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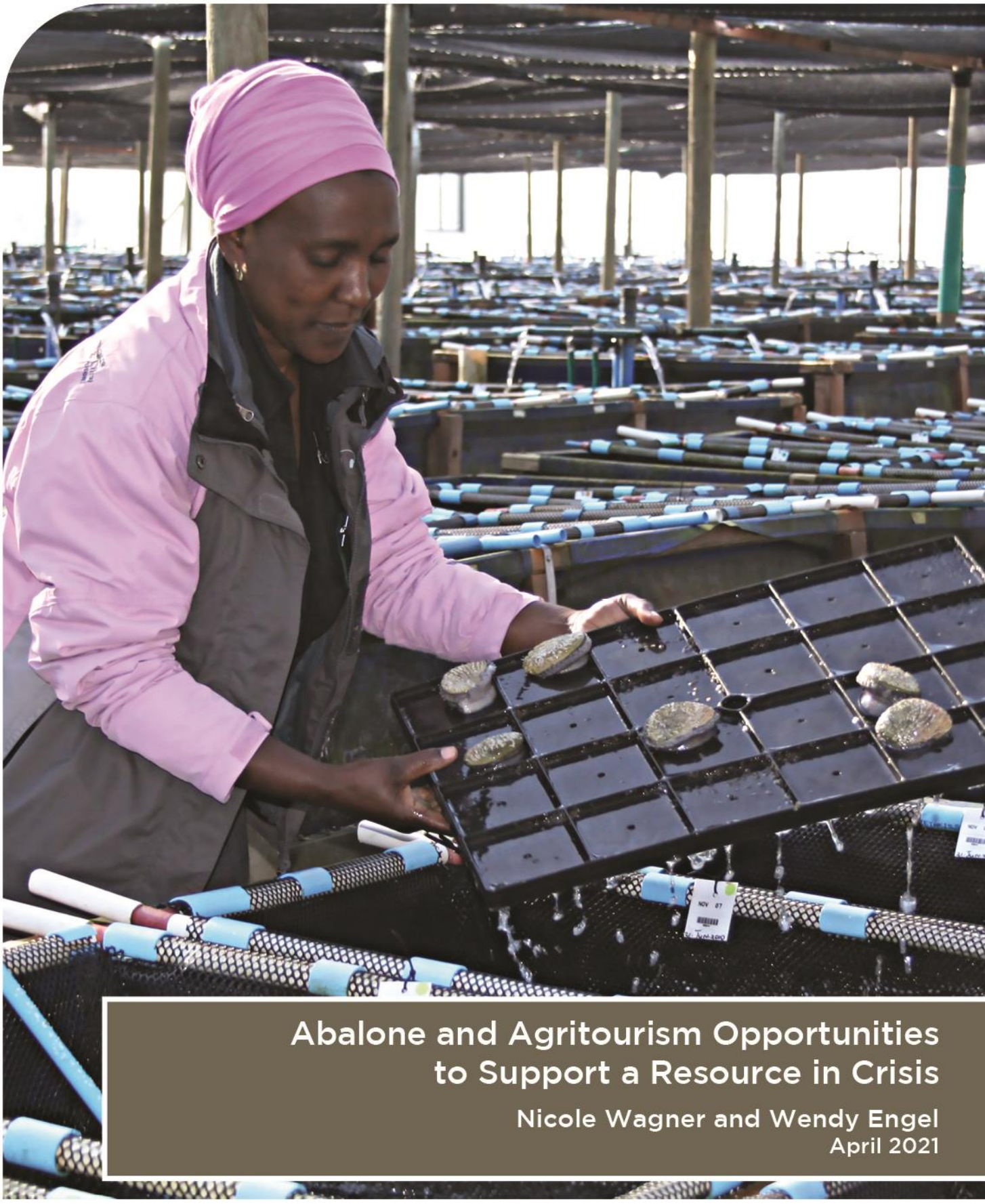

Abalone and Agritourism Opportunities to Support a Resource in Crisis

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Executive Summary

The ability to cope with a changing climate, increasing competition for scarce water resources, rising unemployment and the ongoing energy crisis calls for a shift towards more resilient agriculture to diversify economic growth and lower dependence on more traditional agricultural commodities. The United Nations' Sustainable Development Goals identifies the critical role that marine aquaculture plays in global food security and economic growth. Similarly, in South Africa, aquaculture is recognised in Operation Phakisa for the contribution it plays in economic growth and sustainable livelihoods. For the Western Cape Province of South Africa, home to the largest number of marine aquaculture farms and associated value chain industries, the benefits of growing this sector extend to poverty reduction in coastal communities where unemployment levels are high with dwindling fisheries' growth. Creation of new jobs in agriculture and the sustainable use of marine resources have benefits for local communities.

Agricultural abalone, a form of marine aquaculture, known as *perlemoen* in South Africa is farmed globally, either on-shore or ranched in oceans. Farmed abalone earn high levels of foreign exchange as a high value export commodity with the largest number of consumers in the Far East. This high-growth industry has the potential to contribute to revenues, sustainability and social upliftment in South African rural communities residing along the coastline. Abalone farms have higher levels of employment compared to other forms of aquaculture particularly in coastal communities. This provides a viable alternative to illegal harvesting (poaching) in combination with other social upliftment programmes and rich food culture to offer as a tourism experience. Hence, it presents unique opportunities to grow the sector and protect the resource.

South Africa is one of the three of the largest abalone producers globally with the majority of farms located in the Western Cape Province, with highest concentration in the Overberg region. Increasing prices led by growing demand and access to common marine resources have led to overexploitation, placing entire ecosystems at risk of collapse. Despite quota reductions and policing efforts, export prices continue to increase and world imports exceed legal production levels, indicating that markets continue to consume abalone from illegally harvested sources. Illegal poaching of abalone remains a major threat to economic viability of the abalone value chain. In addition to policing efforts, improved socio-economic conditions may contribute to offsetting environments where illegal harvesting thrives. Opportunities in the abalone aquaculture industry combined with agritourism and collaborative international trade requirements may be part of the solution to this very complex problem.

Abalone aquaculture can legally, and sustainably, supply high-quality products to markets without compromising on quality or price. Since aquaculture farms can

ensure that the species reaches full maturity before entering the market, the sector can ensure a sustainable future source of the product and maintain premium quality.

The expansion of abalone aquaculture and associated agritourism has the potential to create jobs and generate export earnings, providing improved socio-economic conditions to offset illegal poaching of abalone. The benefits of developing the marine aquaculture industry linked to tourism speaks to the National Development Plan 2030 that has identified tourism as an opportunity to expand livelihoods. Producers can leverage the benefits of destination marketing and offer culinary experiences that leverage wine tourism to attract visitors to the area, leading to extended stays and increased spend. Agritourism presents opportunities for the rich heritage of South Africa's abalone food culture to be shared with local and global tourists to build the brand of the country's premium abalone product, creating consumer awareness. Three specific agritourism opportunities exist. Firstly, abalone in restaurant culture, particularly in association with wine tourism. Secondly, abalone tourism targeted at Far East business or leisure travel. Thirdly, food culture tourism focused on tours giving tourists local food experiences, abalone diving excursions, etc.

The role of consuming markets need to be part of a sustainable regulatory solution to combat illegal poaching. With the growing demand for abalone products in Asian markets, the tragedy of the abalone commons cannot be limited to the South African context. Collaborative international efforts for traceability to support legally sourced products plays a significant role in regulating trade. Since such high value is placed on these products, importing countries need to take responsibility for the protection of the resource in crisis and consider what they stand to lose once abalone resources have been exhausted.

In summary, the expansion of abalone aquaculture in the Overberg region together with upscaling related agritourism is presents a unique economic opportunity to uplift marginalised rural coastal communities, maintain South Africa's global presence for world class abalone products and contribute to solutions of sustainable management of marine resources.

Contents

List of Figures

List of Tables

1. Introduction

Producing high value agricultural products present opportunities for economic development and job creation. With its important role in global food production and food security, aquaculture operations are set to increase with human population growth and to offset natural resource depletion (Vasta, 2015). Aquaculture is increasingly being recognised for its potential economic contributions and as such, science-based management policies and regimes for trade have been put in place with a view of achieving sustainable aquaculture systems (FAO, 2020). With regard to sustainability, global awareness and the need to manage aquatic ecosystems have been prioritised since 2015, under the United Nations' Sustainable Development Goals (FAO, 2020). The Western Cape Province can realise many benefits of growing the potential of marine aquaculture to contribute to global food production, economic growth, employment, poverty reduction and the sustainable use of marine resources to benefit local communities (FAO, 2016).

In 2018, global fish production was estimated to be in the region of 179 million tonnes of which 82 million tonnes (valued at USD 250 million) came from aquaculture[1] production employing around 20 million people (FAO, 2018). When just considering farmed molluscs, volume amounted to 17.7 million tonnes, valued at USD 34.6 billion (FAO, 2020). More specifically, for farmed abalone[2], the 2016 figures for global production was 150 000 tonnes, with South Africa producing 1 660 tonnes (2.8% of global supply) (Chigumira, 2016). By contrast, illegally harvested abalone in South Africa was reported to be an average of 2 174 tonnes per year between 2000 and 2016 (with an annual average value of R628 million) (Okes, et al., 2018).

South Africa's aquaculture sector is relatively small, accounting for less than 0.2% of Gross Domestic Product (GDP), but given the potential for growth in abalone aquaculture, the sector has been earmarked by the South African government as a target sector under Operation Phakisa (InvestSA, 2020). Despite being a small market player in volume, South Africa is the third largest abalone producer after China and South Korea (FAO, 2016). South African abalone fetches good prices for their texture, taste, colour and quality (DAFF, 2018). Illegal harvesting however is a risk to economic viability of abalone industry, with negative impacts to local communities and long-term sustainability of abalone and associated marine resources.

[1] Aquaculture is defined as the growing of aquatic plants and animals for any commercial, recreational or public purpose (NOAA Fisheries, 2011).

[2] Abalone, a threatened mollusc of the genus *Haliotis*, are one of the most expensive seafood products with increasingly high demand in Asian countries, given cultural, traditional and medicinal associations with abalone (DAFF, 2018).

Innovative strategies are needed to mitigate illegal poaching and it is fundamental to include partnerships between communities and business, with greater certainty on long-term fishing rights to incentivise fishermen to protect coasts and stocks of abalone (Chigumira, 2016).

This report seeks to highlight economic and farming opportunities to support a valuable resource in crisis.

1.1 Background

Commercial abalone diving in South Africa dates back to the late 1940's, where volumes of up to 3 000 tonnes were recorded in an unregulated environment. Hence it has a long history and integral to fabric of rich and diverse food culture of coastal communities in South Africa. This freedom of common resources, growing demand from Far East markets and the increasing involvement of organised poaching, gave rise to the abalone ecological crisis that began as early as the 1970's (DAFF, 2018). Around the same time, ecologist Garrett Hardin conceptualised the "*Tragedy of the Commons*" as the conflict between users of common goods acting in self-interest, thereby depleting shared resources, rather than acting in favour of the collective good (Hardin, 1968). Marine resources are a classic example of the tragedy of the commons where ownership is incomplete and many users have access to marine resources.

As the actions of individuals continued to be contrary to the common good and wild stocks of abalone saw further depletion by the 1980's, followed by the introduction of commercial quotas to curb an imminent crisis. The apartheid regime at the time introduced policies to exclude black fishermen from the commercial fishing industry. Moreover, the restrictions on traditional fishermen from "coloured" coastal communities, where jobs opportunities are limited, led to engaging in illegal fishing activities to make a living (Oxpeckers, 2017). Towards the late 1980s, as border controls relaxed, organised crime controlled predominantly by Chinese syndicates began recruiting for the illegal poaching of abalone in these struggling coastal communities. The high poaching rate and the number of abalone prematurely poached saw the wild abalone population plummeting, which led to the government further lowering the Total Allowable Catch (TAC) as shown in Figure 1 (Oxpeckers, 2017).

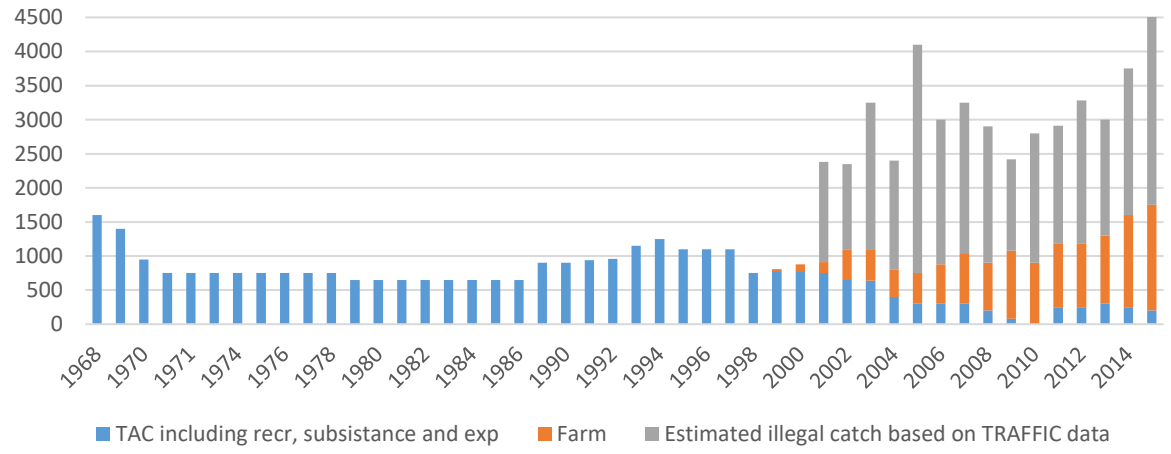

Figure 1: Legal, farmed and illegal abalone fishing in SA (tonnes), 1968 to 2015

Source: Chigumira (2016)

Recognising the vulnerabilities of wild abalone populations and with concerns about sustainable stock rates, in the 1980's Dr. Pierre Hugo (a veterinarian in Hermanus, Western Cape) started studying the potential of breeding abalone in captivity as an opportunity to protect stocks. His home-based experiments were successful and today his legacy and thriving business, Abagold, is a multi-million dollar organisation that continues to dominate and expand abalone aquaculture in South Africa (Antoni, 2018). A number of small operators entered the industry in the 1990s and by 1997 the first ten tonnes were produced (FAO, 2016). Some other abalone farms in the Overberg region include Aqunion, I&J, HIK, Tuna Marine and Buffeljags.

At the same time, exacerbated by social inequalities and high unemployment rates in South Africa, the illegal trade of abalone increased substantially in the early 1990's. With reduced fishing permits allocated to impoverished fishing communities, abalone poaching increasingly became attractive as a means to quickly earn "good money", albeit a risky occupation (Barron, 2018). Over time, illegal abalone fishing and declining stocks, along with changing ecosystem conditions resulted in drastic reductions in the number of abalone quotas issued.

Between 2008 and 2010, the commercial fishing of abalone was banned. When it was reopened in 2010, the annual quota was 150 tonnes per annum whilst recreational harvesting of abalone was suspended indefinitely by 2003 (Oxpeckers, 2017). Further to this, the ecological crisis also faced seaweed surges with the reduced number of abalone, giving rise to knock on effects in seal and shark interaction and other impacts on marine ecosystems (Oxpeckers, 2017). Figure 2 shows the estimated poached abalone in relation to the legal catch between 2000 and 2018.

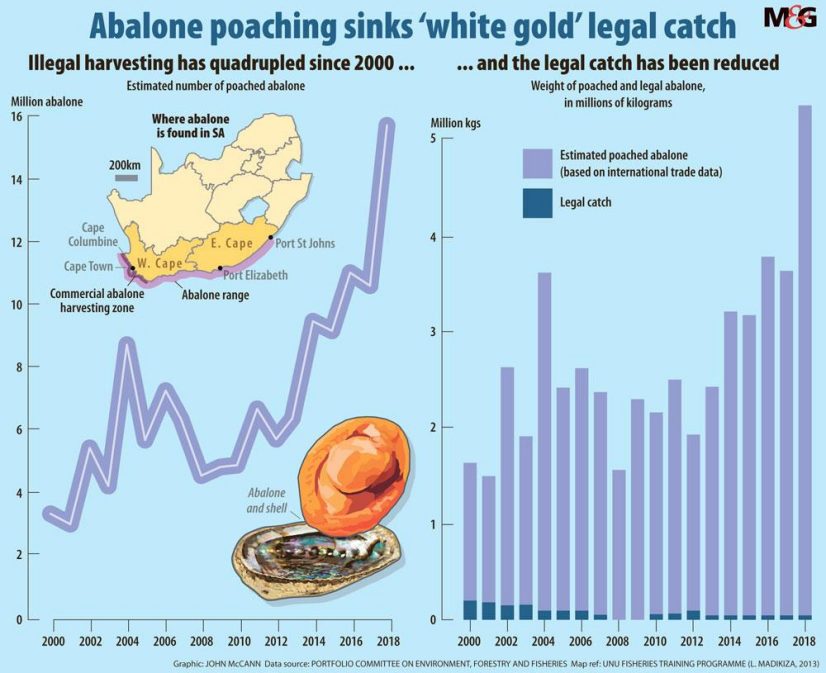

Figure 2: Estimated poached abalone versus legal catch, 2000 to 2018

Source: Smit (2020)

Despite abalone quota reductions and environmental impacts of over-exploitation, export prices for premium South African abalone continued to rise with TRAFFIC estimating the value of Illegal Unreported and Unregulated (IUU) trade in the region of R628 million (Okes, et al., 2018). Furthermore, world imports of South African abalone were reported to exceed legal production levels (Okes et al., 2018), indicating that markets were increasingly consuming abalone sourced by illegal abalone fishing. Okes et al. (2018) also reports on the analysis of trade routes between 2000 and 2016, suggesting that up to 43% of illegally harvested abalone was traded through sub-Saharan African countries that do not produce abalone, and primarily exported to Hong Kong. In the absence of trade regulations for South African abalone, poached abalone becomes legal imports in destination markets. It follows that both regional and international interventions are required to address the illegal trade of this high value product.

With demand increasing, abalone production activities in South Africa are expected to increase by up to 60% by 2021, with the five largest producers currently expanding their operations (DAFF, 2018). Table 1 shows *projected* farmed and fished abalone in tonnes and US dollars.

Table 1: Projected farmed and fished abalone in tonnes and value in US Dollars (USD)

Year	Tonnes	Value of production in USD
2016	2328	84 771 792
2017	2599	96 532 786
2018	2870	108 730 310
2019	3141	121 377 123
2020	3426	135 038 136

Source: Chigumira (2016)

In South Africa, prices have averaged between USD 30 and USD 50 per kilogram for several years, subsequently dubbed as "white gold" (Antoni, 2018) with the industry estimated at USD 60 million per year (Barron, 2018). Given this lucrative market, the industry is faced by a seemingly insurmountable poaching crisis. Despite being dependent on the common resource, the nature of abalone harvesting has limited incentive for practicing conservation: a classic example of the "*Tragedy of the commons*".

With more than 2 000 tonnes of abalone poached annually (Okes, et al., 2018), coupled with the slow rate of sexual maturation of seven years to nine years (Barron, 2018), the South African abalone population could face collapse as acting in self-interest trumps protecting the shared resource for the collective good. Ecosystems and social structures that depend on abalone resources may collapse too.

In his influential article, Hardin (1968) proposed that to avoid the tragedy of the commons, state ownership of the resource system or dividing the resource system (to be managed privately) may be required. However, in the current South African context, the response to such complex crisis needs to be approached from various angles and at different levels. Growing levels of poaching results in fewer opportunities for allocation of rights and inevitably influences the total allowable catch. The impact of inequalities, the role of marine resources historically managed by local communities and the lure export prices for poached goods would need to be part of the complex solution. Response to the multifaceted challenge of common resource depletion requires the collaboration of several organisations (both local and international). The Department of Environment, Forestry and Fisheries (DEFF), the South African Police Service, Worldwide Fund for Nature (WWF), Cape Nature and the Marine Anti-Poaching Unit are among the many organisations attempting to fight the poaching crisis. Though many arrests and convictions have been made over the years, the immense challenge remains and has become increasingly difficult to police (Barron, 2018).

In addition to policing illegal harvests, improved socio-economic conditions and the upliftment of certain communities, may contribute to offsetting environments where

illegal harvesting thrives. Sustainable employment opportunities, skills-based education together with general community awareness of the ecological crisis and a healthy understanding of natural resource stewardship are important elements required to move towards a shift in managing the tragedy of the abalone commons.

Opportunities in the abalone aquaculture industry combined with agritourism and improved (and enforced) international trade requirements may be part of the solution to this very complex problem. Abalone aquaculture is a growing industry that can legally, and sustainably, supply high-quality products (with a potential size advantage linked to market preferences) to markets that are willing to pay a premium for South African abalone.

Aquaculture farms can house up to ten million abalone at a time, ensuring that the species reaches full maturity before entering the market (Heart of Abalone, 2015), also ensuring a sustainable future source of the product whilst maintaining quality. Seaweed farming is an ancillary activity integrated with abalone farming that further reduces pressure on harvesting wild seaweed. Furthermore, given the daily requirements for feeding, cleaning and general maintenance, abalone and seaweed farms are labour-intensive operations with opportunities for long-term job creation (Antoni, 2018).

In the past, growth of marine aquaculture in South Africa has been limited due to a number of reasons, namely:

- The high energy coastline (strong currents and wave action);
- Risk of harmful algal blooms ("red tide");
- Limited number of naturally protected sites;
- Highly sought after coastal strip, with marine aquaculture competing with other activities e.g. real estate;
- Reluctance of financial institutions to lend money to potential farmers;
- Limited human resources in aquaculture research, management, technical and advisory services; and
- Expensive and complicated authorisation processes (DAFF, 2018).

South African aquaculture has more recently been identified as a key economic sector employment cluster. Policies, programmes and initiatives (National Aquaculture Strategic Framework, the Aquaculture Development Enhancement Programme and Operation Phakisa) were developed to support the aquaculture sector to accelerate growth and improve job creation, particularly in rural communities. The policy objectives are:

- To create an enabling environment that will promote the growth of aquaculture in South Africa;
- To promote transformation and broader participation in the aquaculture industry;

- To support and develop regulatory and management mechanisms; and
- To expand the resource base from the few species currently being farmed to a more diverse array of species (InvestSA, 2020).

In addition to the economic benefits of developing the marine aquaculture industry, the National Development Plan 2030 identified tourism as an opportunity to expand livelihoods. The agritourism and food tourism offerings available at some of the leading aquaculture farms is an opportunity to create jobs and have significant economic impact in local communities where economic opportunities are otherwise limited (Antoni, 2018). The potential for growth presents great opportunity for South Africa to grow the export base in a sustainable manner, without compromising on quality or price.

This report seeks to provide insights into industry market information and trade, additionally considering opportunities presented by aquaculture to protect the resource as well as the ecological and social systems that depend on it. The report considers aquaculture tourism opportunities to further support economic growth and diversification in the sector.

1.2 Overview

Abalone belong to the *Haliotidae* family that groups edible sea snails and marine gastropod molluscs. Over 100 abalone species belong to the genus *Haliotis* (DAFF, 2018), a large species of snail found in kelp forests and rocky reefs of temperate water environments (Barron, 2018). Abalone are found in large groups and plays an important role in marine ecosystems. However, declining populations are altering coastlines and marine habitats around the world (Barron, 2018).

The large marine snail with a shell length of 230 mm takes seven to nine years to mature (Steinberg, 2005). Abalone can be found in water temperatures between 9°C and 24°C, with the preferred temperature range between 16°C and 18°C. These cool temperatures are conducive to the growth of the abalone through all the development stages of its lifecycle.

Figure 3: *Haliotis midae*

Source: Farmer's Weekly (2019)

Water temperature plays a key role in the rate of development and growth of abalone, specifically in the earlier stages of the life cycle. If the temperatures are too high, larval development is hindered, whereas temperatures that are too low may result in slower growth and a longer than usual larval growth stage. In the optimal water temperature range, growth rates of approximately 1.6 to 1.8 mm per month can be achieved (DAFF, 2018).

There are five species of abalone endemic to South Africa, *Haliotis midae*, locally known as mother of pearl or *perlemoen*, is of great commercial value and can be found in shallow waters from parts of the Northern and Western Cape to the Eastern Cape (DAFF, 2018; Barron, 2018). In South Africa, abalone is cultivated mainly inshore on land-based tank systems, close to the shoreline for access to large quantities of seawater. Cage farming, suspended off sea-beds with kelp feeding, operates on a relatively small-scale basis in the Western Cape, as it is of an experimental nature at this stage. This is regarded as an economical way of reducing costs of infrastructure and development as required by land-based tank systems. Another method is ranching which is the release of juvenile abalone into wild within an allocated area, and once abalone reaches marketable size, harvesting can be done by permit holders (FAO, 2016).

The South African abalone breeding season is between March and October with spawning increasing between April and June (DAFF, 2018) and the majority of abalone farms for species *H. midae* are in the Overberg region of the Western Cape where water temperatures are in the optimal range (FAO, 2016). Hence, specific opportunities relevant to the Overberg region are provided in the latter part of the report.

2. Global Market

Growth in demand and consumption can be attributed to the growth in the world market, particularly as an Asian delicacy. Abalone can be consumed in a variety of ways: fresh, frozen, dried and salted, which offers year-round availability of product variations and presents opportunities to reduce geographical distance advantages, thus opening up markets further. Lau (2018) suggests that matured and dried abalone has an enhanced flavour that is attractive to Asian markets, a consideration for local producers. Abalone can also be sold as decorative household products and jewellery (Heart of Abalone, 2015). The wide range of products means that farmed abalone can be sold worldwide at any size throughout the year (Krohn, et al., 2016). Asian countries dominate production and consumption markets, and are the main markets for South African abalone exports. There is however more movement in abalone being marketed in local upmarket restaurants (FAO, 2016) that should be noted as an opportunity for local producers, particularly in leveraging wine tourism.

2.1 Market preferences

Market preferences and abalone prices are influenced by several factors namely: size, species, country of origin and type of product (i.e. fresh versus prepared). In Asia, abalone demand is generally divided by size, with the smaller abalone mainly produced in China and Korea fetching lower prices (wholesale USD 15/kg) than the larger, imported varieties (wholesale USD 50/kg and retail over USD 150). Chinese producers are increasing production of *Haliotis discus hanni* to offer additional products to Japanese markets, even though wild caught species is preferred in Japan (DAFF, 2018).

The Japanese consumer market is known for having specific preferences and being particular with regard to quality, flavour and texture. The local (and worldwide most expensive) *Haliotis discus hanni* species is preferred. *H. discus hanni* is generally large, premium quality abalone retailing at higher prices of around USD 1700 a piece, for wild caught abalone (Frost and Sullivan, 2015). The Australian wild caught abalone competes as a luxury product in China and Japan; however the Japanese still show preference for their local product (Australian Wild Abalone, 2015) and the demand for Japanese *H. discus hanni* is growing in China (Frost and Sullivan, 2015).

The South African *Haliotis midae* is an established top-quality product in the Asian market due to its unique flavour, texture, and size (comparable to the Japanese variety). *H. midae* is considered to be a premium product at a good price point, free from preservatives and bleaches (Krohn, et al., 2016). Prices are more dependent on size than product type for live, dried and canned abalone (DAFF, 2018); however, frozen abalone prices are somewhat lower. Canned abalone appears to be the largest traded category as explained in the sections to follow. According to Okes et al. (2018), most illegally harvested abalone is traded in its dried form.

2.2 Production

Globally, there are over 100 abalone species (*Haliotis*) however, only ten of these species are considered to have a commercial value, which are mostly found in China, Korea, Japan, South Africa, Australia, New Zealand, United States of America, and Mexico (Frost and Sullivan, 2015). The most valuable species, particularly when wild caught, is generally the Japanese abalone (*Haliotis discus hanni*).

Since the early 1970's, the total global quantity of abalone produced on farms has increased while the volume of abalone from natural fisheries continues to decline. According to the FAO (2016), total abalone production started increasing around 2006 and expanded rapidly until 2011 with an average yearly growth of 28% (DAFF, 2018). Declining fisheries stocks led to the increase in farmed production and the

establishment of the farmed abalone industry. A brief overview of the top producers is given below:

- **China and Korea** rapidly increased production in farmed production in the early 2000's, with Korea increasing production by 88% in 2010. China increased production[3] by over 170% between 2010 and 2015 (42 737 tonnes to 115 397 tonnes respectively), contributing to about 90% of global production by 2015 (Cook, 2016). The rapid increase in production in both China and Korea can be attributed to changes in production techniques. China's demand for seed and juvenile is a driver of Korean exports as well as demand from other Asian populations in other regions e.g. San Francisco (Cook, 2016). Producers shifted from suspended baskets on land-based farms to off-shore cage culture systems, as shown in Figure 4. Opting for cage systems gave rise to increased capacity and improved profit margins; however, cage systems are not without risks and has a higher probability of disease outbreaks given system densities in these regions (Cook, 2016). Another factor that led to the increase in production is the growth rate of Chinese High Net Worth Individual class, driving the demand for the abalone products (Frost and Sullivan, 2015).

Figure 4: Aerial view of an abalone aquaculture farm in Lianjiang County, Fujian Province, China

Source: Smit (2020)

- **Australia** is considered to be a major supplier of wild abalone, producing three types, namely: the Greenlip abalone, the Blacklip abalone and the hybrid Tiger abalone, which generally receives the highest market price because of its attractive shell (Frost and Sullivan, 2015). Abalone is Australia's fourth most valuable fisheries export, attracting prices over USD65/kg (GLOBEFISH, 2017) with a geographic distance advantage to Asian markets. Despite both wild and farmed

[3] The Chinese production area is located in the south provinces (Fujian and Guangdong) and focuses mainly on the production of the lower value abalone species (*Haliotis diversicolor supertexta*). In 2015, production started focusing on the *Haliotis discus hannai* which is the preferred species for export into Japan (Cook, 2016).

abalone being affected by disease outbreaks in the past, the industries are expanding and a valuable contributor to the Australian economy (Cook, 2016).

- **South Africa**n abalone (*Haliotis midae)* fetches high prices in Asian markets (mostly via Hong Kong) given good quality and high survival rate of the live abalone in transit. It is estimated that one fresh abalone can cost up to USD 250 (Oxpeckers Reporters, 2017). The farmed abalone industry is well established; and positioned as third biggest industry after China and Korea (Cook, 2016). The industry experienced major expansion of over 700% between 2000 and 2015 (DAFF, 2017). Expansion can be attributed to the maturity of the on-shore technology and the seemingly insatiable demand in Asia.

  The quality, size, similarity to Japanese *H. discus hannai* and price point of *H. midae* products makes it further attractive in the international market (Antoni, 2018). Though similar in taste, South African abalone can be larger than Japanese abalone that could be factored into price and a preference in Chinese celebrations (Lau, 2018), an opportunity to consider for farmed abalone in South Africa.

- **Chile** has been investing in abalone production since the 1980's, focussing on producing Red abalone (*H. rufescens*) and the Green abalone (*H. discus hannai*) (DAFF, 2018). Red abalone production reached 1 500 tonnes in 2010 (DAFF, 2018), declining to 1 200 tonnes in 2014 (GLOBEFISH, 2017) and further decline to 700 tonnes by 2015 (DAFF, 2018), mainly due to the impact of disease in farmed stock.

- Similar to Chile, the **Taiwan**ese abalone industry also suffered from disease problems and experienced a decline of 43% in production between 2010 and 2015 (from 300 tonnes to 171 tonnes) (Cook, 2016).

- In the **United States of America**, the market is limited to production in California and Hawaii. The US market is increasing with increased Asian populations; however most exports are destined for Asian countries (GLOBEFISH, 2017). Total production of farmed abalone was estimated at 362 tonnes during 2015, indicating an expansion of about 81% since 2010 (DAFF, 2018). Expansion may be limited given the competition for high land values along the Californian coast (Cook, 2016). Cities with increasing Asian populations should be noted for export opportunities.

- In **Europe**, abalone farming remains a small industry, mostly in their experimental stages of culturing *H. discus hanni.* Abalone aquaculture farms are based in the United Kingdom, the Channel Islands, Ireland, France, and Spain. Expansion will depend on the success of the current experimental stages (Cook, 2016).

- In addition to the higher production countries, commercial aquaculture also exists at much smaller scales in Canada, Iceland, Italy, Namibia, New Zealand, Oman, Thailand and the Philippines (GLOBEFISH, 2017).

2.3 Consumption

The increase in world abalone production has been driven by greater growth in demand for the product and in the various product lines in which it can be sold: live, fresh, or chilled, prepared or preserved (in cans and vacuum bags) or traded frozen, dried, or smoked.

Fresh or live products are considered to be of a higher quality compared to prepared abalone products; whereas, frozen and preserved variations provide opportunities to access markets that would otherwise not be penetrable. Canned abalone is often used for home preparation as it is cheaper and easier to prepare. Canned abalone from Taiwan, New Zealand and South Africa can retail at approximately USD 40-50 per 425g can in Singapore. Dried abalone have their own niche market in Traditional Chinese Medicine (Frost and Sullivan, 2015). Lastly, abalone shells could be traded for traditional medicine uses and as decorative items e.g. ashtrays, soap holders and jewellery (Heart of Abalone, 2015). A brief overview of top consumer markets is given below.

- **China** mainland **and Hong Kong** are by far the largest global markets for abalone and most of the Chinese production is consumed locally (GLOBEFISH, 2017) with Hong Kong also acting as a major distribution hub in the region. Chinese demand is continuously growing, to the point of decreasing exports to Japan. Abalone is considered a delicacy in Chinese cuisine, sought after for medicinal and nutritional value. Traditional Chinese medicine also uses the shell of abalone to treat various health ailments. Furthermore, abalone is customarily served at special occasions and is regarded as a symbol of status and wealth (DAFF, 2018). As a key trading partner, that enjoys preferential trade agreements with China and efficient trade infrastructure (Lau, 2018), the Hong Kong market is critical in any interventions to curb illegally sourced abalone and to foster a sustainable abalone market. According to Lau (2018), dried abalone traded across the China-Viet Nam border may be another area of interest for traceability regulations.

- **Korea**, similar to China, has consumption patterns rooted in the country's traditional cuisine. Abalone is consumed to support digestive and immunity enhancement, for its anti-tumour properties, as well as being a good source of protein and vitamins (Frost and Sullivan, 2015). Korea is one of the largest producers of abalone, therefore with abundant supply absorbed by the local market, abalone is no longer considered a luxury food in Korea (unlike in China) but rather a premium food product (Frost and Sullivan, 2015).

- **Japan** is one of the most attractive global markets for abalone products; receiving the highest prices for the local *H. discus hanni*. Consumption is also dependent on imports with a focus on high quality, fresh abalone products. In Japan, abalone is considered to be a luxury product due to its flavour, medicinal properties and strong influence of cultural history. The declining numbers of traditional *H. discus hanni* fishery operations and decreasing population of wild abalone has led to its premium price (Frost and Sullivan, 2015), making the similar South African variety more attractive.

- **Singapore** consumption is dependent on imports, with a preference for convenience ("ready to eat") food options in the younger market segment (Australian Wild Abalone, 2015). This could be a potential market for abalone producing countries to target (Australian Wild Abalone, 2015).

With the growing demand for abalone products in Asian markets, the tragedy of the abalone commons is not limited to the South African context therefore consuming markets need to be part of the regulatory solution. Since such high value is placed on these products, importing countries need to take responsibility for the protection of the resource in crisis.

2.4 Trade

The World Trade Organisation governs international trade information and the Harmonised System (HS-codes) classify goods into product nomenclature. A trade analysis on abalone is made particularly difficult since there are various products traded and each have had numerous HS-code changes in recent years. The advantage however is that each time changes have taken place, more detailed information is available. To limit confusion, this section will provide a trade overview of the major abalone products trade between 2012 and 2019 by using the following product groups (ITC, 2020):

- Live abalone (HS: 030781);
- Smoked abalone, Frozen abalone or both (combines HS: 030783, 030787 & 030789);
- Canned or preserved abalone (HS: 160557).

Starting with world exports, Figure 5 shows the value of world exports according to the major abalone products traded on world markets. There has been substantial increases of these products combined, growing from R5.4 billion in 2012 to R11 billion in 2019 (ITC, 2020). This represents an average annual growth of 11% over this period. The largest category, canned abalone, which make up around 60% of the total exports, grew by 16% per annum. The second biggest category was the export of live abalone with an export value of R2.6 billion in 2019, followed R1.9 for smoked and or

frozen abalone. These two segments have grown by 8.8% and 2.1% per annum since 2012, the former largely due to strong demand in China and Japan (FAO, 2017). The FAO (2017) reports that demand for live/fresh species resulted in record high prices in 2016, reaching as high as USD 80.

The decline in exported value in the past two years may be as a result of China meeting increased domestic demand, an earthquake experienced in New Zealand and possibly the impact of harmful algal blooms (red tide) in South Africa (FAO, 2017).

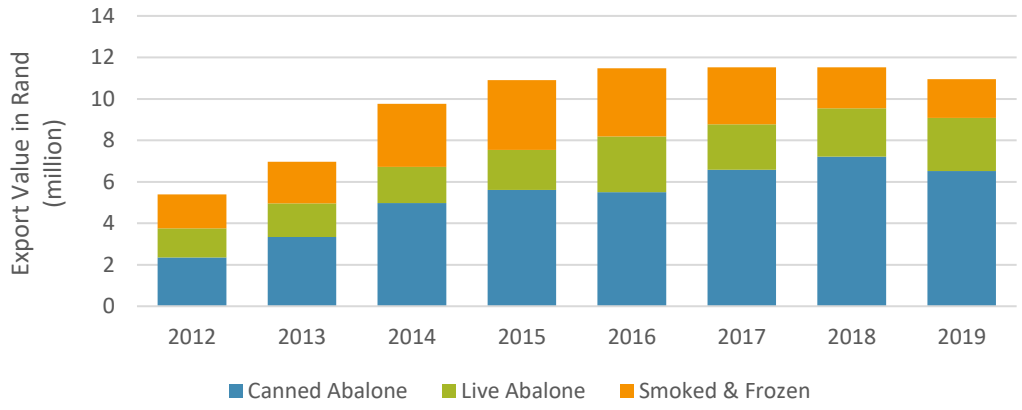

Figure 5: World Exports Value of Abalone products, 2012 to 2019

Source: ITC (2020)

Figure 6 shows the major exporting countries for each of the main abalone product categories based on the volume of exports. In total, world exported canned abalone reached 11 356 tonnes in 2019 with Mainland China as the biggest exporter (64%), followed by Hong Kong (7%) and Taiwan (6%). South Africa's share was 3%, which amounted to 312 tonnes exported.

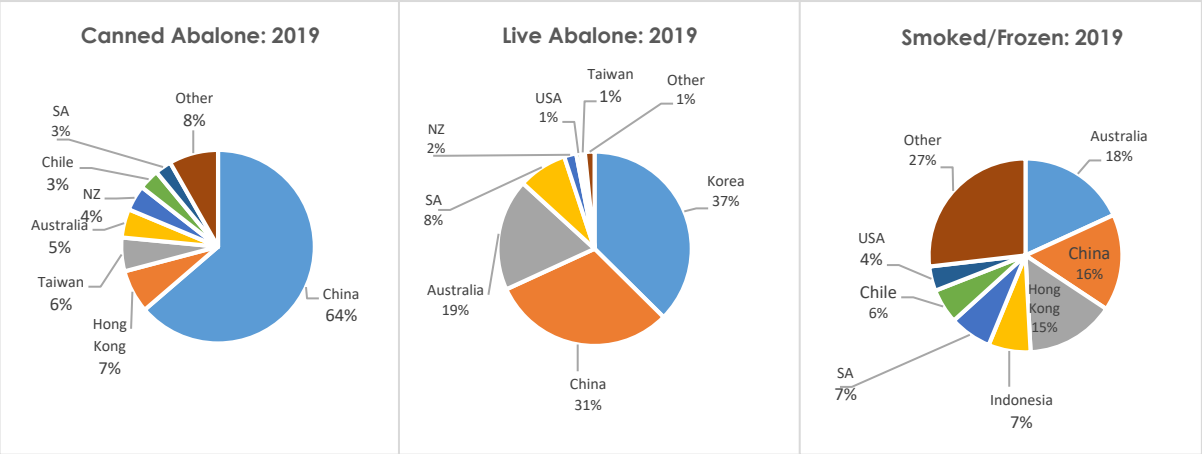

Figure 6: Main exporting countries by abalone production in volumes for 2019

Source: ITC (2020)

South Korea, China and Australia were the major exporters of live abalone for 2019 with a combined market share of 87% between them. South Africa ranked fourth with 436 tonnes exported. Lastly, smoked and/or frozen abalone were mainly exported by Australia, China and Hong Kong, followed by Indonesia and Australia (ITC, 2020). Australia and China hold the largest market share for the frozen category, 43.4% and 33.1% respectively, with South Africa ranking 11th, at a 0.7% market share. Chile (6.5%) is a strong Southern hemisphere competitor for frozen abalone, with a geographical distance advantage to the importing markets in the USA and Canada. Chile is not considered to be a major competitor for South African smoked, dried, salted abalone.

Figure 7 provides the trends in the unit values for world exports, which is considered a good proxy for general price changes in the abalone market. There has been growth in prices for all three categories from 2012 to 2019. For most part, the prices of canned abalone fetched the highest price, which was R574 per tonne in 2019. Canned abalone prices increased, on average and per annum by 4.1%, whilst live abalone and smoked and/or frozen abalone's prices increased 5.3% and 5.1% respectively.

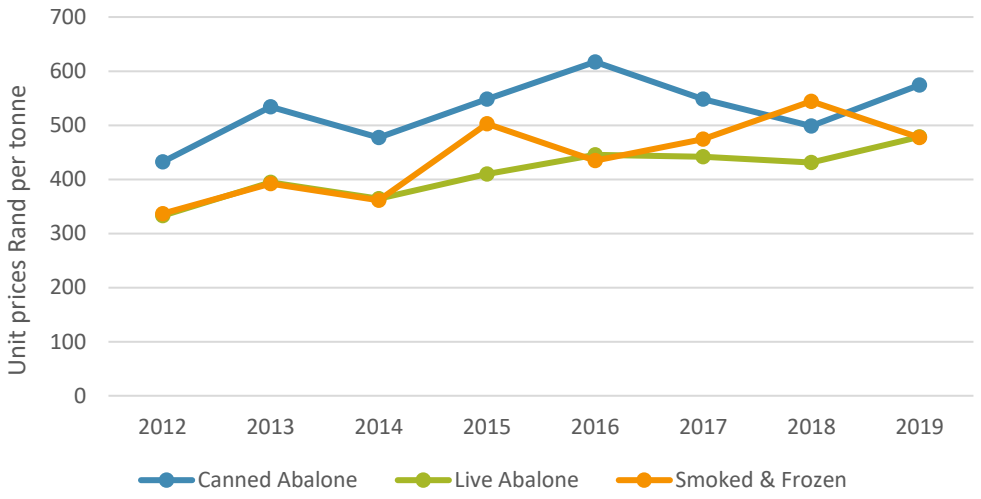

Figure 7: Trends in unit values (prices) for world exports

Source: ITC (2020)

Whereas the previous section dealt mainly with exporting of abalone products, the figures that follow focusses on imports.

Figure 8 shows the value of world imports according to the major abalone products traded on world markets. There has been substantial increases of these products combined, growing from R4 billion in 2012 to R8.1 billion in 2019 (ITC, 2020). This represents an average annual growth of 8% over this period. The largest category, canned abalone, grew by approximately 4% per annum. The live abalone category

grew from an import value of R1.2 billion in 2012 to R2.2 billion in 2019. The import value for smoked and/or frozen abalone grew from R1.1 billion in 2012 to R2.1 billion in 2019.

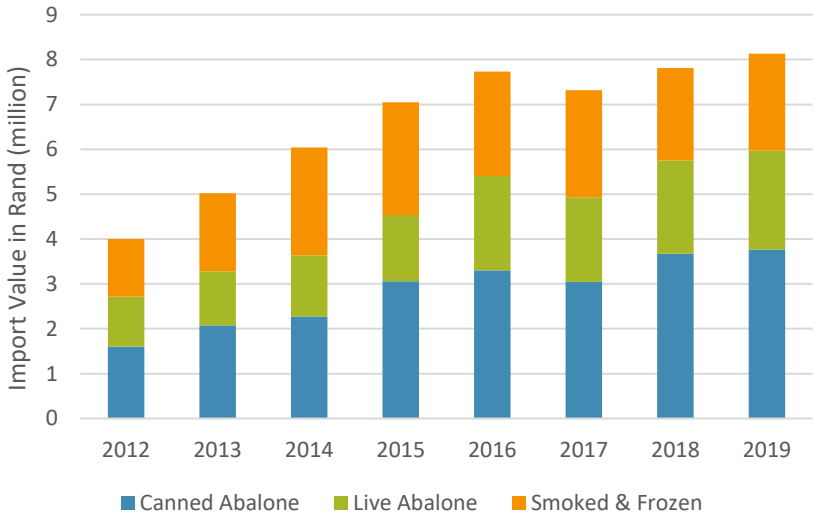

Figure 8: World Imports Value of Abalone products, 2012 to 2019

Source: ITC (2020)

Growth potential for canned abalone is noted; however the farmed abalone South African industry is fragmented in terms of marketing efforts with two main local brands dominating the market in terms of canned abalone products (DAFF, 2018). In order to compete with other leading exporters that could put pressure on abalone prices, local producers could collectively focus on establishing a sustainably sourced initiative to develop South African brands (Krohn, et al., 2016; DAFF, 2018) whilst maintaining productivity brought about by competition. Promoting South African will benefit all producers of any size, looking to supply the export market.

Figure 9 shows the major importing countries for each of the main abalone product categories based on the volume of exports. In total, world imported canned abalone reached 10 323 tonnes in 2019 with Hong Kong as the biggest importer (38%), followed by Singapore (19%). As noted earlier, Hong Kong is a major trade hub importing and re-exporting abalone to China. Japan, China and Taiwan were the major importers of live abalone in 2019 with a combined market share of 75% between them. Lastly, smoked and/or frozen abalone were mainly imported by Hong Kong (30%), Japan (22%) and Taiwan (19%), with Japan importing the most frozen product in 2019 (ITC, 2020).

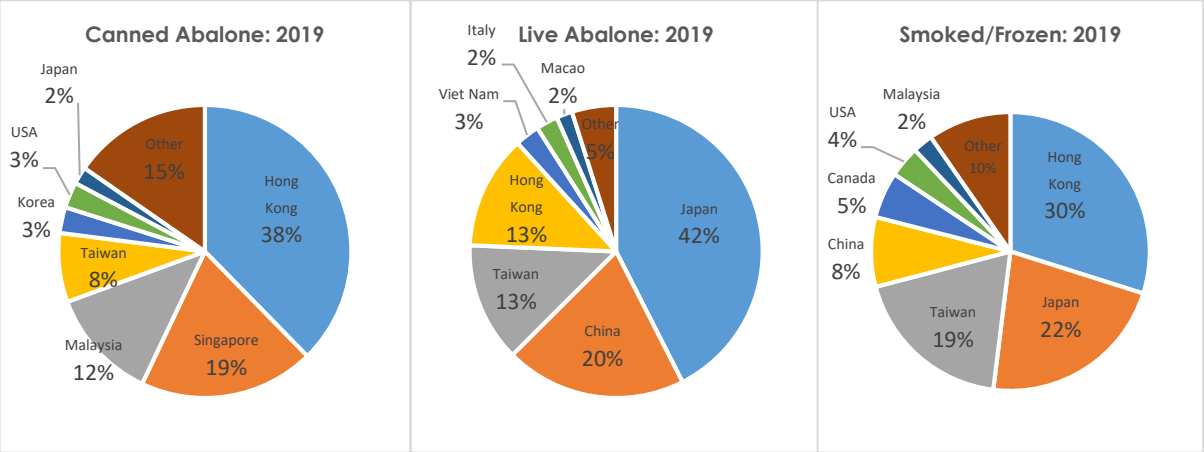

Figure 9: Main importing countries by abalone production in volumes for 2019

Source: ITC (2020)

The extent of trade that flows through Hong Kong across all product categories indicates the lenient regulatory controls of imported goods and highlights the need for regulatory intervention at an international level.

Figure 10 provides the trends in the unit values for world imports, as a proxy for prices changes in the abalone market. There has been growth in prices for live abalone imports from 2012 to 2019. Over the period 2012 to 2019, smoked/frozen abalone fetched the highest price at R499 per tonne in 2016, followed by canned abalone at R497 per tonne. By 2019, the product category with the highest price was live abalone at R478 per tonne with prices for canned and smoked/frozen abalone falling to R364 and R205 per tonne respectively (ITC, 2020).

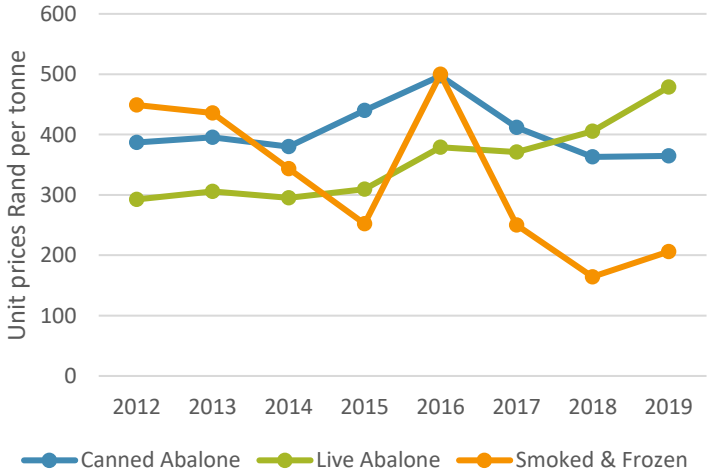

Figure 10: Trends in unit values (prices) for world imports

Source (ITC, 2020)

2.5 South African Export Performance

This section considers the current trade performance of South African fresh and preserved abalone exports (since South Africa remains a small player in terms of frozen abalone exports).

Figure 11 shows that the growth in the value of fresh abalone exports is driven by price increases as well as volume expansion, with unit values used as a proxy for price. Increases can be attributed to an increased demand for the product and the gradual weakening of the South African Rand. Chinese abalone aquaculture production rose in the region of 10% in 2013, seeing a decline in import prices (UCN, 2014).

A suppressed market in terms of volume over 2015/2016 may be due to environmental conditions at the time (harmful algal bloom/"red tide").

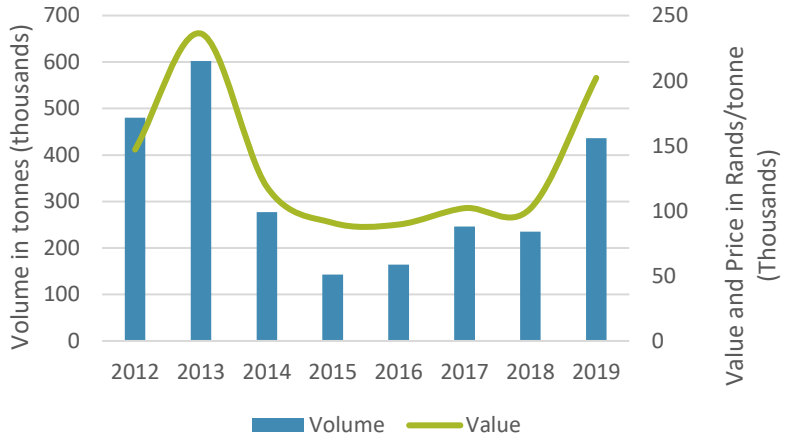

Figure 11: Volume and value of SA fresh abalone exports, 2012 to 2019

Source: ITC (2019)

South Africa's main markets for fresh abalone exports as shown in Figure 12. Hong Kong is shown as South Africa's biggest market, importing fresh abalone valued at R100.2 million in 2012 and peaking at R170.3 million in 2013. In the two years that followed, volumes dropped considerably to 228 000 tonnes in 2014 and to 134 000 tonnes in 2015. Export volumes to Hong Kong has recovered towards 2019 where the value of the Hong Kong market stood at R137 million with 303 000 tonnes exported. The next biggest markets were Taiwan and China with values of R45.7 million and R16 million respectively. Small pockets of regional interest are shown for Namibia, Eswatini and Zambia. South Africa's share of world imports peaked in 2013 with sharp decline following in 2014 and persisting through to 2017. Following a sideward shift in 2018, percentage share of world imports was reported to have increased in 2019, albeit not to 2013 levels.

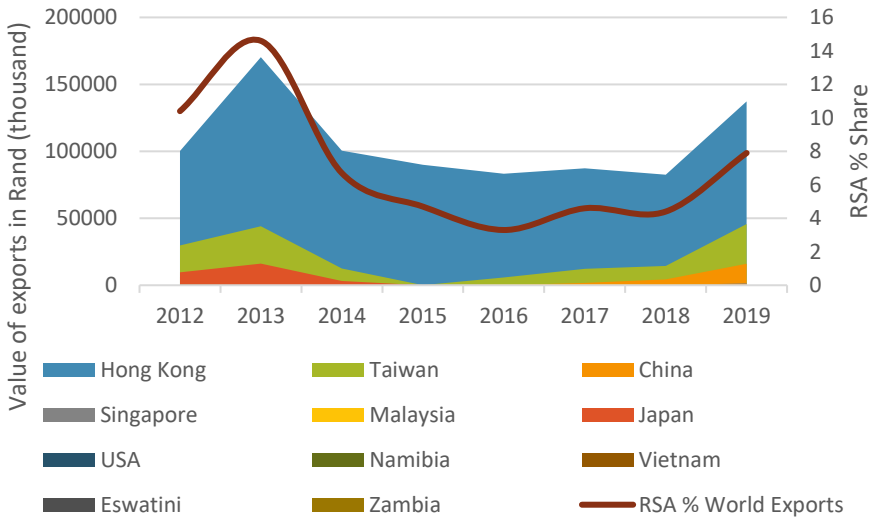

Figure 12: SA fresh abalone importers by value

Source: ITC (2019)

Figure 13 provides trade value for smoked, dried and salted abalone exported from South Africa between 2017 and 2019. Dried abalone has a greater per unit value than other forms and with a lower trade mass, more abalone per tonne can be transported (and over longer periods) and lucrative prices for dried South African abalone is also related to size (Lau, 2018).

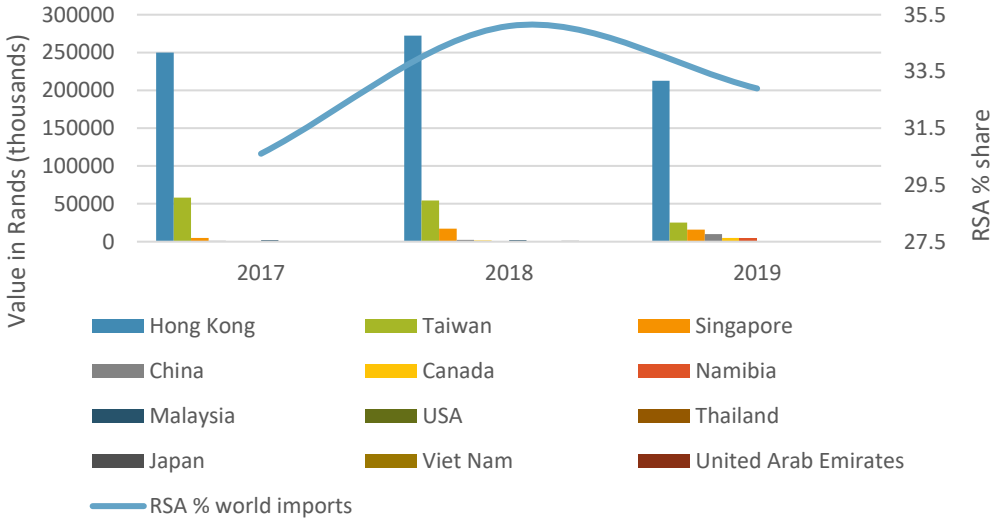

Figure 13: SA exports for smoked, dried and salted abalone, value between 2017 and 2019

Source: ITC (2019)

Hong Kong is the largest importer of South African abalone (*H.midae)*. According to Lau (2018), Hong Kong trade data[4] between 2000 and 2007, indicates that 74% of dried *H.midae* was exported from South Africa to Hong Kong. However, following restrictions between 2007 and 2015, exports dropped to 39%. At the same time, Lau (2018) reports that exports of *H.midae* from other (non-abalone producing) African countries increased. The extent of illegal abalone trade is highlighted, since these countries do not have commercial *H.midae* abalone fisheries and the species is endemic to South Africa. A regulatory "loophole" exists in that South Africa does not require health certificates for dried abalone as with live, frozen and canned variations and Hong Kong does not require health certificates for imports of abalone (Lau, 2018.)

The illegal trade routes as analysed by Okes et al. (2018) and referred to by Lau (2018) highlights the need to explore the traceability of *H.midae* products. Despite the success of blockchain technology for securing the value chain of fisheries (e.g. tuna), aquaculture has been a late adopter of blockchain traceability (Sourcetrace, 2020). The opportunity for South African abalone aquaculture will be considered later in the report.

3. Opportunities

In South Africa, harvesting wild abalone is managed under the TAC system but rampant poaching has put abalone resources at risk with insufficient time for stocks to replenish (Antoni, 2018). The emerging abalone aquaculture industry brings alternative opportunities to this dire situation, serving as a legal, sustainable means of ensuring that abalone continues to contribute to the South African economy[5].

The national government has identified the following opportunities and potential for aquaculture in South Africa:

- Contributing to food security;
- Creating sustainable jobs;
- Fostering economic development;
- Capitalising on export opportunities;
- Stimulating rural development and livelihoods;
- Attracting foreign direct investment; and
- Safeguarding environmental integrity (Semoli, 2019).

[4] Sourced from the Hong Kong Census and Statistics Department

[5] Refer to Table 1 for projected farmed and fished abalone in tonnes and US dollars in South Africa towards 2020

3.1 Abalone Aquaculture

In the National Aquaculture Policy Framework for South Africa (2013) aquaculture is defined as 'the farming of aquatic (marine or freshwater) organisms including fish, molluscs, crustaceans and plants in controlled or selected aquatic environments, with some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. This definition includes ranching and stock enhancement as aquaculture activities' (DAFF, 2013).

Despite being a developed industry with opportunity for investment, the industry still faces numerous challenges that should not be ignored. These include high energy costs, potential labour issues, high capital investment, long payback period and stringent regulatory requirements (Antoni, 2018).

Some of the costs and regulatory processes[6] to consider include Environmental Impact Assessments (EIAs) or Basic Assessments (for new and extended operations) depending on scale, footprint and production output. Land use rezoning or departure, costs of buildings, building regulations and approvals should also be taken into consideration. Scoping reports or EIAs may be required where wastewater is released into the environment and water quality would need to meet quality standards of the Department of Water and Sanitation. Furthermore, regulations for food safety for foreign markets and exporting permits would also need to be considered (DAFF, 2013).

South Africa's aquaculture sector is relatively small (accounting for less than 0.2% of GDP) and although the challenges above are noted, the sector has been earmarked by the South African government as a target sector under Operation Phakisa given its potential for growth (InvestSA, 2020).

3.1.1. General support programmes and initiatives in South Africa

- *Aquaculture Development and Enhancement Programme (ADEP)*: reimbursement of cost-sharing grants for machinery and equipment, bulk infrastructure, land and buildings, leasehold improvements, competitiveness improvements and work boats;
- *Operation Phakisa*: to speed up and simplify processes around the use of ports and unlock the Oceans Economy;
- *Feasibility Studies*: National government has prepared feasibility studies for major locally-farmed aquaculture species to establish minimum viability and to determine suitable locations. The studies include indicative costs for setting up facilities (InvestSA, 2020).

[6] Legislation and regulatory requirements is further detailed in the Guideline developed by DAFF (2013).

In general, abalone aquaculture is a labour intensive activity thus presenting opportunities for long-term job creation and economic growth (Antoni, 2018). The primary production systems (requiring daily, labour intensive tasks) are tanks, cage culture and ranching:

- **Tanks (RAS/flow-through):** Farmed abalone are mainly cultivated in onshore land-based tank systems close to the shoreline, providing access to seawater whilst being partially protected from environmental conditions such as harmful algal blooms (red tide) (FAO, 2016).

- A recirculation aquaculture system (RAS) is a series of culture tanks and filters where water is continuously recycled and monitored to keep conditions optimal all year round[7].
- A flow through system also uses tanks, consisting of an artificial channel or rectangular tanks constructed of concrete with water passing through an inlet and an outlet in the tanks once, before being discharged back into the environment.

- **Cage culture** involves the placing abalone in cages to contain and protect until harvest[8].

- **Ranching** involves the release of hatchery raised abalone into concession areas, where they will grow to maturity and be legally harvested (Antoni, 2018). Ranching aims to enhance wild stock for the common good without the intentionally benefiting a specific user group (DAFF, 2013). Ranched abalone is intended to be harvested by permit holders to ensure sustainability and has potential to contribute to livelihoods of local communities.

Substantial investment towards experimental ranching initiatives is required in South Africa. This also means that strong "buy-in" from coastal communities would be required for long-term ranching or fishing rights to incentivise the natural stock and rehabilitation of abalone local fishery (with a view to offset illegal harvesting) (Krohn, et al., 2016).

[7] Water is filtered and treated biologically using UV sterilization, ozonation and oxygen injection to neutralise harmful chemicals. The system may be a partial re-circulation system (only a very small percentage of the water is passed back into the system before being released) or a full re-circulation system (at least 10 per cent of the water is passed back). In general, a tanks allows for high-density production under controlled environmental conditions (DAFF, 2013).

[8] Floating cages are floating mobile units. Pen-cages are stationary-netted enclosures on the shore of the ocean, dam or river concerned.

3.1.2. The Overberg Region as an example of opportunity in abalone aquaculture

The Overberg region has a high dependence on agriculture, aquaculture (mainly abalone) light industrial/manufacturing such as agriprocessing and tourism for economic growth and job creation. In 1996, the agriculture sector was the biggest employer in the Overberg region, estimated to have employed 46 569 people (Overberg District Municipality, 2018). The sector has been adversely affected by climate change and experienced the impacts of drought for several years, including competition for scarce water resources. By 2017, the number of people employed by the sector reduced by about 25% (Overberg District Municipality, 2018). For many years the District has been proactively seeking out economic activities to supplement its agricultural and natural resource base and expand a tourism-based economy, particularly in communities where fishing activities have diminished and unemployment levels are high (Overberg District Municipality, 2018). The Overberg region (where water temperatures are optimal for abalone habitats) is well suited towards aquaculture development with various opportunities listed below:

- Established abalone farms and associated processing facilities provide employment and economic growth - Aquinion (employs in excess of 110 staff, 50 of which employed at the processing facility (Aqunion, 2020), Abagold (240 employees (Abagold, 2020), HIK (employs about 300 people from local community (HIK , 2020), Aquafarm Development (more than 85 people employed (Erasmus, 2012);
- Feed for abalone: Opportunity in feed production and export, not only for local abalone farms, but also to meet the increase feed demand and depleting stocks in China (Chigumira, 2016). For example, Abfeed based in Hermanus supplies abalone feed to local aquaculture farms as well as feed markets in New Zealand and the USA (Marifeed, 2020);
- Research and Development: opportunities in abalone diets are ongoing and the continuous requirements for monitoring system and water quality is an opportunity for job creation. Opportunities further extend to collaboration with local universities;
- Opportunities extend to value adding processes associated with the industry such as transport, canning, packaging, logistics, technology and equipment supplies (Lau, 2018); and
- Renewable energy: Opportunities around introducing cost-saving elements in terms of renewable energy (solar and/or turbine) (Erasmus, 2012) given the ongoing energy crisis and costs in South Africa.

3.2 Agritourism and abalone aquaculture

Tourism is viewed as an effective means of economic diversification from the traditional dependence on agriculture in many economies (Overberg District

Municipality, 2018). Agritourism and related food tourism has the potential to contribute to the sustainable competitiveness of a destination (du Rand, 2006).

Agritourism is defined as "any activity in which a visitor contemplates farm landscape or participates in an agriculture process for recreation, leisure" (Tew & Barbieri, 2012:216) or educational purposes (Gill Arroyo, et al., 2013) not readily available in urbanised areas (Rogerson and Rogerson (2014b). Agritourism activities have gained importance given the relationship to resource protection (Barbieri, 2010), the opportunity it presents for farmers to diversify farm income (Engel & Wagner, 2019) and its role in job creation and economic growth for rural communities (Adrian, et al., 2012). Whilst there has been a growing body of knowledge on terrestrial farm based agritourism (Tew & Barbieri (2012); Rogerson and Rogerson (2014b); Barbieri (2010)), mostly focused on wine tourism, the role of food tourism has received little attention in destination marketing literature in South Africa (du Rand, 2006).

Food tourism is recognised as part of local culture, a component of local agriculture and economic development. Food as a tourism product and experience, if developed and executed correctly (du Rand, 2006), can be a key element of competitive, destination marketing (Hall, 2003). For example, in Australia and New Zealand, wine tourism networks have been a catalyst for developing and promoting the food tourism industry. Similarly, in Europe a number of regions (particularly Italy and France) utilise their reputation for food and wine to market tourism and destinations e.g. Bordeaux, Champagne etc. South Africa, rich in culinary resources with diverse offerings across the nine provinces, has great potential to capitalise on food tourism and competitive destination marketing (du Rand, 2006).

3.2.1. Abalone aquaculture tourism opportunities in the Overberg

The Overberg region, especially Hermanus, is well-known for its whale tourism and has been a tourism destination for locals and international tourists for many years. However, agritourism and abalone aquaculture is fundamentally different from traditional tourism goods and services and should be recognised as a basis for sustainable competitiveness for the region (du Rand, 2006). The packaging and marketing of abalone agritourism could contribute to making the sector more resilient. Examples of abalone tourism opportunities follow.

3.2.1.1 Aquaculture farm tours

Internationally, marine aquaculture in Cyprus for example, has been expanding for educational purposes but mostly viewed as a contributor to tourism to support tourist demand for fish resources, whilst taking precautionary measure to protect the environment (Stephanou, 1999).

Marine aquaculture, more specifically abalone, has a long culinary history and heritage in the coastal town of Hermanus in the Overberg region of the Western Cape. The well-known aquaculture farm, Abagold, started aquaculture activities in the 1990s and began exporting in the early 2000s. Today Abagold is a multimillion-dollar business with a successful processing factory as well as farmed feed manufacturing plant (Antoni, 2018). The industry has expanded in the region with more than a dozen farms, along the Overberg coast e.g. Viking, HIK, Buffelsjag, Tuna Marine, I&J and Aqunion (Antoni, 2018). Abagold identified economic opportunities in agritourism and has seen the benefits of including tourism as part of their activities (Vasta, 2015), by offering farm tours and culinary experiences (Heart of abalone, 2015).

Abagold's "Heart of Abalone" is the tourism leg of the business that conducts daily guided walking tours on the history of abalone in South Africa, species biology and infrastructure required to farm millions of abalone. The experience includes a walk-through of the facility where guests can touch and taste the delicacy in various forms, possibly paired with local wines. Offerings also extend to shell souvenirs, jewellery, recipe books and canned products (Heart of Abalone, 2015). Online reviews of the tours is an indication of its growing success. These tours have created new jobs and generates awareness of farmed abalone, as well as the importance of legally sourced abalone products. Opportunity exists for other abalone farms to include guided tours as part of their offerings too.

3.2.1.2 Culinary experience and sustainability

Abalone features on the menus of numerous top-rated restaurants in Hermanus. The development and success of agritourism and food tourism of this nature has become more significant since Hermanus was awarded the UNESCO City of Gastronomy in 2019 (Pretorius, 2019). The UNESCO Creative Cities are recognised for innovative thinking and practices that contribute to achieving the Sustainable Development Goals. Of the 66 Creative Cities, only ten were recognised for gastronomy, with Hermanus being one of them (and a first for Africa) (Pretorius, 2019).

The international recognition of this region as a centre of culinary excellence creativity and sustainability, speaks directly to the role of abalone aquaculture agritourism (and food tourism) to support this resource in crisis.

3.2.1.3 Niche tourism for the Chinese market

The Overberg District's ability to cope with a changing climate, competition for water, unemployment and the energy crisis can be improved if it moves towards more resilient activities, and diversifies economic growth to lower dependence on traditional agricultural activities (Overberg District Municipality, 2018). Tourism is not only a means of economic stimulation; it is also a field through which businesses can

create positive socio-economic, cultural and environmental interactions in the Overberg region (Overberg District Municipality, 2018).

Niche tourism (such as culture and food tourism) is a concept that emerged to counter mass tourism and offer more sustainable and meaningful experiences to travellers. It can attract high-spending tourists and has the potential to include more micro tourism suppliers. Even though niche markets are often smaller than mainstream tourism market sizes, niche offerings may lead to higher yields per visitor in terms of foreign exchange earnings and consumer spending (Overberg District Municipality, 2018).

Given that China is a main market for abalone products, the Chinese travel market in South Africa may be considered as a target for niche (abalone) tourism. Figure 14 provides a snapshot of the China travel market, by illustrating the number of arrivals in South Africa versus the Western Cape as well as the average spend in South Africa and the Western Cape respectively (between 2014 and 2018) (WESGRO, 2019).

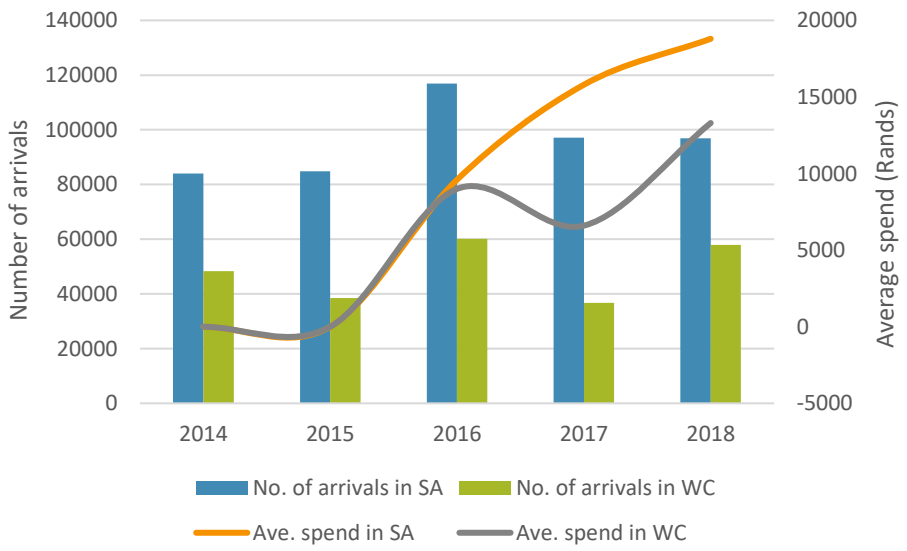

Figure 14: China travel market in SA and WC, 2014 to 2018

Source: WESGRO (2019)

The figure shows an upward trend for average spend in the Western Cape. The Overberg region could try to leverage that spend by offering the Chinese market niche offerings related to the market's global demand for abalone products. Creating community-based packages based on abalone heritage in collaboration with aquaculture farm tourism; and culinary excellence associated with local restaurants in the Overberg, has the potential to attract Chinese visitors to the region. Attractive niche offerings could extend length of stay in the region and province, increasing overall average spend in the Western Cape and South Africa.

3.3 Opportunities in traceability

Fish products are among the most traded products worldwide, supporting livelihoods of millions of people. Global stocks are being overexploited and the increasing demand coupled with illegal harvesting brings the sustainability of the oceans economy to the fore. Traceable data and issues of quality are imperative for all fish products (Sourcetrace, 2020) and presents opportunities for abalone producers and disruptive technology service providers in South Africa. Collaborative participation in the global abalone market may be the only way to make an impact in combating illegally harvested and traded abalone products.

Until fairly recently, blockchain technology was not widely understood and a relatively intimidating concept; however, the technology is fast becoming more mainstream, particularly in agriculture. Blockchain based traceability technology has already been reported to be making a contribution to agriculture by reducing processing and transaction times. Moreover, improving relationships of trust throughout the value chain and reliability between producers, retailers and governments (ICSF, 2018).

An example of success is the "US Seafood Import Monitoring Program" that uses the blockchain platform Earth Twine-Stratis. The programme requires importers to provide and report key data ranging from the point of harvest, to entry to the U.S. market for the most highly vulnerable species of seafood, including abalone, Atlantic Cod, Blue Crab, Dolphinfish, Group, King Crab, Pacific Cod, Red Snapper, Sea Cucumber, Sharks, Shrimp, Swordfish, and five species of tuna (Global AgInvesting, 2017). Another example is Walmart China that sought to achieve traceable seafood sales of 12.5% by the end of 2020 (Saladplate, 2020).

In South Africa, BKB (leaders in wool and mohair) has successfully used technology to link each sheep to the internet to collect and share "value digital profile data" on each sheep to make for a more efficient auction process (BKB, n.d.). BKB then went on to leverage blockchain technology to offer complete traceability and ensure trust along the entire supply chain. Benefits to stakeholders include financial advances for emerging farmers, opening up new markets, public health and product safety, improved planning for wool buyers and simplifying the value chain (BKB, n.d.).

Similarly, the benefits of blockchain technology could be extended to aquaculture and tailored to make use of a shared protocol for data collection and sharing, using a transparent database for abalone products (ICSF, 2018). This means tagging abalone products to allow for tracking all movement of the product from producer, including intermediaries to the end user. According to the Fishcoin Project, the industry would be incentivised to input data at every point in the value chain; and more data would lead to the improved resource management and production efficiency (Sourcetrace, 2020).

On the consumer market side, with more collaboration on regulatory restrictions, importing countries may be more responsible in sourcing legally harvested products; which would assist in combating the local abalone poaching crisis. With this level of transparency and traceability in the market, retailers would also know exactly where products have been sourced from which would be reflected in the price and price premiums could result.

The opportunities for this kind of technology intervention would need to be met with trade and public policy implications.

4. Conclusion

Aquaculture serves an important role in global food security, economic growth and job creation. South Africa is the third largest abalone producer, globally, generating high levels of foreign exchange with the highest concentration of abalone farms in the Overberg region of the Western Cape Province. Abalone aquaculture was identified as a priority sector through Operation Phakisa Oceans Economy presenting two key niche opportunities for the Western Cape Province: Firstly, expansion of abalone aquaculture and secondly scaling up of agritourism around abalone aquaculture.

The benefits of growing the potential of abalone aquaculture can further extend to poverty alleviation and the sustainable use of marine resources to benefit local communities in the Western Cape.

Despite quota reductions, export prices continue to rise and world imports exceed legal production levels, indicating that markets continue to consume abalone from illegally harvested sources.

Specific opportunities for Abalone aquaculture expansion are:

- Abalone is consumed in a variety of ways offering year round availability of product variations, thus reducing geographical distance advantages and opening up markets. In terms of volumes traded and market prices, canned and dried abalone are important variations for local producers to consider;
- The quality, size, similarity to Japanese *H. discus hannai* and price point of South African *H. midae* products makes local abalone attractive in international markets. The declining numbers of traditional *H. discus hanni* fishery operations and decreasing population of wild abalone has led to its premium price, making the similar *H. midae* more attractive. Local producers should consider that *H. midae* abalone can be larger than *H. discus hannai* and that could be factored into prices and a preference in Chinese celebrations;

- Producers should consider opportunities in the import dependent Singapore market, with a preference for convenience food options in the younger market segment;
- On the production side, the local abalone aquaculture industry is fragmented (FAO, 2016). To compete with other leading exporters that could put pressure on prices, local producers could collectively focus on establishing a sustainably sourced initiative for *H. midae* products (whilst maintaining the benefits of competition in the market to drive productivity) Promoting South African will benefit all producers of any size, looking to supply the export market;
- Re-seeding programmes can improve wild stock and redress social injustices and could focus on employing youth from previously disadvantaged communities (some abalone producers in Overberg region offer bursaries and training);
- Improved adoption of blockchain based traceability technology would improve traceability in the abalone value chain; and
- Seaweed farming associated with abalone farming could be expanded to create jobs, reduce pressure on wild seaweed stocks and contribute to carbon sequestration.

Opportunities in the abalone aquaculture industry, combined with agritourism and improved (and enforced) international trade requirements may be part of the solution to this complex problem, as noted below:

Abalone aquaculture tourism:

- Expansion of agritourism focused on aquaculture farm tours and food tourism related to abalone partnering with local world class hospitality offerings presents an opportunity to create jobs and expand livelihoods;
- Tours can be scaled-up to focus on local heritage and abalone food culture in coastal communities in Overberg region (in partnership with existing tourism entities to expand current offering);
- Agritourism can create awareness around legally sourced products and develop culinary experiences, particularly for international tourists from the Far East. Increased movement in abalone marketed at local upmarket restaurants presents opportunities for local producers;
- Destination marketing and culinary experiences attract visitors, leading to extended stays, increased spend and further links to wine tourism;
- Given that Far East markets are the largest consumers of abalone globally, a niche abalone agritourism opportunity exists to target tourists from Far East focused on the Chinese travel market. This would include both business and leisure travel, in association with WESGRO in the Overberg region, including world class food heritage and culinary experiences.

Illegal harvesting of abalone remains a risk to the future sustainability of the sector eroding millions in revenue. In addition to ongoing policing of illegal harvests, improvement of socio-economic conditions focused on job creation in abalone aquaculture and agritourism provide tangible alternatives to illegal poaching.

In summary, the expansion of abalone aquaculture in the Overberg region together with upscaling related agritourism is presents a unique economic opportunity to uplift marginalised rural coastal communities, maintain South Africa's global presence for world class abalone products and contribute to solutions of sustainable management of marine resources.

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