowledge indicated as a need by hatchery workers (n=10)*

Skills	Type of Competence	Frequency
Understanding of the whole farm or business (See explanation)	Functional	7
Growing of feeds (Algae)	Functional	7
Data capture	Functional	5
Understanding the life-cycle of animals	Functional	4
Knowledge and skills relating to spawning	Functional	4
Understanding of animal diseases and how to take care of diseased animals	Functional	3
Mechanic	Functional	2
Reading	Behavioural	2
Writing	Behavioural	2
Driver's Licence	Functional	2
Hazard Analysis Critical Control Point (HACCP) Training	Functional	2
Learn the job before starting – training for the job as part of the induction process	Functional	2
Knowledge and understanding of how to maintain the water system used on the farm (Technical skill)	Functional	1
Basic Computer skills	Functional	1
Electrical knowledge – how to identify and fix electrical faults (Technical skill)	Functional	1
Communication Skills	Functional	1
Knowledge of Occupational Health and Safety	Functional	1
International Standards Organisation (ISO) Training	Professional	1
Welding to repair and maintain tanks and the water system (Technical Skill)	Functional	1
First Aid	Behavioural	1
Nutrient values of feed	Functional	1
Water Quality	Functional	1
Water Testing	Functional	1
Swimming	Behavioural	1
Aquaculture Certificate	Functional	1

Table 10 lists the frequency of skills required by hatchery workers. Along with the need to understand the whole farm or business cycle, the most frequently mentioned need, particularly in the abalone industry, was the need to understand how to grow feeds, particularly algae. Hatchery workers want to know more about the animals that they are rearing. This is shown with high frequencies of knowing about spawning, animal life cycles and understanding animal diseases. The majority of skills required relate to the functional competencies.

* As far as possible, focus groups included those working in a specific area of an aquaculture farm. This was not, however, always possible as farms and their division of labour were different. To this end- *n* indicates the number of focus group interviews that included hatchery workers.

Table 11: Skills and knowledge indicated as a need by those working in the grow out / processing area of the farm indicating Skills required in grow out (n=19)

Skills	Type of Competence	Frequency
Understanding of the whole farm or business (See explanation)	Functional	19
Data capture (Computer skills)	Functional	19
Plumbing skills	Functional	17
Repairing tools	Functional	16
Growing of Feeds(algae)	Functional	13
Understanding the life cycle of animals	Functional	11
Mechanic (Technical skills)	Functional	10
Understanding animal diseases and how to take care of diseased animals	Functional	9
Spawning	Functional	6
Maths	Behavioural	8
Reading	Behavioural	7
Writing	Behavioural	6
Driver's licence	Functional	6
HACCP Training	Functional	6
Learn the job before starting – training for the job as part of the induction process	Functional	4
Management of the Water System (Technical skills)	Functional	3
Electrical knowledge – how to identify and fix electrical faults (Technical skill)	Functional	2
Communication Skills	Behavioural	2
Occupational Health and Safety	Functional	1
ISO Training	Professional	1
Welding to repair and maintain tanks and the water system (Technical Skill)	Functional	1
First Aid	Behavioural	1
Nutrient values of feed	Functional	1

Table 11 indicates the frequency of skills and knowledge indicated as a need for those working the so-called grow out or processing area of an aquaculture farm. The need to understand the whole farm or business was indicated most frequently, along with a need for the knowledge and skills of how to use a computer to capture data. In addition to this, the need for technical skills such as mechanical skills to repair vehicles and equipment, management of the water system, electrical knowledge and welding skills were mentioned with high frequency. It is to be noted that not all organisations have a dedicated maintenance team, and workers are thus often required to assist with repairs and maintenance in the area of the farm where they are working. Most of the skills and knowledge listed as a need fit into the functional competency category.

Table 12: Skills needed by those working in the factory and export division (n=4)

Skills	Type of Competence	Totals
Understanding of the whole farm or business (See explanation)	Functional	4
Knowledge of Food Safety	Functional	4
Data capture	Functional	4
Maths	Behavioural	2
HACCP Training	Professional	2
Communication skills	Functional	2
Computer skills	Functional	2
Life cycle of animals	Functional	1
Spawning	Functional	1
Professional	Professional	1
Repairing tools	Functional	1
Occupational Health and Safety	Functional	1
Mechanic	Functional	1
Reading	Behavioural	1
Writing	Behavioural	1
Understanding of animal diseases	Functional	1
Driver's licence	Functional	1
Learn the job before starting – training for the job as part of the induction process	Functional	1

The opportunity to interview workers in the factory and export divisions of four farms was afforded. Table 12 indicates the skills and knowledge needs of those working in the factory and export divisions of aquaculture farms, in particular in the abalone sector. The need to know the full business cycle was again noted with the highest frequency, along with the need for knowledge of food safety. Skills relating to computers, maths and data capturing were also frequently mentioned. The need for Hazard Analysis and Critical Control Point (HACCP) training was also indicated with a relatively high frequency. Most of the skills listed as a need fall into the functional category of competence.

Table 13: Skills and knowledge indicated as a need by those working in the so-called maintenance or technical departments of an aquaculture farm (n=10)

Skills	Type of competence	Totals
Communication Skills	Behavioural	10
Electrical knowledge and skills, to be an electrician for an aquaculture business	Functional	10
Maths	Functional	6
Mechanical skills to repair vehicles and equipment	Functional	6
Knowledge and skills to repair broken tools	Functional	5
Knowledge and skills of plumbing to build and maintain an aquaculture system	Functional	4
Conflict Management	Behavioural	3
Driver's Licence	Functional	2
Welding knowledge and skills to building and maintaining aquaculture systems	Functional	2
Writing	Functional	2
Carpentry	Functional	1
Computer	Functional	1
Team working skills	Behavioural	1

Those working in the maintenance or technical departments mostly mentioned a need for communication skills and a need for electrical and mechanical knowledge and skills to repair broken down equipment such as fans, pumps and vehicles. This was included with a need for plumbing skills, particularly related to an aquaculture farm. Most of the skills listed as a need fall into the functional category of competence.

Aquaculture farmers:

Aquaculture farmers mostly felt confident with the practical skills and knowledge gained in their area of work through experience as aquaculture farm assistants. General supervisory skills were most frequently mentioned as a need by aquaculture farmers, specific supervisory skills such as people management, discipline and conflict handling were also mentioned frequently, indicating that the greatest need for aquaculture farmers is skills and knowledge relating to what is required of a supervisor. Table 14 below indicates the frequency that skills were indicated in the focus groups.

Table 14: Skills and knowledge required by aquaculture farmers (n=12)

Skills	Type of Competency	Frequency
Supervisory skills	Professional	11
Communication Skills	Behavioural	11
Computer skills	Functional	10
Management skills	Professional	10
Business skills	Professional	10
People Management skills	Professional	10
Discipline	Professional	10
Budgeting	Professional	9
Conflict handling	Behavioural	8
Administration	Functional	7
Creating a schedule	Functional	7
Multiskilling	Functional	7
Leadership Skills	Professional	5
Technical skills – plumbing, electrical and welding	Functional	5
Problem solving	Professional	5
Diving (SCUBA)	Functional	5
Assertiveness	Professional	4
Counselling	Professional	4
Animal life cycles	Functional	4
Planning	Professional	3
Marketing	Functional	3
Skipper	Functional	3
Pre-sea	Functional	3
Animal Husbandry	Functional	2
Maths Skills	Functional	1
Organising	Professional	1
HACCP	Professional	1
Values	Professional	1
Motivation	Professional	1

Aquaculture farmers indicated a number of skills required, with the most frequent of these being related to supervisory and communication skills. The need for computer skills and management skills were mentioned with equal frequency. Computer skills were indicated as a need to do the job better now, and in the future, whereas management skills were indicated as a need for future development. The skills required fall mostly into the professional category of competence, indicating that aquaculture farmers have a greater need to develop professional competencies than functional competencies.

The needs of aquaculture farmers show a relationship with the general priority skills as per the AgriSETA Sector Skills Plan for 2017/8. The analysis of all stakeholder engagements has highlighted

the relative scarcity of a general set of skills across all sub-sectors and stakeholder categories, for both skilled and unskilled labour. The Agricultural sector has a relatively large proportion of unskilled labour. The analysis points to the following skills needs listed below across sub-sectors and stakeholder categories. This list was corroborated through consultation with the Farm and Allied Workers Union.

General priority skills for unskilled labour:

- Language & literacy skills – reading and writing
- Numeracy skills
- Business skills – income and expense analysis
- Basic agricultural skills – horticulture, tools & implements, biosecurity
- Employee skills - occupational health and safety, worker's rights, time management
- Life skills – personal health and wellbeing, HIV Aids awareness, alcoholism awareness (AgriSETA, 2016)

Table 15: Aquaculture Farm Manager skills and knowledge required (n=21)

Skills	Type of Competency	Frequency
Management skills	Professional	21
People Management skills	Professional	20
Leadership Skills	Professional	20
Conflict handling	Professional	19
Business management skills	Professional	18
Budgeting	Professional	16
Communication Skills	Behavioural	16
Planning	Behavioural	15
Problem solving	Behavioural	7
Computer skills	Functional	6
Business Etiquette	Behavioural	6
Discipline	Behavioural	5
Counselling	Behavioural	5
Securing funding	Professional	4
Assertiveness	Behavioural	3
Cultural Diversity	Behavioural	3
Team skills	Behavioural	2
Administration	Functional	1
What is your purpose	Behavioural	1
Life Skills	Behavioural	1
Email etiquette	Behavioural	1

Managers most frequently mentioned the need for management skills, closely followed by people management skills. Related to people management skills needed, and indicated with high frequency, was leadership and conflict handling skills. Business management skills and budgeting were mentioned with high frequency. The greatest needs for managers had thus been indicated as management skills, people skills and business management skills. The majority of skills listed as a need fall into the behavioural category of competence, suggesting a bigger need for soft skills training among farm managers.

8.1 Skills and Knowledge needs common to different occupational categories:

The lists below give an indication of skills and knowledge needs that are common to different occupational categories. Addressing these needs would assist in meeting the current needs of employees and planning for the future needs. Common needs for aquaculture farmers and farm managers are listed, as well as common needs of aquaculture farmers and farm assistants. Needs that have been indicated as having specialist knowledge and skills, are also listed. These are indicated as needs for professionals in the aquaculture industry. They are not listed by frequency, as each of these is considered to be an important or critical need within the aquaculture industry.

Skills and knowledge needs common to aquaculture farmers and aquaculture farm managers:

- People management
- Leadership skills
- Motivation of teams and individuals
- Management training
- Report writing skills
- Conflict management

Skills and knowledge needs common to aquaculture farm assistants and aquaculture farmers:

- Work-related computer skills, particularly using programmes to write reports and capture data
- Communication skills
- Maths' skills
- Time management
- Safety training
- Problem solving
- Working with people – values such as respect and understanding of diversity within the workplace
- Being an effective team member

Specialised skills and knowledge needs:
The following list of knowledge skills have been identified as a need by aquaculture farm managers and aquaculture professionals. Many of these have also been cited by stakeholders as critical or scarce skills within the industry.

- Veterinarians qualified for aquaculture
- Designing and building of efficient aquaculture systems
- Hazardous and Critical Control Points knowledge
- Quality assurance and food safety
- Brood stock selection
- Breeding and larval rearing
- Aquatic (Aquaculture) specific laboratory skills
- Technical divers for building and maintain offshore systems

9. Scarce or critical skills and knowledge as indicated by stakeholders

Managers and experts (professionals) in industry were asked to comment on what they perceived to be the scarce skills within the industry. These skills have not been listed according to frequency, as the perceptions of different individuals across different disciplines in aquaculture have been collected.

- Management skills
- Business skills
- Practical skills fish knowledge technical skills
- HACCP systems management
- Hatchery biological skills
- Technical skills (Plumbing, electrical and welding)
- Industry packaging specialists
- Aquaculture Veterinary specialists
- Aquatic animal health specialists
- Designing and building aquaculture systems
- Qualified skippers in the mussel and oyster industries
- Qualified divers in the mussel and oyster industries
- Feed manufacturing knowledge

It can be noted that skills such as management skills, business skills, and knowledge of animals, technical skills, HACCP and aquatic animal heath knowledge perceived to be scarce within the industry, have also been indicated as a need by aquaculture farm assistants, farmers and managers.

10. How people learn best

When respondents were asked how they learnt best, 97% of aquaculture farm assistants and aquaculture farmers indicated that they learn best by on-the-job training. They all also indicated that a combination of theory and practical is important, with the practical component being larger. In their view, the practical-to-theory ratio should be either 60% practical and 40% theory or 70% practical and 30% theory. Approximately 3% of aquaculture farm assistants and aquaculture farmers indicated that they preferred classroom learning to practical learning. When asked where they would prefer to learn, 85% of aquaculture farm assistants and aquaculture farmers indicated that it would be preferable for training to happen at the workplace, with 15% indicating that they would prefer attending training away from work at a training centre or a college or university.

Approximately 60% of aquaculture farm managers indicated that they learnt best when getting a theoretical foundation and having the opportunity to practically apply what has been learnt in the classroom; 15% of managers indicated that they learnt best on-the-job and 25% indicated that they learnt best in the classroom. When asked where they would prefer to learn, 75% of managers indicated that they prefer training at the workplace, while 25% would prefer to attend training away from work at a training centre, college or university.

The preferred learning style of the majority of respondents was a combination of practical and theory. This would be an essential consideration when planning interventions in the aquaculture industry.

11. Perceived barriers to gaining opportunity for learning or training

Participants were asked what they felt were barriers to learning that they had faced:

These have been listed in order of frequency:

- Lack of finances.
- Not enough time to complete studies while working. Respondents indicated that they work most of the time and have family responsibilities at home.
- Lack of education – Respondents indicated they did not have the required minimum education standard to do courses.
- Lack of communication skills – English reading and writing is not at the required proficiency level and therefore access to courses is limited.
- Age – Many felt they are too old to learn, as they have not been a part of formal learning for a long time.
- Lack of knowledge of where to gain access to learning.
- No opportunities at work.
- Personal fears, such as lack of self-esteem - Many participants felt they may not be able to meet the required standards.

Approximately 97% of participants cited the lack of funds as a major barrier to gaining knowledge and further education in the aquaculture industry. A lack of time to complete studies and meet family responsibilities was cited by 75% of participants as a barrier, as most of their time was spent at work, and family responsibilities also added to the lack of time to complete further studies after hours. Lack of education was mentioned as a barrier to gaining further education and training by 60% of participants. This was especially evident among aquaculture farm assistants and aquaculture farmers. Participants who are not English literate (lack reading and writing skills) said that the lack of English communication skills prevented them from gaining further education and training. A small percentage of participants said that the lack of knowledge of where to gain access to learning and not having opportunities at work were barriers. A small percentage said that their age and personal fears, such as lack of self-esteem, were barriers for them to gaining further education in the field of aquaculture.

What managers look for when interviewing potential employees

Managers were asked what they look for when interviewing potential employees. Most managers mentioned that they are interested in the person having the right attitude, and those without prior training could be taught on the job. This was especially evident with regard to elementary occupations, whereas those being interviewed for aquaculture farm manager or professional positions, an aquaculture-related qualification was required.

12. Human Resources-recommended interventions

Human resource managers, training managers and human resource practitioners were asked their opinion on what interventions they would recommend for the aquaculture industry. These are listed below:

- Training of practical farm skills
- Mentorship programmes to be implemented for succession planning
- More extension officers required – extension officers to receive aquaculture-specific training
- Knowledge of basic chemistry
- Basic numeracy and literacy skills – Adult Education and Training interventions are recommended
- Basic biology – qualifications or short courses that teach animal biology
- Communication skills
- Computer skills – specifically skills required to use programmes for data input and report writing
- Mechanical skills
- Time management
- Laboratory skills
- Environmental impact assessment skills and knowledge
- Encouraging the development of new technologies

- Alternative sustainable feeds – programmes that specifically support the research for the development of alternative sustainable feeds
- Diseases' knowledge – interventions that assist in gaining knowledge of diagnosing and treating animal diseases.

13. Recognition of Prior Learning

The person responsible for human resources and aquaculture farm managers were asked what they understood by Recognition of Prior Learning (RPL) and whether they felt that this would be a useful intervention. Most indicated that they understood the meaning of RPL. The response as to whether it would be a useful intervention, varied. Most responded that it would be beneficial to offer RPL to those who have been in the industry for a long time, and who have worked across the various disciplines. However, they also indicated that due to most people working in a specific area on a farm and most workers having likely had little or no exposure to the different areas of the aquaculture operation, there would be gaps in the knowledge and skill of workers.

The solution that had been put forward the most was a combination of RPL and Training. A person could begiven the opportunity to complete RPL for areas where knowledge and skills are established but offered training and assessment in areas where there were gaps.

14. Recommendations for interventions

Taking into account the quantitative and qualitative data received through this survey, ten interventions are recommended. These interventions include education, training and skills development interventions across all occupation groups targeted. These are not listed in order of priority, but suggested as high, medium or low priority.

According to the aquaculture yearbook published in 2014, the Western Cape has the largest aquaculture industry in terms of full-time employment followed by the Eastern Cape, Limpopo and Mpumalanga. This suggests that training programmes should be addressed in these provinces first, for maximum benefit (Aquaculture yearbook 2014).

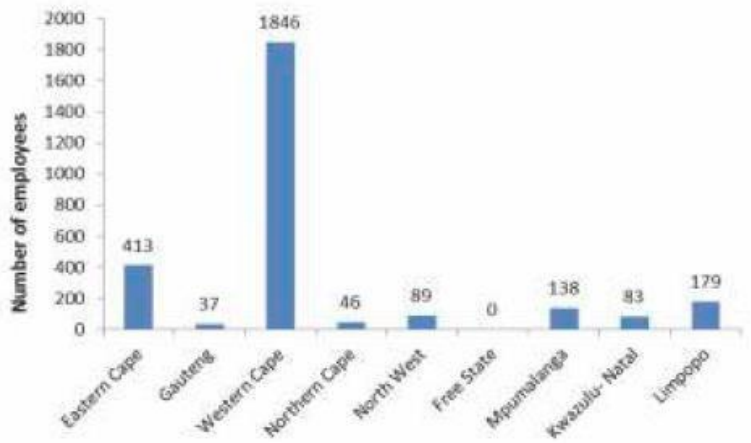

Figure 63: Full-time employment in South Africa's aquaculture sector in 2013

1. Adult Education and Training (AET):

High priority - Immediate implementation recommended

A large percentage of aquaculture farm assistants and aquaculture farmers have not completed formal schooling. It is recommended that the literacy and numeracy levels at all levels of the organisations be determined through an English Language Skills Assessment (ELSA). This assessment assists in determining the literacy and numeracy levels of a person. From this assessment, a programme is recommended to be made available to give workers the opportunity to improve their literacy and numeracy.

The recommended process is as follows:

1. Secure funding for Adult Education and Training (AET) programme– AgriSETA has, for example, in the past made AET grants available.
2. Determine the functional literacy and numeracy levels of employees in the industry, using a tool such as English Language Skills Assessment (ELSA). This tool is used to determine the functional literacy and numeracy of a person, and in turn the AET level of the person tested (L1 – L4).

3. Level of appropriate AET training to be offered to employees determined, based on their ELSA assessment.
4. For those who are above an AET 4 Level but may not cope with the literacy and numeracy fundamentals in the planned aquaculture qualifications - a communication and maths bridging programme is recommended.

The above is a broad overview of the recommended initiative.
It would be recommended that a programme be initiated as soon as possible, as this would ensure that when the process of developing the new aquaculture qualifications is completed, employees have the appropriate literacy and numeracy skills to gain access to the qualifications.

3. Accessibility to the aquaculture qualifications currently being developed:

High priority – Implementation recommended as soon as this qualification becomes available

It is recommended that the aquaculture qualification currently being developed, be accessible to farm assistants and farmers in the aquaculture industry.

Due to there being a number of small aquaculture businesses that do not pay SDL or are not affiliated with a SETA, it is recommended that those working in these organisations also have access to these qualifications. A recommended intervention is to source funds to make the qualification accessible to all organisations in the aquaculture industry.

4. Supervisory training:

High priority - Immediate implementation recommended

Aquaculture farmers across all sectors of the aquaculture industry have indicated a need for supervisory skills. It is recommended that different supervisory training programmes be investigated, and one that meets the needs of aquaculture farmers within the aquaculture industry be selected. I Where needed; the training can be adapted to meet the specific needs of aquaculture farmers in the aquaculture industry.

This training programme should address topics such as people management, business management and budgeting.

5. Management interventions:

High priority – Immediate implementation recommended

Managers across all sectors have indicated the need for management skills, with particular reference to people management and business management skills. It is recommended that various business management programmes be investigated, and one that meets the needs of managers within the aquaculture industry be selected, and - if needed - adapted to meet the specific needs of managers in the aquaculture industry.

6. Develop an Aquaculture-specific technical qualification:

Medium priority

Technical skills have been identified as a need by workers in the aquaculture industry. This has also been indicated as a set of scarce skills by managers and professionals in the industry.

It is recommended that the viability of developing a qualification or skills programme for aquaculture technicians be investigated.

7. Aquaculture veterinary courses, qualification, or specialisation to be investigated:

High priority – Immediate attention should be given to this

Aquaculture veterinary practitioners are scarce in South Africa. There is not currently a channel for South African veterinarians to study or specialise in Aquaculture Veterinary. It is recommended that the possibility of including aquaculture-specific training or courses be investigated as part of a Veterinary Sciences degree.

8. Research funds for feed manufacturing:

Medium to high priority

Aquaculture-specific feed manufacturing has been indicated as a scarce skill. It is recommended that funds be made available for the research and development of feeds and feed manufacturing in South Africa.

9. Short courses and skills programmes to be made available to organisations in the aquaculture industry:

Medium priority

One of the major barriers to gaining knowledge and skills in the industry has been indicated as the lack of finances. Several "soft skills" have been indicated as a need in the aquaculture industry. It is recommended that funding be made available for short courses and skills programmes needed by aquaculture farm assistants, aquaculture farmers and managers in the industry.

Each organisation will have different needs, but universal needs include diversity training, problem solving skills, budgeting skills and others listed in the section on skills need.

10. Make information available to organisations pertaining to SETAs and access to funding:

High priority – Immediate implementation is recommended

It is recommended that a document be circulated to all aquaculture organisations informing them of the Skills Development Levy, joining an appropriate SETA – mostly AgriSETA - and learnerships and funding opportunities available through the SETAs.

11. An intervention specifically directed at building positive relationships with aquaculture farmers

High priority

With the above interventions in mind, it would be recommended that any interventions implemented be done with the purpose of building positive relationships with aquaculture business owners and managers, especially in the freshwater sector.

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