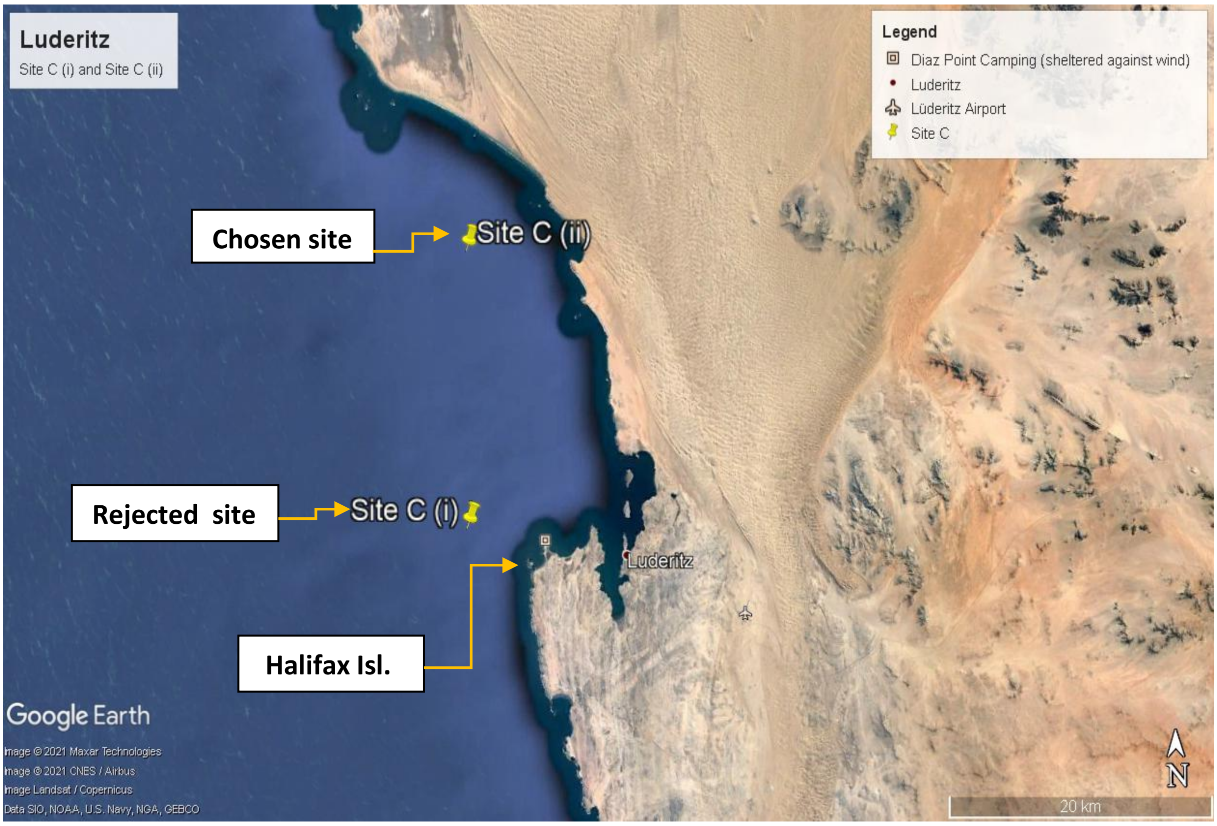
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

for

LILONGENI FISH-FARMING (Pty) Ltd.

on

FINFISH CAGE CULTURE OFFSHORE, LÜDERITZ, //KARAS REGION, NAMIBIA



Note: Site C (i) was proposed by the Proponent, however, after the Public meetings held at Lüderitz, Site C (ii) was opted to be the most favourable location.
(26.45 Latitude south and 15.00 Longitude east)

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As additional supporting documentation, which appears as a hard copy at the Environmental Commissioner Office (ECO), MEFT, Windhoek, for viewing.

LIST OF ACRONYMS

BCLME = Benguela Current Large Marine Ecosystem

BID = Background Information Document

D of A = Directorate of Aquaculture

D of RM = Directorate of Resource Management

DEAF = Department of Environment Affairs and Forestry

EC = Environmental Commissioner

EAP = Environmental Assessment Practitioner

ED = Executive Director

EEZ = Economic Exclusive Zone

EIA = Environmental Impact Assessment

EIAR = Environmental Impact Assessment Report

ECC = Environmental Clearance Certificate

EMP = Environmental Management Plan

FAO = Food and Agriculture Organization

HPPII = Harambee Prosperity Plan II

HQ = Head Quarters (MFMR)

I & AP = Interested & Affected Parties

ICSEAF = International Commission for the South-East Atlantic Fisheries

MAWLR = Ministry of Agriculture, Water and Land Reform

MEFT = Ministry of Environment, Forestry and Tourism

MFMR = Ministry of Fisheries and Marine Resources

MPA = Marine Protected Area

NatMIRC = National Marine Information and Research Center (MFMR, Swakopmund)

NIMPA = Namibia Island's Protected Area

NDP 5 = National Development Plan 5

NMA = Namibia Mariculture Association

Nm = Nautical mile

PPE = Policy Planning and Economics Directorate (MFMR)

Proponent = The client Lilongeni Aqua Fishing (Ltd)

PS = Permanent Secretary

RAS = Recirculating Aquaculture System

ROV = Remotely Operated Vehicle

SANUMARC = Sam Nujoma Marine and Research Center (UNAM – Hentiesbay)

UNAM = University of Namibia

FATE OF THE WORLD'S FISHERY RESOURCES

During the 17th and 18th Century the sea was perceived to be a place that offered an endless supply of fish and that fishing was a "free for all". Even until recently, fishermen had the notion and belief that the oceans' fish was a renewable resource that could not be depleted. However, in the past four decades, the perception in this regard changed as wild fish stocks began to dwindle and no longer could sustain themselves and the question rose "is there enough fish for everybody to have enough".

The Food and Agriculture Organization (FAO) has widely accepted that the "aquaculture sector" is the only way to meet an ever-increasing demand for fish for human consumption **(Fig. 1)**. The commitment of the Government to promote, support and implement the Blue Economy, which Namibia's NDP5, the Harambee Prosperity Plan II and Vision 2030, address and support this notion i.e., how can Namibia's vast expanse of untapped Atlantic Ocean be sustainably utilised to stimulate economic growth, improve livelihoods and jobs at coastal towns, while preserving the health of the Namibian ocean ecosystem.

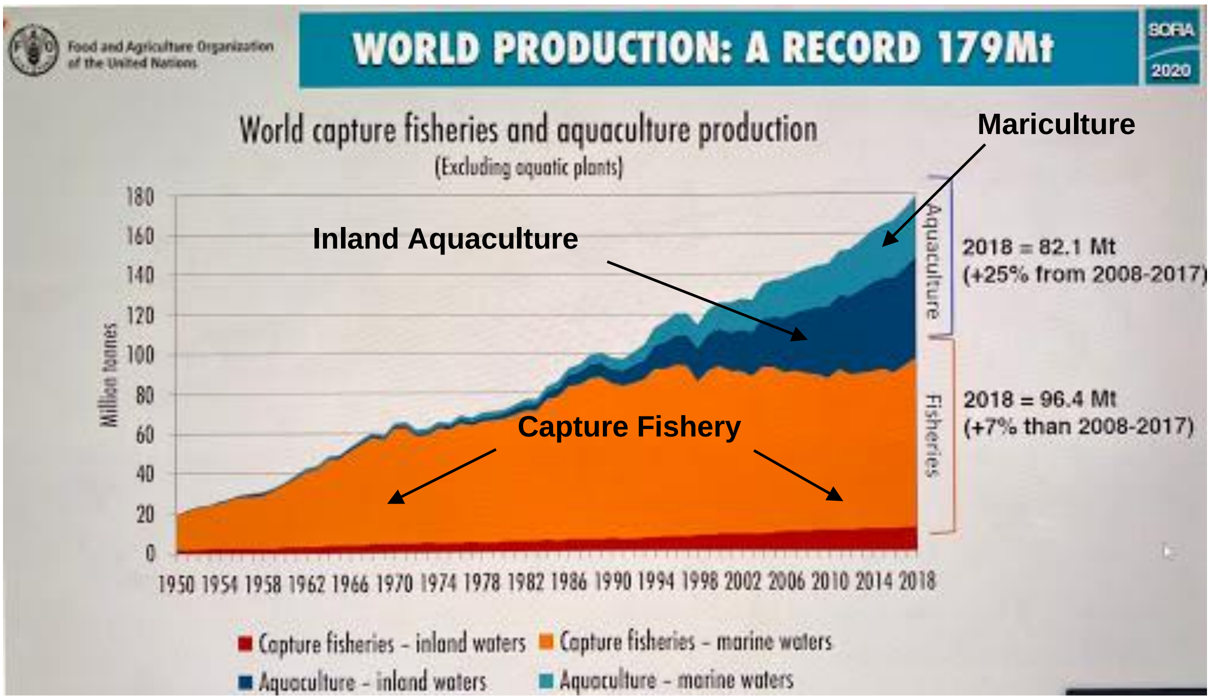

Figure 1: Annual world capture fishery compared to aquaculture production since 1950 to 2018 (FAO, 2018).

EXECUTIVE SUMMARY

This document provides an EIA for the proposed finfish cage culture in the Atlantic Ocean, northwest of Lüderitz. The study was prepared by Atlantic Consulting Services (CC 2021/03824) upon the request of the Namibian Proponent Lilongeni Fish-Farming (Pty) Ltd. This EIA has been prepared and completed to comply with the Policies, Acts and Regulations that Namibia has in place that are required to be followed and adhered to when applying for an Environmental Clearance Certificate and an Aquaculture License.

The Aquaculture Directorate was officially established by the Ministry of Fisheries and Marine Resources (MFMR) on 1st October 2003 with its main goal to assist in developing the aquaculture sector. However, to date the mariculture finfish sector has not yet taken off as expected. It is against this background that Lilongeni Fish-Farming (Pty) Ltd. has embarked on taking advantage of optimizing Namibia's untapped ocean in the development of a mariculture farm to farm with finfish 12nm northwest of Lüderitz.

The feasibility study (Annex 1) commissioned by the proponent recommended four alternative sites located between Swakopmund to Oranjemund. During the EIA process which included the screening, scoping and public participations process, a site northwest of site C(i) was chosen as an alternative based on the best environmental data on hand including the positive socio-economic impacts that this project could have for the coastal town of Lüderitz.

Government is committed in harnessing Namibia's water resources sustainably for future socio-economic development in line with the Blue Economy National Policy which is currently being finalised. In essence, the Blue Economy approach is an attempt to create a holistic socio-economic development framework that seeks to meet the interest of environmental protection, economic development and social upliftment. Government, through the HPPII and NDP5, is committed in harnessing Namibia's water resources sustainably for future socio-economic development.

The proposed finfish cage farming at site C (ii), which lies within the Lüderitz upwelling cell between the 60m and 75m isobar, is approximately 10 to 12nm away from the Lüderitz harbour and the important bird islands Halifax and Ichaboe. This area also falls outside the current rock lobster sanctuary and the proposed line fish and rock

lobster sanctuaries. In addition, the site is off the current main shipping lanes but still in the proximity to the harbour which makes the day to day operations cost effective.

This EIA was a process which included in meeting stakeholders on a one to one basis including three public meetings held at the three mains coastal of Swakopmund, Walvis Bay and Lüderitz. The concerns raised on the potential negative impacts that the project could have on the ocean environment including the two long term oceanic monitoring lines at Walvis Bay and Lüderitz, were considered and measures to mitigate these negative impacts were addressed. It is against this background that Lilongeni Fish-Farming (Pty) Ltd., intends to contribute to unlock this "potential resource" to develop and manage a sustainable mega fish farm in the Atlantic Ocean, north-west of Lüderitz.

PROPONENT AND THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

The Proponent

The proponent, Lilongeni Fish-Farming (Pty) Ltd., which is a Namibian registered company (Co. Reg. No. 2015/0190), hereby seeks approval for the activity of putting up a mariculture farm in the Atlantic Ocean north west of Lüderitz to farm with two (2) indigenous and one (1) foreign marine fish.

This EIA was prepared on behalf of Lilongeni Fish-Farming (Pty) Ltd. P. O. Box 655, Omaruru, Namibia. Lilongeni Fish-Farming, which is a joint venture company, was established by four individuals of which two of the founding members are Namibian based.

Lilongeni Fish-Farming (Pty) Ltd

Co. Reg. No. 2015/0190

Vision: To become a major Namibian sea fish ranching company serving the economy of Namibia by developing the first mariculture cage farm in the Atlantic Ocean of Namibia.

Mission: To develop Lüderitz into an international fish farming hub to compensate for the shrinking global capture fishery and to keep the existing underutilized fish industries in Lüderitz utilized.

The company is committed to follow and adhere to all the Namibian Policies, Acts and Regulations that will impact on this mariculture project.

The Environmental Assessment Practitioner (EAP)

- The proponent has appointed Atlantic Aquatic and Terrestrial Consulting Services, with Dr Ekkehard Klingelhoeffer as the lead consultant, as the Environmental Assessment Practitioner (EAP).

- Document contributors include, Ms. Maria Shimhanda, Ms. Ndamona Kauluma, Dr Andrea Klingelhoeffer and Ms. Alusha Hitula.

- The EAP hereby brings it to the attention of the Ministry of Environment, Forestry and Tourism (MEFT) in accordance with the Environmental Management Act (7 of 2007) and the Ministry of Fisheries and Marine Resources (MFMR) Aquaculture Act of 2002, the intentions of the proponent to farm with indigenous and foreign finfish in the Atlantic Ocean, ca. 12nm north west of Lüderitz.

- The appointed EAP (**Appendix 1**), conducted intensive one to one stakeholder meetings with the industry, local authorities, NAMPORT and government officials at Swakopmund (MFMR) and Lüderitz (MFMR) including three public meetings held at Swakopmund, Walvis Bay and Lüderitz. Outcomes of these meetings assisted the team to develop and compile the Environmental Impact Assessment (EIA) and the Environmental Management Plan (EMP) which was to find mitigating solutions to the possible environmental consequences that could be associated with the envisaged mariculture operation.

- Dr Ekkehard Klingelhoeffer, the appointed EAP, has been in the position of a marine biologist since Namibian independence and was eventually tasked to develop and lead the newly established Directorate Aquaculture for MFMR on 1st October 2003. During his tenure he was, amongst other, responsible for introducing the "one stop shop" for the application of aquaculture license.

Atlantic Aquatic & Terrestrial CONSULTING SERVICES CC/2021/03824

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ACKNOWLEDGEMENTS

Foremost the public is hereby thanked for their active participation and support at the three (3) public meetings held whose inputs were noted and addressed in this EIA report. Both staff of the Ministry of Environment (MEFT) and the Ministry of Fisheries and Marine Resources (MFMR) are thanked for their valuable insights and criticism during the EIA process. Lastly the Team of experts involved in compiling this EIA report, who was reachable at all hours of the day, a big thank you for your dedication in making this EIA process a reality.

1. INTRODUCTION

1.1 Purpose of this report

Lilongeni Fish-Farming (Pty) Ltd., a Namibian registered company (Co. Reg. No. 2015/0190), intends to farm with finfish in the Atlantic Ocean of Namibia. The Proponent identified four alternative sites where it intends to farm with finfish in cages at a sea depth ranging from 65m to 75m.

The Proponent hereby seeks approval for the activity of putting up a mariculture farm in the Atlantic Ocean to farm with two (2) indigenous and one (1) foreign finfish species.

This report was prepared to comply with the Environmental Management Act No. 7 of 2007 and to follow the Environmental Impact Assessment (EIA) process in which it has addressed the feasibility of the proposed finfish project.

The main issues to be addressed by the EIA is to determine the feasibility and impacts that this fish cage culture could have on the immediate environment. The Proponent's request is to erect cages in the sea which are to be suspended to the ocean floor with buoys in an area occupying initially no more than 250ha.

The main objective of this EIA is to provide decision-makers with an account of the implications of proposed courses of action before a decision on a project is made.

The purpose of this report is to provide a description of the project and to summarise the Environmental Impact Assessment (EIA) process that need to be followed for the proposed Finfish Farm Project which includes the background of the project.

The report also summaries the public participation and consultation of the Interested and Affected Parties (I&APs) as per the EIA Process (see Section 6). The management and mitigation measure for the potential impacts of the project are contained in Environmental Management Plan (EMP).

In summary this EIA study serves to determine, analyse and present the environmental impacts (positive and negative) of a proposed development project and associated infrastructure, formulate remedial measures to mitigate the negative impacts and plan in such a way that enables a rational decision to be made regarding the implementation and management of the proposed project. The EIA further contributes to the reduction or mitigation of adverse impacts by generating a number of project alternatives for the proposed developments. In general, the purpose of the EIA is to anticipate and prevent, minimise and/or manage, potential significant negative impacts that may develop.

1.2 Introduction to the proposed project

Lilongeni Fish-Farming (Pty) Ltd. intends to spearhead and make finfish farming in the marine environment a first in Namibia off the coast of Lüderitz. The Proponent intends to farm with the Namibian Yellowtail kingfish (*Seriola lalandi*), the Silver cob (*Argyrosomus inodorus*) as well as the Atlantic salmon (*Salmo salar)* for commercial purposes.

The Yellowtail kingfish and Silver cob fish species are well known along the Namibian coast and have the potential to support a lucrative export market and ensure that the demand for oceanic fish is maintained through a mariculture operation. The Silver cob is a popular angling fish along the central Namibian coastline and at times caught inshore by purse seine fishing boats. Yellowtail kingfish is being farmed successfully for the past few decades in both Japan and Australia and the breeding trials of Cob at Sam Nujoma Marine and Research Center (SANUMARC – UNAM) are ongoing.

Atlantic salmon is not indigenous to Namibian water and is native to the north Atlantic and Rivers that flow into it. However, *Salmo salar* has been introduced to many parts of the world south of the equator, for aquaculture purposes and in some locations for sport fishing or fisheries (Invasive Species Compendium (ISC), 2021). Currently Atlantic salmon are successfully farmed in countries outside their native range such as in the United States, Canada, Chile, Australia, New Zealand, Ireland, Scotland, Norway, the Faeroe Islands, Russia, and Iceland. According to the feasibility study done on the 1st of September 2020 by InnovaSea (Annex 1), the farming of *Salmo salar* is feasible and would thrive well in the cold water of the Atlantic Ocean north and south of Lüderitz.

The company will be constructing and operating a mariculture farm in the ocean northwest of Lüderitz, which will cover an area initially of 250ha with a possible extension to a maximum of 500ha for future expansion. The envisaged site C (ii) (**Fig. 2**) was chosen as appropriate to farm finfish as it falls outside the allocated rock lobster and line fish sanctuaries and is situated at least 12nm from the major bird Islands. Furthermore, the area is situated in an optimal oceanic environment within the Lüderitz upwelling cell.

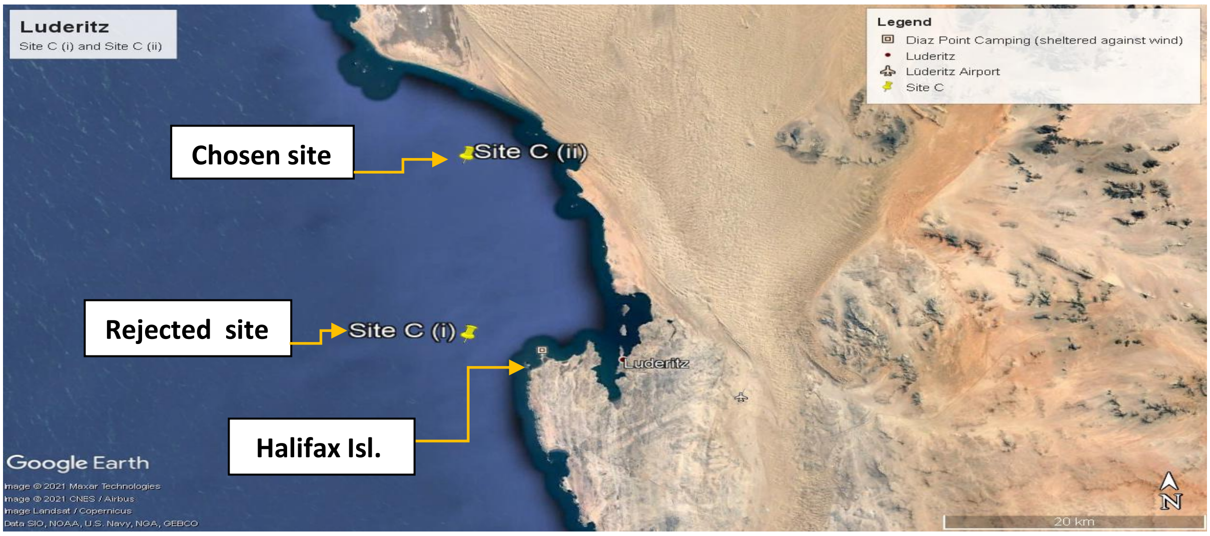

Figure 2: Regional location of the proposed finfish farm project indicating alternative site C (ii) at ca. 70m isobar at 26º27'00''Latitude south and 15º00'00'' Longitude east (26.45 and 15.00).

Note: Site C (i) was the original site proposed by the Proponent (in proximity of Halifax island and the foraging grounds of the endangered jackass penguins).

1.3 Assumptions and limitations of this report

A desktop study for the baseline information of the environment was conducted which was based on literature review and professional inputs from the marine ecologists during this report. Potential environmental and social projections that may arise e.g. impacts due to climate change, are not included in this study. Project description is based on the information provided by the Proponent and by specialists at the time of this process.

The EIA is based on judgement, literature review and inputs received from I&AP. The impacts documented from all over the world where offshore cage culture is practiced, were consulted to determine the likely impacts that this project, could have on the environment (refer to Chapter 8).

2. AQUACULTURE OVERVIEW AND MOTIVATION FOR THE PROPOSED FINFISH FARM PROJECT

2.1 Project motivation for Namibia, Lüderitz

The Namibian economy is currently in a downward spiral due to various factors which can be ascribed to drought, COVID19 related stagnation of medium and small scale businesses, global recession, limited fish resources, collapse of the tourism industry, to name a few.

Countries with coastlines are endowed with a range of environmental, economic and aesthetic benefits which are unavailable to landlocked countries. However, Namibia's coastal towns that had relied heavily on the fishing and tourism sectors are currently hardest affected by the economic recession and are open to investors who wish to optimize Namibia's resources in a sustainable manner.

On the 1st October 2003 the Directorate of Aquaculture was established within the MFMR, to assist and to stimulate this potential sector which has gained recognition as an industry that could contribute and supplement the current global shortfall of finfish. However, Namibia with a coastline of 1570km, has not been able to date to attract investors to venture into this lucrative business of finfish farming in the Atlantic Ocean, which is perceived as a sustainable industry.

The MFMR and its sister ministries have put in place policies and a legal frame-work which is to guide and support such an emerging industry to conduct aquaculture in Namibia. In addition, the Directorate of Aquaculture (MFMR), Section Mariculture, has an office at Swakopmund and Lüderitz to provide support to any emerging mariculture initiatives.

The social and economic impacts of this proposed finfish farm at Lüderitz has the potential to revive the current slump experienced in the fishing industry and its related business. For example, two million people are estimated to be engaged in the mariculture industry in Japan, with women and older workers involved in all stages of the culture of yellowtail kingfish (*Seriola lalandi*). A similar scenario could also apply to the Lüderitz coastal town.

According to the Food and Agriculture Organization (FAO) of the United Nations (FAO, 2020) aquaculture is among the fastest growing food sectors in the world, accounting for nearly 50% of the world's total fish production.

The global demand for seafood is steadily increasing. Human population growth, rising per capita incomes, and urbanization are fueling a 6.9 - 9.9% increase in demand each year. Currently, traditional capture fisheries can only supply half the global seafood demand. The other half of the global seafood supply already comes from aquaculture. Since many fishing stocks are facing intense depletion – *the world's growing demand for seafood can only be met by increasing aquaculture production* (FAO, 2020). The Proponent is banking on the prediction that farm-raised yellowtail kingfish, silver cob and the Atlantic salmon can contribute and help feed the world with high quality protein.

According to FAO (2020), aquaculture will need to supply two-thirds of the world's seafood requirements by 2030. Without aquaculture, the world will face a seafood shortage of 50-80 million tonnes per annum by 2030.

A concept note that was prepared for the interested and affected parties (I & AP) outlines the intentions and importance of this proposed finfish project and was widely distributed **(Appendix 2)** and a letter requesting for support / consent to operate a fin fish cage culture offshore of Lüderitz was submitted to the Competent Authority, MFMR on the 23rd November 2020 and 12th April 2021 **(Appendix 3).**

2.2 Status of current fish stocks

According to the most recent FAO statistics (2020) the global annual capture fishery has shown a steady decline where annual farmed fish have currently exceeded the capture fishery **(Fig. 1)**.

In the Benguela Current ecosystem (South Africa, Namibia and Angola – west coast) similar trends have been observed where the fishery has decreased over the past five (5) decades where the total annual catch peaked over 3 million tonnes in 1968 and dropped off to 1,2 million tonnes in the 1990's (In: Klingelhoeffer, 2005 and Hampton *et al.,* 1999). Currently the capture fishery in Namibia contributes to less than 0.5 million tonnes annually (Chirpanhura and Teweldemedhin, 2016 and Bartholomae pers.com 2020). The above trends of the capture fishery from the 1960's to the late 1980's have been well documented in the annual reports of the International Commission for the South-East Atlantic Fisheries (ICSEAF).

This indicates that finfish farming off the coast of Namibia has an opportunity to prosper as it is a niche that has not yet been exploited. According to the most recent FAO statistics, since the early 1990s, trends indicate that most growth in production of the fishing sector has been contributed to aquaculture, while the capture fisheries production had been relatively stable (FAO, 2018).

Global fish production is estimated to have reached about 179 million tonnes in 2018 with a total first sale value estimated at USD 401 billion, of which 82 million tonnes, valued at USD 250 billion came from aquaculture production (FA0, 2018).

2.3 Namibian Atlantic Ocean – an untapped potential

The intentions of Lilongeni Fish-Farming (Pty) Ltd. are to spearhead and to make finfish farming in a marine environment a first in Namibia.

The Benguela Upwelling system is one of the four major eastern boundary upwelling systems in the world and includes the most intensive wind-induced upwelling cell in the world at Lüderitz (Bakun, 1996). It is globally unique in the sense that it is the only cold-water upwelling system bordered by warm-water systems in the north by the Angolan Current system and in the south by the Agulhas Current system (Shillington et al., 2007).

The Benguela Current upwelling system off Lüderitz, near surface ocean is rich in plankton and due to intensive upwelling in this region has oxygen levels up to 5 + mg/L, (In: Klingelhoeffer, 2005) which makes it an ideal environment to embark on this proposed finfish .

A detailed description on the dynamics of major upwelling cells in both Lüderitz and Walvis Bay are provided in Chapter 7 and Annex 9.

The direct benefits and related spin offs of this initiative at this coastal town of Lüderitz by the Proponent include:

- quality finfish of high protein for the export market which will contribute to the GDP of Namibia
- provision of job opportunities from both the skilled and unskilled labour force
- revival of small business related to the fishery sector that had stagnated over the past decade

Namibia possesses an extensive coastline and ocean area under its jurisdiction and boasts considerable concentrated economic activities in these areas such as mining, fishing, aquaculture and tourism.

Mariculture, also referred to as the *'Blue Revolution – a Blue Economy towards a sustainable utilization of the ocean'* **(Fig. 3),** is the future way to go in which finfish farming can be operated in a sustainable way. The area identified for the mariculture finfish cage farm will cover an area initially of no more than 250ha which is situated approximately 12nm northwest from Lüderitz and 5nm from the shore.

2.4 Namibia's commitment to the blue economy

The commitment of the Namibian government aims to guarantee a more secure future for all its citizens through developing resilient processes, systems and institutions. Government is continuing to mold a society which has a chance to pursue their dreams through equitable access to opportunities. As per the HPPII – Pillar 2, the Namibian Atlantic Ocean is recognized as a potential resource available to its citizens which, when managed sustainably, can contribute to the socio-economic upliftment of our coastal towns.

The important difference between the term **'blue economy'** and the idea of the traditional ocean economy is that the former emphasizes that any economic development taking place within the ocean and coastal regions should do so in a way that is both environmentally sustainable and improves the wellbeing of coastal communities. For additional information on the blue economy the HPPII should be referred to.

The idea of **'blue economy'** or also referred to **'blue growth'** is closely linked to the "broader green movement" and increased global evidence and awareness of the current damage caused by human activities to the oceans' environment **(Fig. 3).** In essence, one can argue that the blue economy approach is an attempt to create a holistic socio-economic development framework that seeks to meet the interest of environmental protection, economic development and social upliftment. In summary:

- Namibia to take the lead in finfish ranching
- Cage culture is inherent to sustainable fish farming
- Need to take advantage of our underutilized Atlantic Ocean

Ecologically speaking, cage culture is a low impact farming practice with high returns and least carbon emission activity. Farming of fish in an existing water body removes one of the biggest constraints of fish farming on land, namely, the need for a constant flow of clean, oxygenated water.

Figure 3: The overview of the Blue Economy for Namibia.

2.5 The socio-economic value of the project

The Namibian government is acutely aware of the societal need for a more prosperous and equitable society. Thus, government has repeatedly emphasized its commitment to “growing the economy in a sustainable inclusive manner and through the creation of decent employment opportunities”. This clarion call for national equitable, economic growth is clearly evident in the Harambee Prosperity Plan (HPP1) launched in April 2016 and HPP2 launched in March 2021. In addition, the MFMR is a proponent of the blue economy which is linked to the NDP5. These initiatives are all aimed at achieving Vision 2030 when Namibia strives to be become an industrialized nation and a regional leader in the aquaculture sector.

Namibia is committed ensuring overall sustainable development with the clear aim of environmental protection which is enshrined in the Constitution under Article 95. In addition, since Namibian independence, the state has established a legal and regulatory framework for environmental protection. Nevertheless, instances of tension between economic interests and environmental protection resulting in disagreements, conflict and legal action are a regular occurrence e.g. the controversy around an industry proposal to mine phosphate from the ocean floor south of Walvis Bay.

The initial employment of the project will be to employ at least 50 comprised of experts, managers, technicians, ship crew, and workhands.

2.6 Envisaged sustainability

The Proponent has recognized that:

- This mega fish farm in the Atlantic Ocean when managed effectively and considering potential impacts, can be operated sustainably.
- It will be fundamental to good oceans management to maintain the health and integrity of Namibia’s marine ecosystems, to ensure the Benguela Current ecosystems’ continued sustainability.
- As per the Islands Marine Protected Area (NIMPA) “good oceans management” is the ‘foundation’ on which the multiple-use e.g., mining, fishing, aquaculture, and tourism needs to be pursued (NIMPA, 2008 and 2012).
- When compared to other industries the Carbon footprint of this proposed fish farm will be negligible – a resource that can be optimized sustainably.

3. ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

3.1 Environmental Impact Assessment Process

The EIA is an iterative process for identifying and assessing the likely significant effects of a proposed development. These effects can occur at any time during the development process, from site installation to operation and decommissioning. When adverse effects are identified that cannot be avoided through combining mitigation into the design of a proposed development, appropriate mitigation measures to reduce or offset the effects are proposed.

The main steps of the EIA process as relating to the Proposed Development are broadly summarized as follows:

- **Screening:** A Background Information Document (BID) and the accompanying application form was submitted to the Environmental Commissioner, Department of Environmental Affairs and Forestry, MEFT office on the 11th of November 2020. The application for Environmental Clearance Certificate has been verified by the Environmental Commissioner and allocated an application number/ Reference of **APP-002735 (Appendix 4)**.

  The purpose of this screening stage is for the Department of Environmental Affairs and Forestry (DEAF) to decide whether the proposed finfish farm project should be subjected to an environmental assessment or not. According to the application feedback from the Environmental Commissioner of DEAF, due to the location of the project, pollution potential, sensitivity of the area and scale of operation of the project, the proposed project is subject to an EIA, therefore the following documents are required:
  - Full EIA and EMP
  - Consent letter or support doc from relevant Authority
  - Proof of Consultation (Minutes, Newspaper adverts, etc.)
  - Project Site Area (map) with clear coordinates
  - Curriculum Vitae of designated EAP to manage the assessment process as per Regulation 3 & 4

- **Scoping and consultation:** The EAP had consultations with the competent authority and the interested and affected parties (see Chapter 6). During consultations, the Background Information Document (BID) and Scoping document were submitted as a hard copy to the EC office, Windhoek (Annex 2 of 11th November 2020 and Annex 3 of 30th January 2021). The documents include: the Background Information Document (BID), desktop study, consultations and the PowerPoint presentations. The scoping documents informed and focused on the scope of the EIA on likely significant effects that could be expected because of the Proposed Development. In Chapter 5, consultation and Gap Analysis, a detailed summary of Scoping responses and other consultations is provided. Throughout the EIA process, consultees had additional opportunities to comment on areas where they believed there was the potential for significant effects under the terms of the EIA Regulations.

- **Baseline studies:** Desk-based assessments, baseline surveys, and site visits, as appropriate, have been conducted to determine the baseline conditions of the environment and area that may be affected by the Proposed Development. The methods and findings are described in detail in each technical assessment, as reported in Chapters 6–8 and oceanographic data in Annex 1 and Annex 11.

- **Predicting and assessing impacts:** Interactions between the Proposed Development and the baseline conditions have been considered. The effects' nature, such as direct or indirect; positive or negative; long, medium, or short term; temporary or permanent, has been predicted and assessed. Section 3.3 (Chapter 3) outlines a general methodology for assessing significant effects, with specific methodologies in Chapters 7 and 8.

- **Mitigation and assessment of residual effects:** Possible effects have been avoided or mitigated to the greatest extent possible through embedded mitigation. In cases where this is not possible, operational mitigation or other measures to mitigate and/or offset significant effects are proposed. More detailed mitigations are found in Chapter 8.

- **Cumulative effects:** Section 3.3.4 in Chapter 3, explained in detail the generalized methodology for assessing the cumulative effects of the Proposed

Development in conjunction with other proposed or consented developments. For each technical assessment, cumulative effects have been considered.

- **Production of the Environmental Impact Assessment Report (EIAR):** The The EIAR contains the results of the EIA. The EIAR aims to communicate effectively to the reader, therefore the quality should reflect a clear structure with a logical sequence that describes:

    - Background information to the proposed project
    - Project justification and description
    - Legal policy and framework that impact on the project.
    - Baseline information
    - Stakeholder consultation
    - Predicted impacts (nature, extent, and magnitude),
    - Proposed mitigation measures
    - Concluding remarks by the EAP

The EIA report should set out the methodological considerations and the reasoning behind the identification and assessment of significant effects so that others can see the weight attached to different factors and can understand the rationale of the assessment. The format that captures the main elements of a typical EIA report is provided in the Table of content.

3.2 Impact assessment methodology

The determination of whether an effect is significant per the EIA Regulations combines professional judgement with consideration of the following:

- The sensitivity of the resource or receptor under consideration.
- The magnitude of the potential effect occurs because of the Proposed Development.
- The type of effect, i.e., adverse, beneficial, neutral, or uncertain.
- The probability of the effect occurring, i.e., certain, likely, or unlikely; and
- Whether the effect is temporary, permanent and/or reversible.

A generalised methodology for assessing significant effects is detailed below, however, each technical area will have a specific assessment methodology which may vary from that detailed in the following subsections.

3.2.1 Sensitivity of the receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Proposed Development or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations, professional judgement, and Marine Evidence-based Sensitivity Assessment. The Table 1 below details a general framework for determining the sensitivity of receptors.

Table 1: Method assessment for sensitivity of the receptors.

Sensitivity of receptors	Definition
Very High	The receptor has little or no ability to absorb change without fundamentally altering its present character, is of very high environmental value, or international importance
High	The receptor has a low ability to absorb change without fundamentally altering its present character, is of high environmental value, or national importance
Medium	The receptor has a moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance
Negligible	The receptor is resistant to change and is of little environmental value

3.2.2 Magnitude of effect

The magnitude of potential effects was identified through consideration of the Proposed Development, the degree of change to baseline conditions predicted because of the Proposed Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation. General criteria for assessing the magnitude of an effect are presented in the Table 2 below.

Table 2: Method assessment for the magnitude of the effect.

Magnitude of effect	Definition
High	A fundamental change to the baseline condition of the asset, leading to total loss or major alteration of character
Medium	A material, partial loss or alteration of character
Low	A slight, detectable, alteration of the baseline condition of the asset.
Negligible	A barely distinguishable change from baseline conditions

3.2.3 Significance of the effect

The sensitivity of the asset and the magnitude of the predicted effects was used as a guide, in addition to professional judgement, to predict the significance of the likely effects. The Table 3 below summarises guideline criteria for assessing the overall effect and whether this is significant.

Table 3: Method assessment for magnitude of the effect.

Magnitude of effect	Sensitivity of receptor				
	Very High	***High***	***Medium***	***Low***	***Negligible***
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

The significance effects predicted for the proposed finfish farming that is categorised as **Major** or **Moderate** are considered as *'significant'* in this EIA and are shaded in red colour in the above table. Zero magnitudes of change upon a receptor will result in no effect, regardless of sensitivity.

3.2.4 Cumulative effects

Per the EIA Regulations, this report will also consider cumulative effects. These are the effects of incremental changes caused by past, present or reasonably foreseeable future actions in conjunction with the Proposed Development. Two types of effects will be considered in the cumulative assessment. The first is the combined effects of individual effects such as benthic effects and water column effects resulting from the proposed Finfish Farm Project. Secondly, are the combined effects of the proposed Finfish Farm Project with other several developments in the Lüderitz area that may be insignificant on an individual basis but have a significant effect when combined, such as effluents or landscape and visual effects.

3.3 EIA Team

The Core Team of experts that were co-opted to assist and contribute to this EIA are provided in Table 4.

Table 4: EIA Core Team of Experts.

Specialist Name	Expertise
Dr Ekkehard Klingelhoeffer Environmental (Assessment Practitioner)	Aquaculture (mariculture and freshwater)
Ms Maria Shimhanda	Sustainability and Environmental Management Specialist
Ms Ndamononghenda Kauluma	Aquaculture Specialist
Dr Andrea Klingelhoeffer	Veterinarian specialist (Aquaculture & Intensive Farming)
Ms Alushe Iitula	Aquaculture consultant
Dr Marion Klingelhoeffer	Editor/Moderator and Admin Support

Other contributors

Geographic Information System (GIS) specialist was temporally hired from site mapping. Aquaculture and marine ecologist for the baseline condition and alternative sites. Detailed CVs of the above experts is provided in Annex 4.

4. RELEVANT REGULATORY FRAMEWORK

4.1 Aquaculture activities and environmental legal framework

The main source of legislation is the Constitution of the Republic of Namibia (1990) which makes provision for the creation and enforcement of environmental policies. According to Article 95 (Chapter 11) of the constitution, the state shall actively promote and maintain the welfare of the people by adopting inter alia, policies aimed at maintaining the ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future.

The Ministry of Fisheries and Marine Resources (MFMR) is the competent authority for aquaculture or mariculture activities in Namibia. The Aquaculture Act (No. 18 of 2002) is the most important regulatory framework that provides regulations and control of aquaculture activities in Namibia, for the sustainable development of aquaculture resources. Several explicit references to the environment and its protection are contained in the Aquaculture Act, which provides for environmental impact assessments, and impact mitigation, disease and pollution control and prevention.

On the other hand, the Ministry of Environment, Forestry and Tourism (EMA), and the Department of Environmental Affairs and Forestry (DEAF) implements environmental laws and guides the environmental impact assessment process.

In reference to the proposed Lilongeni Finfish Farm project, the following subsections summarizes the important legislation and guiding principles underpinning the environmental impact assessment process and requirements for an aquaculture license.

4.1.1 Environmental Management Act 7 of 2007

Environmental Management Act aims to ensure that people care and timely consider the environmental impacts of their activities and to ensure that all interested or affected parties have a chance to participate in environmental assessments as well as to ensure that the findings of environmental assessments are considered before any decisions about activities are made.

Section 3(2) of the Environmental Management Act (EMA) also sets out principles that implement integrated environmental management provisions in the constitution. When decoding the proposed Finfish Farm project, decision-makers must take account of these principles. EMA clearly defines that without an Environmental Clearance Certificate (ECC) obtained from the Environmental Commissioner, no party, whether private or governmental, may perform any activities listed (EC). The proposed project falls under the listed activities in EMA, Part VII, Section 27**.**

4.1.2 Environmental Impact Assessment Regulations (EIA) of 2012

Per Section 56 of the Environmental Management Act of 2007, the EIA Regulations 2012 was gazetted on February 6, 2012. The regulations provide for the regulation of the 'listed activities." The listed activities are prohibited until an ECC from the Department of Environmental Affairs and Forestry is obtained. DEAF can only issue an Environmental Clearance Certificate if compliance with the EIA Regulations 2012 has been demonstrated. The EIA regulation lays out the procedures and documentation that must be followed when conducting an EIA process.

The listed activities under the EIA regulations that are relevant to the proposed Finfish Farm project are as follow:

- **Section 7 (1):** Construction of facilities for aquaculture production, including mariculture and algae farms where the structures are not situated within an aquaculture development zone declared in terms of the Aquaculture Act, 2002.
- **Section 7 (2):** The declaration of an area as an aquaculture development zone in terms of the Aquaculture Act, 2002.
- **Section 7 (8):** The introduction of alien species into local ecosystems.
- **Section (10.1) (e)** The construction of any structure below the high-water mark of the sea"

4.1.3 Aquaculture Act No. 18 of 2002

The Aquaculture Act regulates and controls aquaculture activities in Namibia to promote the sustainable development of aquaculture resources. Under the Aquaculture Act, the following apply to the proposed development:

- Part III Aquaculture Licenses; Sections 11 to 24
- Part IV Management and Control measures; Sections 25 to 30
- Part VI Aquaculture Development Zones; Sections 25 to 30

4.1.4 Aquaculture (Licensing) Regulations of 2003

The Aquaculture (Licensing) regulations came into force on 3 December 2003. This regulation is associated with the Aquaculture Act 18 of 2007. The following stipulated in the Regulations apply to the proposed Finfish Farm Project:

Part IV of the regulations concerning aquatic organism's health management in aquaculture facilities. This regulation states that all aquatic health management should conform with international standards and consistent with Namibia's human rights.

Part V of the Regulation covers the control of disease outbreaks in Namibian waters, specifically disease zoning, emergency disease situations and intra-national movements of live aquatic organisms.

Part VI deals with the protection of the aquatic environment and covers the release and escape of aquaculture products, the discharge of wastes from aquaculture facilities and the introduction and transfer of aquatic organisms.

4.1.5 Import and Export of Aquatic Organism and Aquaculture Product Regulations 2010

This regulation relates to the 'Import and Export of Aquatic Organisms' and covers the permitting requirements and conditions for the import and export of aquatic organisms. To be specific, Part II of the regulations stipulates that a risk assessment is required as part of the import permit application. Annexures I and J of the regulations provide lists of marine aquatic organisms approved for importation, and whose importation is restricted or prohibited, respectively. The following Sections are also crucial in reference to the proposed Finfish Farm project:

- **Section 2** requires that a person intending to import aquatic organisms must register as an importer and apply for an import permit in terms of these regulations.
- **Section 5 (1)**, give the requirement to complete Annexure C for the import of aquatic organisms.
- **Section 5 (2)** states that a person intending to import aquatic organisms for introduction or transfer must apply, in terms of regulation 21 of the Aquaculture (Licensing) Regulations, for a permit to introduce or transfer aquatic organisms.

- **Section 6 (1)**, states that before deciding on an application for an import permit, the Minister may require an applicant to carry out a **risk assessment** in respect of the aquatic organisms to be imported.

- **Sections 13 and 14** refer to the procedures that need to be taken to operate a quarantine facility.

4.1.6 Marine Resource Act (No.27 of 2000)

The Marine Resources Act mandates the conservation of the marine ecosystem, as well as the responsible use, conservation, protection, and promotion of marine resources on a sustainable basis, as well as the control of marine resources for the purpose to provide for the exercise of control over marine resources. Part 2 Section 2 of the Act mandate that the management, protection, harvesting and utilization of marine resources in Namibia and Namibian water shall be subject to the Act.

Part 10 of the Marine Resources Act empowers the Minister to prescribe specific conditions and restrictions regarding closed areas and exclusion zones, applicable to commercial fishing rights, quotas and licenses granted under the Act. In this regard, trawling and longlining are prohibited in waters shallower than 200m.

There are further conditions applicable to hake trawling vessels fishing south of 25° latitude, where the fishing exclusion has been extended to a depth of 300m. Freezer trawlers fishing in this area, are confined to fishing in depths of 350m or more (Currie et al. 2008). The Act also provides for the declaration of Marine Protected Areas and fishing areas.

4.1.7 Namibia Island's Marine Protected Area (NIMPA) No.316 of 2012

These regulations cover the zonation delineated within the MPA and the restrictions and prohibitions applicable to each zone. Relevant to this project are the regulations under the Marine Resources Act relating to the Namibian Islands' Marine Protected Area (NIMPA) (No. 316 of 2012). In reference to the project, Part 5 of the regulations covers restrictions and prohibitions within the NIMPA buffer zone while the Mariculture activities are only permitted in Zone 3. Other Parts of the regulations that may impact the proposed project include:

- **Part 4, Section 4 (4) stipulates that Zone** 3 restrictions are enforceable to a perimeter of 120 m from each Island and islet Rock.

- **Part 5, Section 13 stipulates that the** obstruction of cetacean pathways prohibited, and a person may not conduct marine operations, erect structures, fixed moorings, or lines that obstruct any known cetacean pathways in the Namibian Islands' Marine Protected Area like in the approved management zonation, around each island, islet or rock such as **Mercury, Ichaboe, Halifax and Possession Islands.**

- **Part 9, Sections 19 (6), Section 24 (6) and Section 27 (5)** mandate that mariculture operations are only permitted outside the Zone 3 co-ordinates indicated in **Part 4 (Zonation)** of **Sub-regulation (4)** and that such operations may not obstruct the free movement or passage of whales, dolphins, African penguins, and other protected species moving through Spencer Bay and around Mercury Island and that the mariculture activities may only take place by boat-based ranching or diving around Ichaboe. The aquaculture operations may be conducted provided they do not obstruct the passage of the Heaviside's dolphins and African penguins in Guano Bay.

4.2 Summary of other laws, strategies, bills and policies relevant to this project

A summary of other relevant legislations and policies relevant to this proposed fin fish culture in cages offshore from Lüderitz is provided in Table 5 below.

Table 5: Other relevant legislations.

Acts, Policies, or Regulations	**Relevance**
Marine Traffic Act (No. 2 of 1981) (as amended by the Marine Traffic Amendment Act (No. 15 of 1991)	Marine (shipping lanes) traffic
Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990	Natural resource use
Dumping at Sea Control Act (No. 73 of 1980)	Emissions and nets
Water Act, 1956 (No. 54 of 1956), as amended	Abstraction from and discharge into the sea
Water Resource Management Act 11of 2013	Water use, water quality and effluents to water bodies
Public Health Act 36 of 1919 (as amended)	Export fish products and import of smolt

Labour Act, 2007 (No. 11 of 2007)	Socio-economics
Namibian Ports Authority Act (No. 2 of 1994) and Port Regulations	Harbour facilities to be used
Nature Conservation Amendment Act No.5 of 1996	Impact on biodiversity and protected areas
Pollution Control and Waste Management Bill (draft) 2003	Waste on water, air, and land
National Solid Waste Management Strategy	Solid waste management
Seabird and Seals Protection Act 46 of 1969	Impacts on birds and seals

4.3 Other relevant guidelines and policies consultation

The following policies and guidelines were consulted which may have possible impacts on the cage culture in the Namibian Atlantic Ocean.

- A review of Aquaculture Policy and Institutional capacity in the BCLME Region, with recommended regional policy options. BCLME Project LMR/MC/03/0 (1st July 2006).
- Fisheries and Aquaculture industry in Namibia Series Report No. 2 on the Fisheries and Aquaculture review in the 22 ATLAFCO member countries (October 2012).
- The Aquaculture Strategic Plan for the Directorate of an Aquaculture (MFMR (2004).
- Aquaculture Master Plan for Namibia 2013 to 2023. (2012).
- Marine Spatial Plan in Namibia (Draft Report) – Current Status Report knowledge baseline for Namibia's Central Marine Plan (2016).

4.4 International laws and conventions

The following listed international treaties and obligations have been signed by Namibia and may have possible impacts on the proposed Finfish Farm project.

- Convention on Biological Diversity, 1992
- The Benguela Current Convention, 2013

- United Nation Law of Sea Convention, 1982
- Base Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989
- International Convention for the Prevention of Pollution from Ships, 1973
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973
- Stockholm Convention on Persistent Organic Pollutants, 2001
- SADC Protocol on Shared Watercourse Systems in the Southern African Region, 1995

5. DESCRIPTION OF THE PROPOSED PROJECT

5.1 Overview and background of the Finfish Cage Farm Project

Due to an increase in fish consumption, wild stock declines and the current global poor farming economy, has increased the interest in fish production in cages. Nowadays, investors are looking for alternatives to traditional agricultural crops. Aquaculture appears to be a rapidly expanding industry with cage culture offering an investor a chance to utilize existing water resources in which most cases have only limited use for other purposes e.g., the ocean waters off Lüderitz.

Lilongeni Fish-Farming (Pty) Ltd, which is a Namibian registered Company (Co. Reg. No. 2015/0190), has proposed to develop a mariculture farm in the Atlantic Ocean northwest of Lüderitz to farm with finfish. This type of farming is referred to as the method of culturing aquatic organisms in the open sea in enclosed cages made of various materials also known as open **sea cage culture** or **fish ranching.**

The proposed site (cii), is located off the northeast coast of Lüderitz in an expanse of open water at 26° 27’ 00’’ Latitude south and 15° 00’ 00’’ Longitude east at 60m – 75m isobars **(Fig. 4).** Initially a surface area of 250ha is requested and to be extended to 500ha to cater for future development and also to act as a buffer zone to other prospective mariculture farmers. The farming operation will be conducted both onshore and offshore and includes:

- Onshore – to utilize current existing underutilized infrastructure to install a quarantine facility (RAS), storeroom for fish feed and equipment, laboratory for testing water quality, admin support, freezing and fish processing facility and
- Offshore - to deploy 3x cluster cages which will be operated 24 hours a day by a Service Vessel on site **(Fig. 5)**

The focus of this fish farm will be on the production of quality finfish in a dynamic pollution-free marine ecosystem for the export market to both Asia, the USA and Europe.

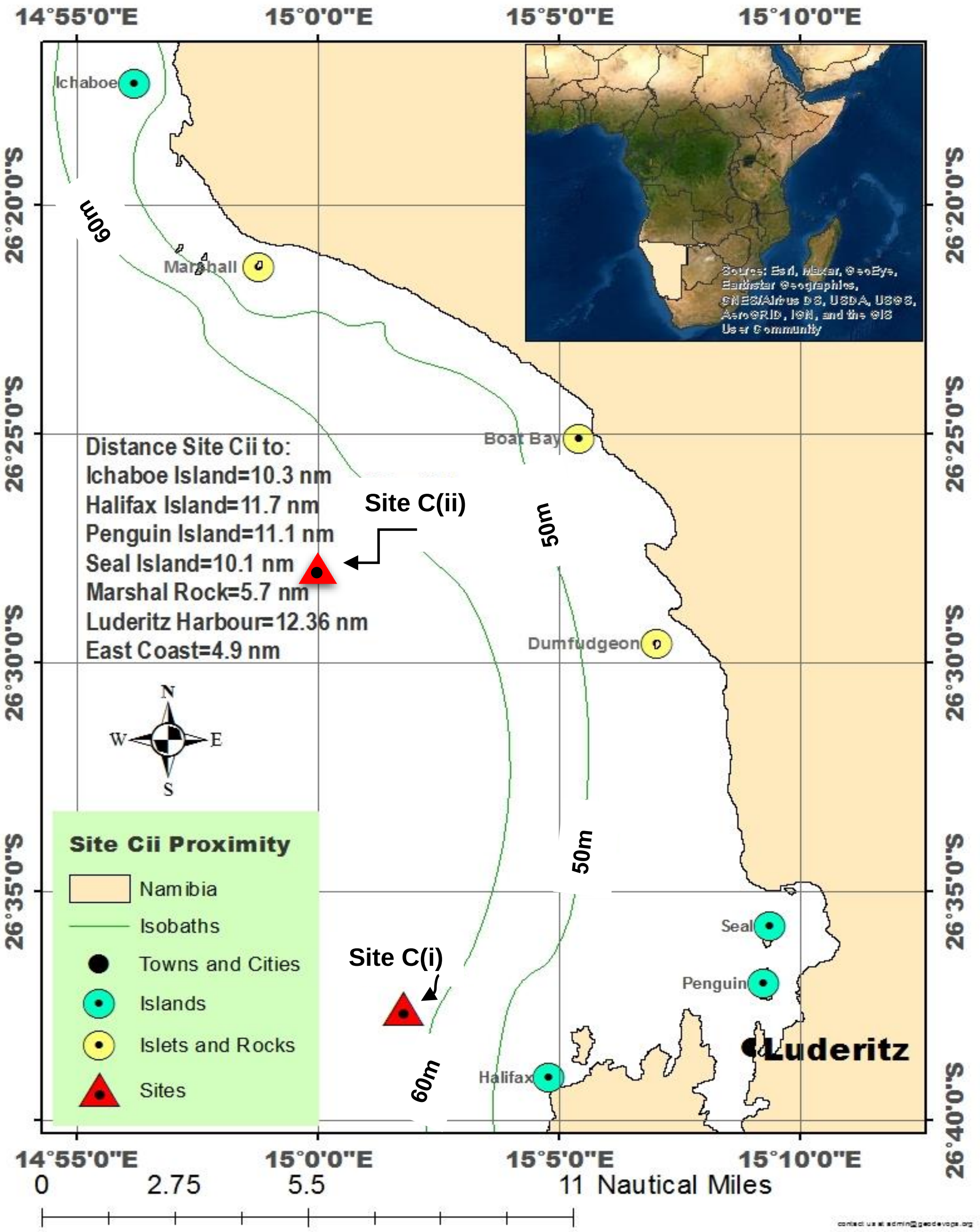

Figure 4: Site C(ii) proposed for the finfish cage culture in relation to the four main bird islands in its proximity at 26º27’00’’ Latitude south and 15º00’00 Longitude east.

(26.45 and 15.00)

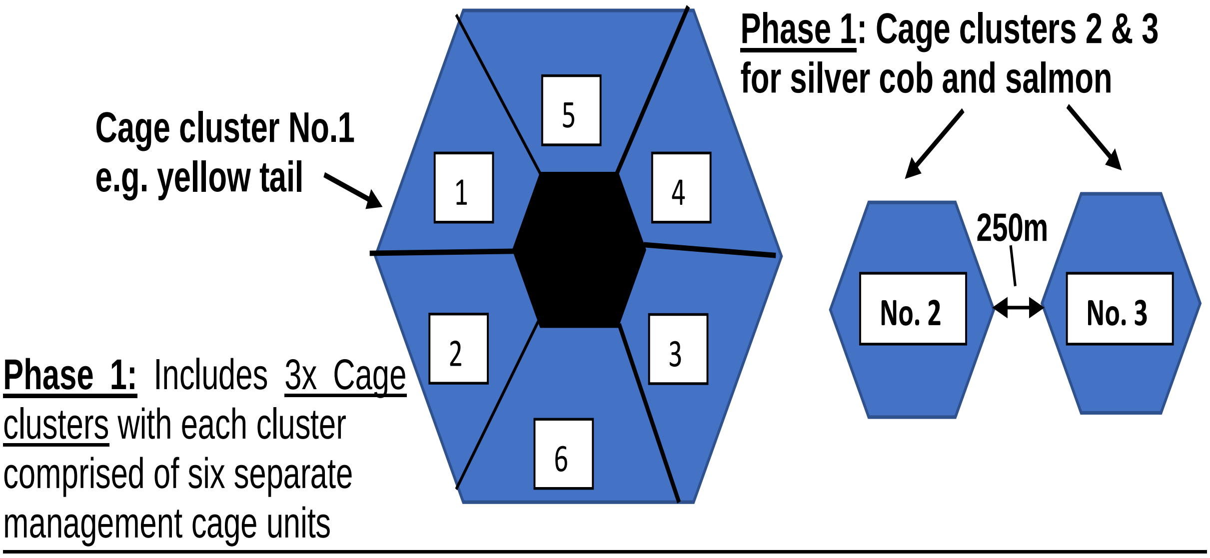

Figure 5: Schematic example of a “cage cluster” with a total water capacity of 500 000m^3 producing approximately 10 000 tonnes fish per 18 to 24 month cycle (pending on growth rate) stocked at 16 fish/m^3 (ca 1.5kg/fish) separated from each other by 250m.

5.2 Fish species to be farmed

Based on the Feasibility Study (Annex 1) and Business Plan (Annex 5) conducted by the Proponent and inputs from the EAP and public, the following three (3) species to be farmed offshore include:

- Silver cob; Yellowtail kingfish and Atlantic salmon

The Dusky cob which prefers warmer waters according to Griffiths & Heemstra (1995) is to be considered at a later stage of this project where it will be farmed onshore.

In Annex 6 additional information on the biology of the fish species is provided.

5.2.1 *Argyrosomus inodorus* (Silver cob)

5.2.1.1 Species profile

Argyrosomus inodorus **(Fig. 6)** has a seasonal migration pattern (Griffiths & Heemstra, 1995) and is clarified based on tag-recapture data. Spawning adults start migrating southwards against the north-westerly surface currents at the beginning of the austral summer from the northern end of their distributional range to their spawning grounds, Sandwich and Meob Bays **(Fig. 7)**.

It is suggested that after spawning larvae drift north with the current to the nursery areas, the West Coast Recreational area (WCR). When juveniles reach the age of approximately 2 years they gradually move north towards the adult feeding ground of the Skeleton Coast Park (SCP) waters. At the end of the spawning season when the surf-zone water temperature decreases to about 15°C adult silver cob complete their spawning cycle by returning to the adult feeding ground, probably moving slightly offshore and with the current to south of Walvis bay.

Figure 6: The popular coastal silver cob *(Argyrosomus inodorus).*

Silver cob is widely distributed along the coast of Namibia **(Fig. 6).** The silver cob is mostly found in the central parts of Namibia extending into the northern tip of the Lüderitz upwelling cell **(Fig. 7).** According to Decoteau et al, (2005), the silver cob has a wide distribution ranging from Namibia to the east coast of South Africa.

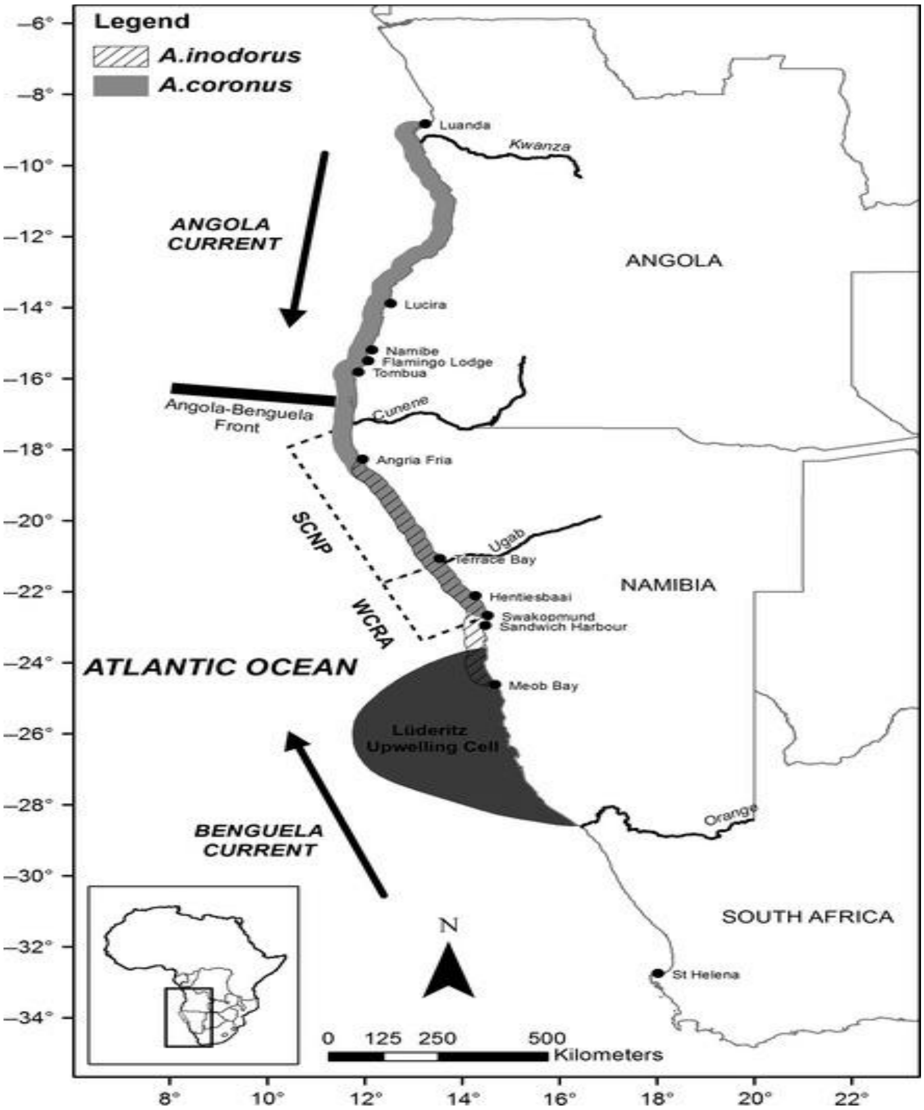

Figure 7: The distribution of both silver and dusky cob along the coast of Namibia.

SKNP = Skeleton Coast National Park, WCRA = West Coast Recreational Area.

https://www.researchgate.net/figure/The-southwest-African-coastline-showing-the-known-distribution-of-Argyrosomus-coronus-and_fig3_261770718

5.2.1.2 Life cycle and biology

In Namibia, the silver cob is most abundant along the coast north of Lüderitz. It is a relatively large species of the Sciaenid family, reportedly attaining a maximum total length of 130cm **(Fig. 6).** Silver cob is a carnivorous fish preying predominantly on shrimps, fish, squid, and octopus, a similar diet to other farmed Sciaenid species.

According to Kirchner and Voges (2000), the median age of sexual maturity in the wild is 1.5 years. It is estimated that wild female silver cob from Namibian waters attain sexual maturity at a length of 43 cm and males at a length of 47 cm after 2.4 and 2.9 years, respectively. This allows for fish to be harvested before they become sexually mature (< age of 2 years) which prevents the fish to invest energy into gonadal development. As a native to Namibian waters, silver cob will be more tolerant of the local environmental parameters. It is recorded that silver cob requires at least 80% oxygen saturation at 16°C for ideal growth with a temperature range from 13 – 25 °C (Chapter 7 – Baseline study). Silver cob is recommended over the dusky cob **(Fig. 8)** as the latter has received less attention by academics and aquaculturists, as they prefer the warmer waters found north of the Angola-Benguela front**.**

5.2.2 *Argyrosomus coronus* (Dusky cob)

5.2.2.1 Species profile

The dusky cob is widely distributed along the northern coast of Namibia **(Fig. 8)** and can be found in estuaries (Cunene River), the surf zone and further offshore in northern Namibia and Angola, indicating a preference for warmer waters. They are caught most frequently at depths of 20-40m (Griffiths and Heemstra, 1995). This species should not be confused with the non-indigenous *Argyrosomus japonicas,* which is found in South Africa, Mozambique, Australia, and Japan and is already a popular aquaculture species.

Figure 8: The Namibian coastal dusky cob (*Argyrosomus coronus*).

5.2.2.2 Life cycle and biology

The adult dusky cob migrates north as far as Gabon in winter and returns south to Angola and Namibia in spring. This is when spawning takes place offshore. The juveniles appear to remain in the offshore zone, to a maximum depth of 100m, only moving into the inshore zone when they are approximately 300mm in size (Potts *et al*., 2010). For males, 50% maturity was found to be at 82.3cm and 4.4 years of age. For females, 50% maturity was found to be at 90.4cm and 4.3 years of age (Potts *et al*., 2010). The maximum size and weight published for dusky cob was 200cm and 77kg (Griffiths and Heemstra, 1995).

Observations in the Namibian National Aquarium demonstrate an exceptionally rapid growth rate in captivity and potential for spawning. Exact aquaculture production targets for the dusky cob are not known, as there is still very little research available, and values are extrapolated from *Argyrosomus japonicus* and *Argyrosomus inodorus.* One available study concluded that *Argyrosomus inodorus* shows promising growth in captivity, with a median weight increase of 2000g over 18 months. Diet was one of the main factors influencing the growth rate, as well as some seasonal fluctuations independent of diet (Schoonbee 2006).

5.2.2.3 Namibia current fisheries status for Silver cob and Dusky cob

Cob fishing falls under the line fishing industry of which angling contributed N$14 million to the gross national income of Namibia, comprising 3.6% of the whole fishing industry (Kirchner *et al*, 2001). Line fishing species are under threat, although new regulation policies have been put in place in Namibia. Angola on the other hand still has very few catch restrictions in place (Potts *et al*., 2010).

As a native to Namibian waters, silver cob will be more tolerant of the local environmental parameters. It is recorded that silver cob require at least 80% oxygen saturation at 16°C for ideal growth with a temperature range from 13 – 25 °C (Chapter 5 – Baseline study). Silver cob is recommended over the dusky cob as the latter has received less attention by academics and aquaculturalists, as they prefer the warmer waters found north of the Angola-Benguela front **(Fig. 7).**

Due to the current lack of knowledge concerning the dusky cob and silver cob aquaculture, an initial land-based tank production system (RAS) is considered at this point, to elucidate growth rates and establish the viability of large-scale RAS or cage farming.

5.2.3 *Seriola lalandi* (indigenous Yellowtail kingfish)

5.2.3.1 Specie profile

Seriola lalandi is a member of the family Carangidae. (Kailola *et al.*, 1993; Fielder, 2013). The upper surface of the torpedo-shaped body of yellowtail kingfish is generally blue or blue green providing camouflage against the ocean depths when viewed from above **(Fig. 9).** Likewise, the white-silver underside provides camouflage when viewed from below against the mirror-like sea surface (Fielder & Heasman, 2011,). Juveniles have distinctive black and bright yellow lateral bands and fins, but these fade as the fish ages. By about 30 cm, the yellowtail kingfish has assumed adult colouration.

Yellowtail kingfish *(Seriola lalandi)* has been identified as an ideal aquaculture species because of its rapid growth rate, culture ability, excellent flesh quality for a range of product options (such as whole fillets, sushi and the highly valued sashimi) and significant international market opportunities.

Figure 9: Adult yellowtail kingfish (*Seriola lalandi*) appearance.

5.2.3.2 Life cycle and biology

Yellowtail kingfish are serial spawners and spawn offshore from March through July, with a peak in May or June. Females reach sexual maturity between age's three to five (Gillanders et al., 1999). The length, weight and age recorded are a maximum of 250 cm, 96.8 kg, and 21 years for yellowtail kingfish (Gomon et al. 2008). Yellowtail kingfish are generally about 100 cm large in Australia, 10-15 kilograms and 10-12 years old.

Annual growth rates vary between 98mm/y to 144mm/y for 500mm fish (Gillanders et al., 1999; Stewart et al., 2004; Fielder & Heasman, 2011). Most yellowtail farmers target market size of about 2-5 kg, while some even raise the fish to 7-8 kg. The average harvest sizes are 6 kg in 19-20 months in high-temperature areas, 5-6 kg in 27 months in medium-temperature areas, and 3.5-4.5 kg in 27 months in low-temperature areas.

5.2.3.3 Distribution

Yellowtail kingfish is found circum-globally mainly in salinity (marine) waters but prefers temperate and subtropical water (18 - 24 ℃). Populations are disjunct occurring in the Indo-Pacific (South Africa, Japan, Australia, New Zealand) and the Eastern Pacific like in Canada to Chile, Eastern Atlantic: St. Helena, South Africa) **(Fig. 10).**

In Namibia yellowtail kingfish is native and is of commercial importance. Yellowtail is most abundant in the vicinity of the Walvis Bay area (Figure 8). Yellowtail kingfish is caught in the bottom and pelagic trawls and rarely by shore anglers (Bianchi et al., 1999; Van der Elst, 1993; Fielder & Heasman, 2011). Schools of juveniles are generally found in offshore waters, often near or beyond the continental shelf. The area of Lüderitz coastal sites in the southern part represents an area most suitable for the culture of yellowtail kingfish.

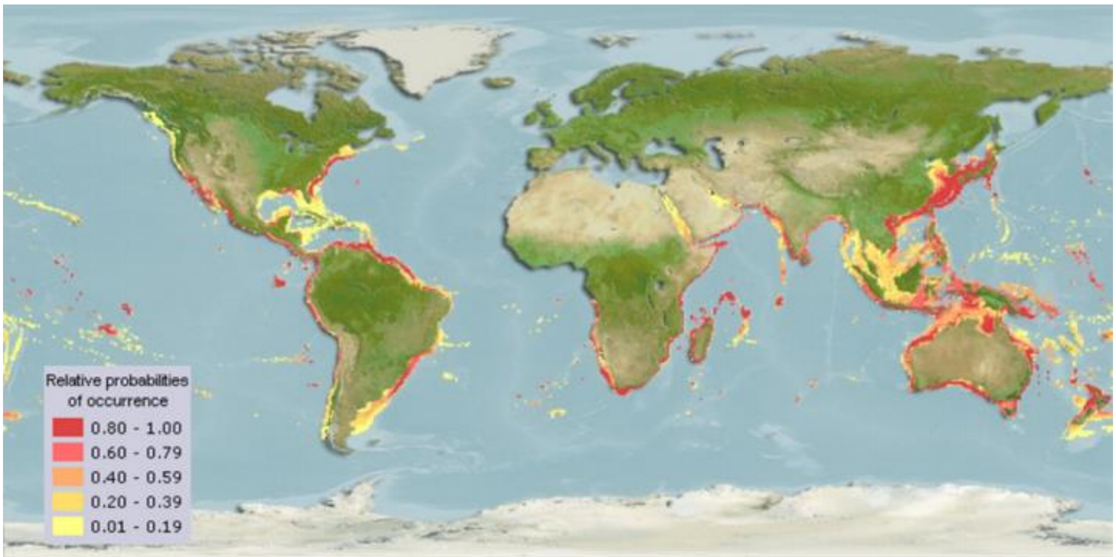

Figure 10: Global distribution of yellowtail kingfish (*Seriola lalandi*).

5.2.4 *Salmo salar* (Atlantic salmon)

5.2.4.1 Species profile

Salmon are not indigenous to Namibian waters. Since the mid-1960s, Atlantic salmon (*Salmo salar*) farming has grown into a large industry within the native range of northern Europe and eastern North America, and beyond western North America, Chile, and Australia. Countries like Norway, Chile, Scotland, and Canada are the largest producers of Atlantic salmon. The total world production of salmon in Norway (46%), Chile (31%), Scotland (10%) and Canada (7%) are the largest producers (Thorstad et al., 2008). Atlantic salmon farming has long been controversial due to its effect on the environment. To protect this lucrative market, countries have therefore been forced to undergo extensive research and have made leaps and bounds in industry advancements that have resulted in a drastic reduction in local feed, waste, and chemical pollution. Therefore, there is no other aquaculture industry that is so advanced and motivated in protecting the environment and ensuring a healthy and sustainable product.

5.2.4.2 Life cycle and biology

The Atlantic salmon **(Fig. 11)** has a slender silvery body, small head, blunt nose, small eyes, large scales, slightly forked caudal fins, adipose fin, a mouth that gaps back below its eye and has a row of conical stout teeth. They grow to be 60-90cm long and on average can weigh up to 5.5kg

Figure 11: Atlantic salmon (*Salmo salar*).

Salmon are anadromous, being born in freshwater, migrating to the ocean as young adults and returning to freshwater to reproduce (Fidra, 2020). The juvenile freshwater stage of Atlantic salmon (*Salmo salmar*) takes 24-36 months in the wild, and 6-12 months in farms, developing from egg through the alevin, fry and parr stages to the smolt stage which can then move to saltwater. Atlantic Salmon live in fresh water for the first 2–3 years of life before migrating to the sea where they live another 1-2 years before returning to freshwater to reproduce (Invasive Species Compendium (ISC), 2021). But due to the efficiencies of farm husbandry practices, the farming process of Atlantic salmon accelerates the life cycle to 1 year or less in freshwater (smolts typically 4-g to 120g), with harvesting after a further 16 to 20 months of growth in sea cages.

Spawning occurs in October and November, and the eggs usually hatch in April. The young remain in the gravel as alevin until the yolk sac is absorbed and they emerge as fry in May or June.

5.2.4.3 Environmental parameters

According to the Invasive Species Compendium (ISC), 2021), the mesothermal climate preferred by Atlantic salmon prefers an average temperature of coldest month >0℃ and <18℃ and a mean warmest month >10℃. The microthermal climate tolerated by Atlantic salmon is an average temperature of <0℃ in the coldest month and >10℃

in warmest months reproduce. The detailed parameters are stipulated in the Table 6 below.

Table 6: Atlantic salmon preferred environmental parameters.

Parameter	**Maximum value**	**Minimum value**	**Typical vale**	**Life stage**
Salinity (part per thousand)	33	34		Adult
Spawning temperature (ºC)	5	10		Brood stock
Suspended solids (mg/l)			<25.0	All stages
Water pH	6	9		Adult
Water pH	5.5	8.0		Egg, Larval and Fry
Water temperature (ºC)	1.0	12.0		Larval
Water temperature (ºC)	1.0	14.0		Fry
Water temperature (ºC)	<12	16		Adult (less than -7 or more than 27°C is harmful)
Water temperature (ºC)	8	12		Egg (acceptable range is 1.0 to 8.0°C)
Nitrite (mg/l)			<0.2	Egg Larval and Fry
Nitrite (mg/l)			<0.03	Adult
Nitrate (mg/l)			<50.0	Larval and Fry
Dissolved oxygen (mg/l)			7.0	Egg, Larval and Fry
Dissolved oxygen (mg/l)			>5.0	Adult and Brood stock
Carbon dioxide (mg/l)			<10.0	Egg
Carbon dioxide (mg/l)			<6.0	Larval and Fry
Ammonia [unionised] (mg/l)			<0.0025	Egg, Larval and Fry
Ammonia [unionised] (mg/l)			<0.01	Adult

5.2.4.4 Distribution

The Atlantic salmon is a native species found in the colder oceans of the northern hemisphere **(Fig. 12).** Over the past decades, the cage culture of the Atlantic salmon is being extensively farmed in the oceans of all world continents including South America, Australia, New Zealand, Oceanic islands, except for Africa **(Fig.12).** Atlantic salmon is not indigenous to Namibian waters. However, Namibia offers the opportunity to become the 1st country in Africa to operate a cage fish farm off the coast of Lüderitz.

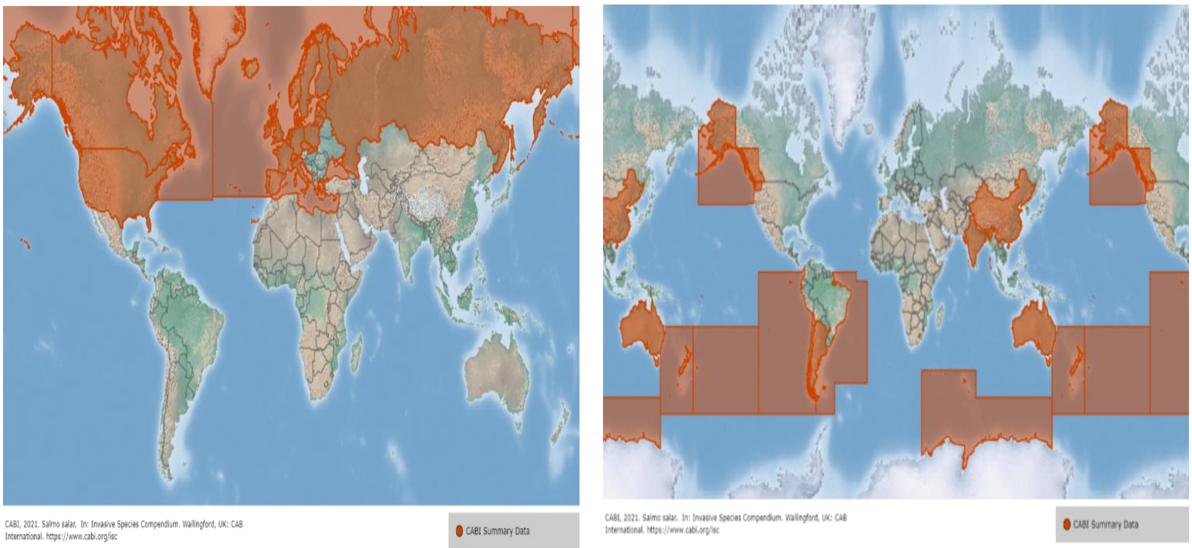

Figure 12: Global distribution of the native Atlantic salmon (LHS) and introduced Atlantic salmon (RHS).

5.3 Farm design and technology choice (Design innovation)

5.3.1 Fish cage selection

Four different types of cages are commonly used in open ocean fish culture such as the fixed, floating, submersible, and submerged. Lilongeni Fish-Farming (Pty) Ltd. will operate on submersible cages which are developed by BW Fish Farm to a client's specifications **(Fig. 13)** (Appendix 5 and Annex 7). The submersible cages are built with a rigid frame and can be moved up and down (via a hydraulic system) in the water column to take advantage of favourable water conditions. In rough weather conditions, this cage can be lowered to calmer water. The cages have a robust design with double barriers to prevent the escape of biomass and protection against predators. Alternative designs by InnovaSea (2021) for offshore cage culture were also consulted (Annex 8).

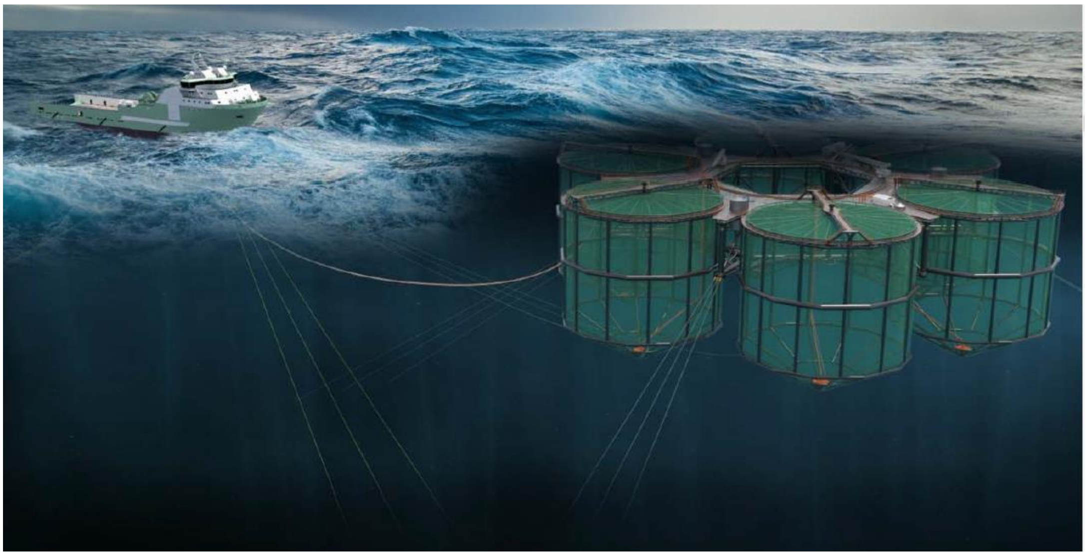

Figure 13: Submersible cages operating in rough sea conditions (BW FishFarm, 2021).

5.3.2 Fish cage structure and specifications

The cages consist of a double barrier "escape-proof" with an inner net in Dynema and an outer barrier is "typical Blue Sea Mesh". The entire system is remotely operated from a Service Vessel with fully integrated feed and dead-fish extraction system. Each cage is equipped with a movable cover with a net to sort out the fish for harvesting. The service crane for operation and maintenance is operated from the service vessel **(Fig. 14).**

The fish cage design opted by the Proponent **(Fig. 14)** is made up of a cluster of 6 separate units which are connected to a center frame and operated from a service vessel (BW Fish Farm 2020 and 2021). (Appendix 5; Annex 7)

The main cage specifications (Appendix 5):

- The diameter is 80m
- Depth range 45m to 60m

- Inner net from knotted nylon
- Outer protection net made from corrosion-resistant mesh to prevent escapees
- The volume of a sub-unit 83 300m^3
- Cage cluster total volume 500 000m^3

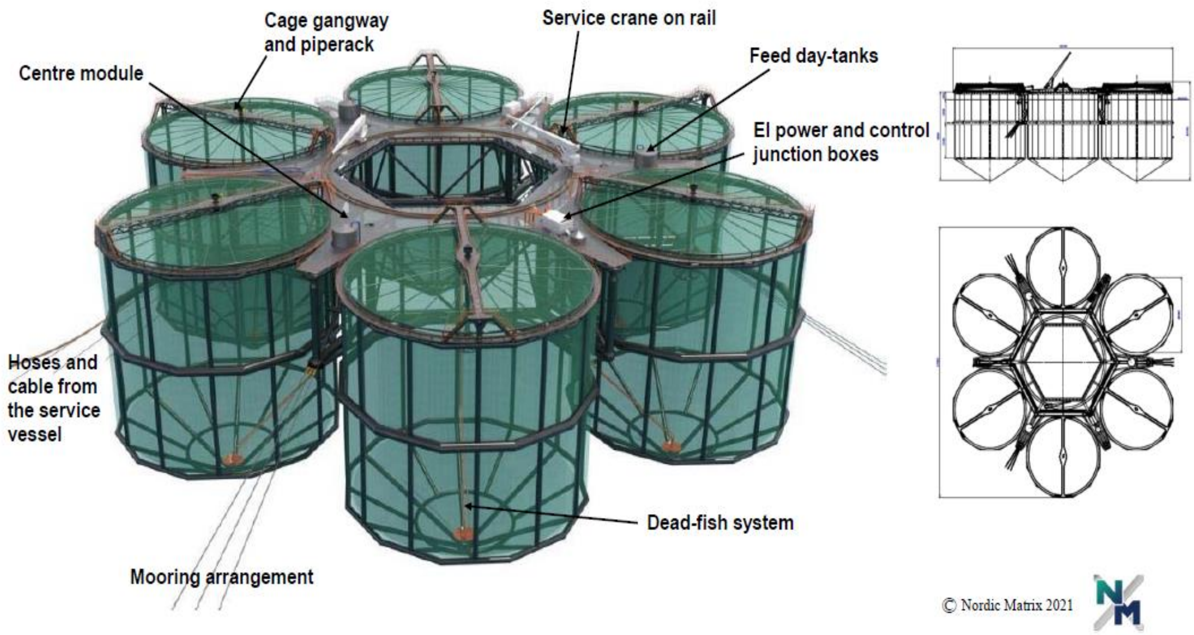

Figure 14: Illustration of the selected fish cage structures and specifications developed by BW Fish Farm (BW FishFarm, 2020).

5.3.3 Moorings

The cages will be held together by a rope and chain grid matrix. The moorings will be specifically designed to meet the predicted meteorological, hydrological, and topographical conditions at the Proposed Development **(Fig. 15).** The moorings system will be checked as part of the daily containment checks, and at the end of each production cycle, trained personnel will conduct a full inspection of parts. As a standard operating procedure, staff will be trained on mooring check methodologies, as well as the escapees (Annex 7).

To anchor the cage clusters safely to the seabed, BW FishFarm (2021) has designed, according to international standards, a structure which has a spread mooring arrangement appearance. This mooring design is based on 3 x 3 mooring lines with the wire as top section and chain and anchor at the bottom **(Fig. 15)** for each cage cluster.

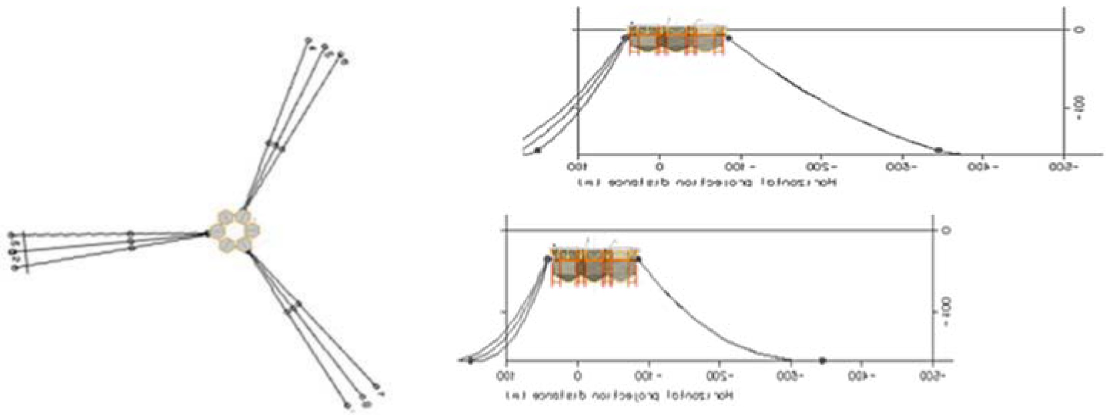

Figure 15: The mooring arrangement per cage cluster to the seabed (BW FishFarm, 2021; Annex 7).

5.4 Lilongeni finfish cage farm concept

5.4.1 Onshore concept

The onshore design consists of a quarantine facility based on a Recirculating Aquaculture System (RAS) which will be recirculating the water through various filters. It will also include a fish processing, freezer facility, storage and an administration block as illustrated schematically in **Fig. 16.** The terrain to establish the facilities will be hired from the existing fish processing company e.g. Seaflower, which is currently running at a low capacity. InnovaSea came up with an onshore design layout (RAS) that may be considered **(Appendix 6).**

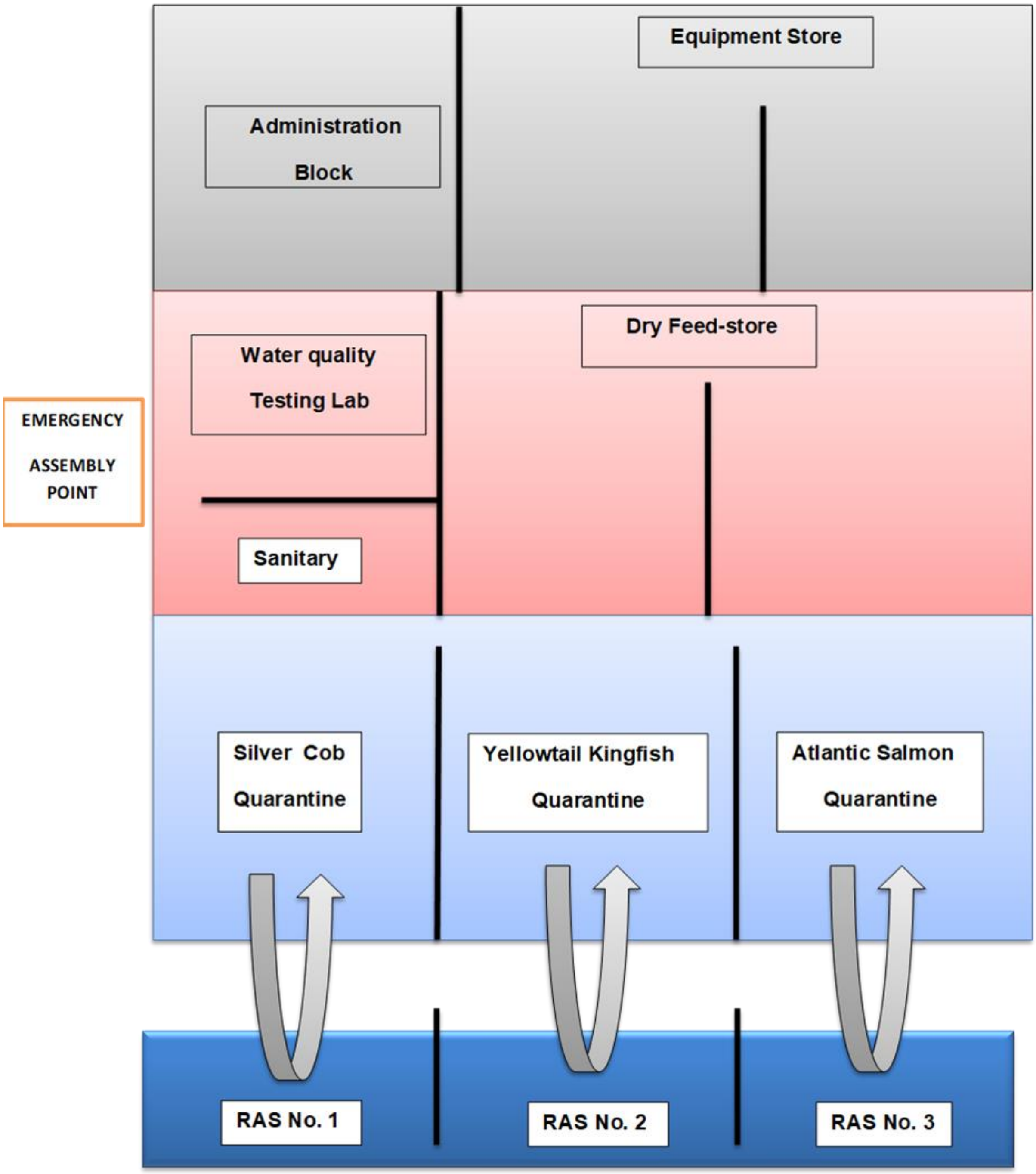

Figure 16: Schematic presentation of the onshore facilities for the Lilongeni Fish-Farming (Pty) Ltd.

5.4.2 Offshore farm concept

5.4.2.1 Offshore proposed farm layout

A bird's eye view of the fin fish farm layout of a cage cluster is presented in **Fig. 17.**

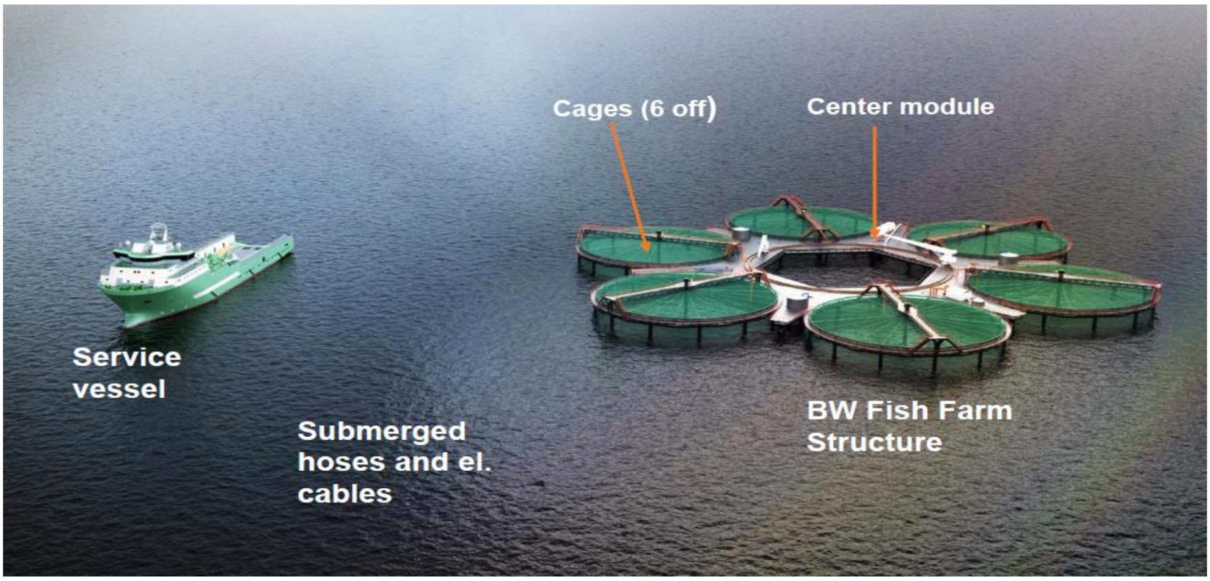

Figure 17: Bird's view of the offshore farm layout for the fin fish cage culture (BW FishFarm, 2020).

For the initial operation, a total of three cluster cages will be installed. The three cluster cages will be deployed in two (2) Phases with each comprising of 4 sub-units in Phase 1 and 6 sub-units in Phase 2 for each fish species as illustrated in **Fig. 18** and **Fig. 19.**

The fish species cluster cages will be separated by 250m to ensure each fish species is well managed. Each cage cluster has the following capacity and output potential:

- Each sub-unit in a cage cluster has a water volume of ca 83 000m^3
- 1 x cage cluster (each with maximum 6 sub cages): total water volume of a 500 000m^3
- Stocking density of 16 fish/m^3 (ca 1.5kg/fish) i.e., 24kg/m^3.
- Total output for each cage sub-unit = 1 992 tonnes
- Total output per cage cluster per species = ca 11 952 000 tonnes

5.4.2.2 Phase 1 offshore cage layout and installation

Three (3) fish cage clusters, each with 4 sub-units, are to be deployed for yellowtail kingfish, Atlantic salmon, and silver cob are schematically illustrated in **Fig.18.** The Center module is operated from the service vessel for feeding, cleaning, and harvesting. The three (3) cluster cages are to be positioned in series perpendicular to the current (250m from each other) to ensure that each cage cluster has a constant flow-through of fresh oxygenated seawater.

The installation of navigational buoys at the proximity of the cluster cages as per specifications, are to be deployed.

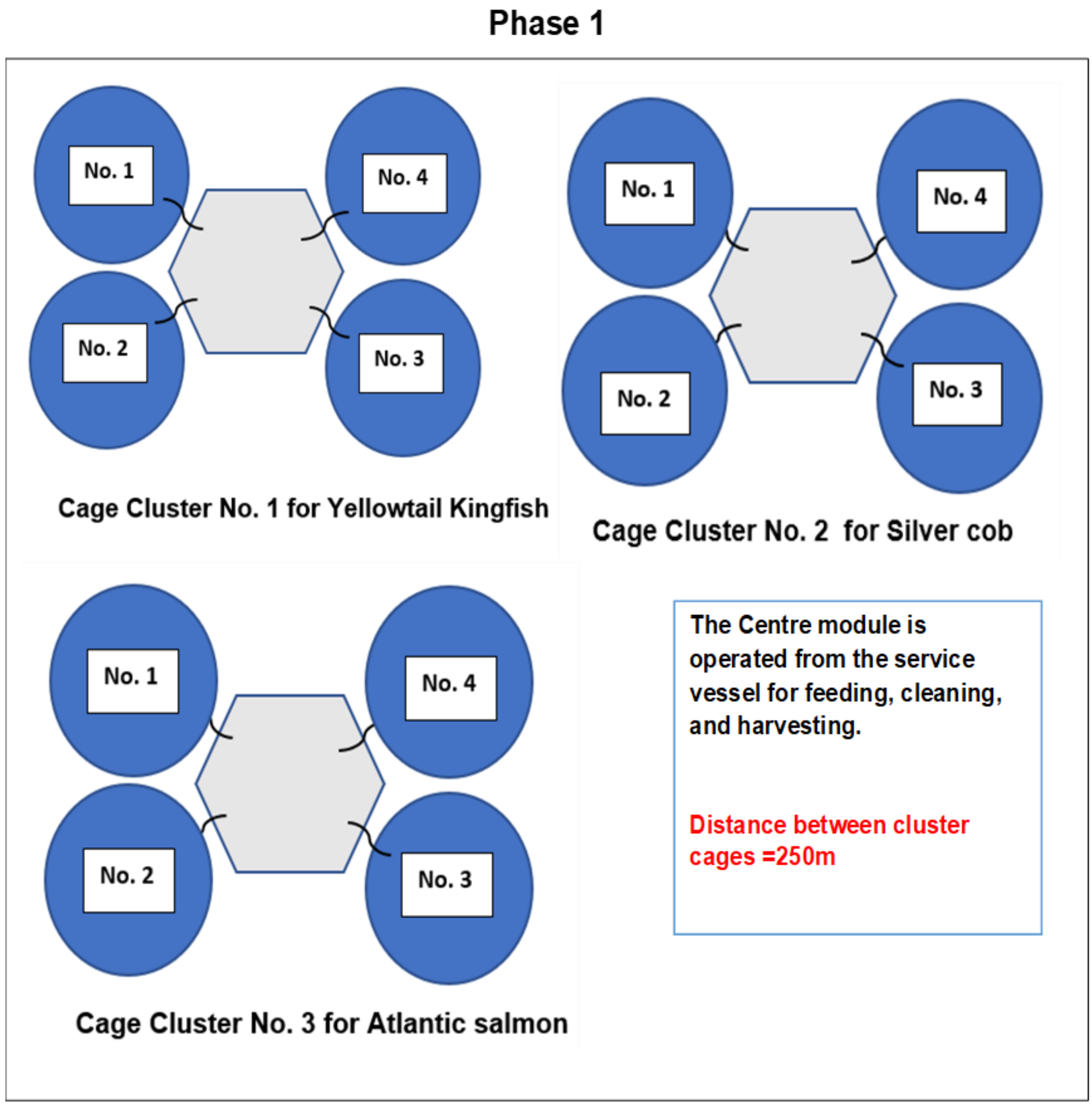

Figure 18: Phase 1 schematic presentation of the fish cage installation layout offshore.

5.4.2.3 Phase 2 design

The Phase 2 **(Fig. 19)** will be an extension to the Phase 1 layout **(Fig. 18).** In Phase 2, an additional 2 sub-units will be added to each cage cluster which implies that for each species i.e. yellowtail kingfish, Atlantic salmon, and silver cob will consist of six (6) sub-unit cages **(Fig. 19).**

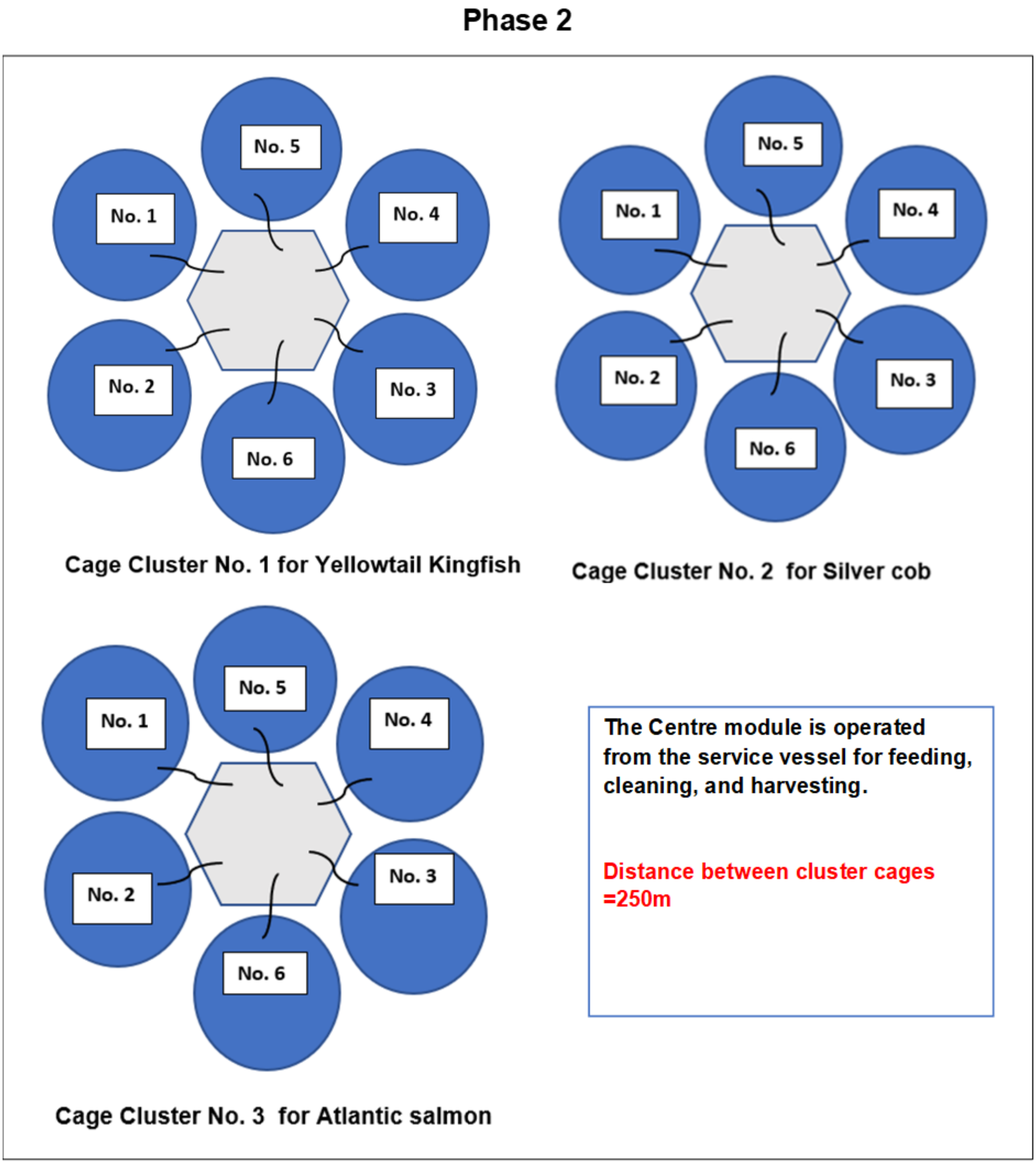

Figure 19: Phase 2 schematic presentation of the cage layout and installation.

5.4.2.4 Phase 1 and 2 cage production capacity

- For Phase 1 **(Fig 18):**
  - **Silver cob**: cage cluster (comprising of four sub-units: 1 to 4), with a cage cluster having a holding capacity of ca 7 968 tonnes for silver cob.
  - **Yellowtail kingfish:** cage clusters (each comprising of four sub-units: 1 to 4), with each cage cluster having a holding capacity of ca 7 968 tonnes.
  - **Atlantic salmon:** clusters (each comprising of four sub-units: 1 to 4), with each cage cluster having a holding capacity of ca 7 968 tonnes.
  -
- For Phase 2 **(Fig. 19):**
  - To add cages 5 and 6 to each cage cluster for yellowtail kingfish, silver cob and Atlantic Salmon – with each cage cluster with a total holding capacity of ca 11 952 tonnes for each specie, respectively.

5.4.2.5 Future expansion

After 8-10 years of operation (pending on maximum capacity having been reached), Phase, 1 and 2 is to be replicated. Future expansion of the cage culture will be identical to Phase 1 and 2 which are to be deployed in parallel to Phase 1 and 2 with a 300m distance between the 2 operations. Initially, a water surface area of 250ha is being required. However, to cater for future expansion and to provide for a buffer zone an additional 250ha is required. The proposed expansion may include:

- **Phase 3:** 2x cage clusters (each comprising of four sub-units: 1 to 4), with each cage cluster having a holding capacity of ca. 7 968 tonnes for yellowtail kingfish and Atlantic salmon respectively

- **Phase 4:** To add cages 5 and 6 to each cage cluster for yellowtail kingfish and Atlantic Salmon – with each cage cluster with a total holding capacity of ca. 11 968 tonnes for each species respectively

5.4.3 Husbandry

In addition to the innovative technical designs outlined **in this section,** the proposed Finfish Cages Farm Project will also incorporate several enhanced management measures including good husbandry, dedicated nutritionists and veterinary services and the use of biological and physical therapies such as cleaner fish, freshwater treatments and hydrolyses where it is appropriate.

5.4.3.1 Production cycle

The Financial Module: business plan (Annex 5) includes a detailed example production cycle for the maximum biomass at the Proposed Development, which includes information on the proposed time of stocking, input numbers, expected growth, estimated mortality, and harvest numbers. A proposed production cycle with a maximum standing biomass of 36 000 tonnes is being expected for the initial production.

The Proposed Development will be operational for 22 months out of every 24 months, ensuring a two-month fallow period before the introduction of the next input of smolts. During the fallow period, the Proposed Finfish Cage Farm will perform necessary maintenance and repairs to prepare for the introduction of the next cycle of fish. All nets will be removed from the pens at the end of each cycle and sent to the manufacturer for testing, cleaning, disinfection, inspection, repair, and antifouling onshore.

Nets that meet specific quality standards will be cleaned and disinfected before being returned to the site after an inspection and, if necessary, repairs. The mooring legs and pen mooring grid components will be inspected, and any required maintenance, repair, or replacement work will be performed by qualified personnel.

5.4.3.2 Stocking

A functional boat referred to as a well-boat **(Fig. 20)** would be used at the beginning of the production cycle to stock the fish cages with smolts over a period of 1 to 2 months as illustrated in the figure below.

Before transport, post fingerlings are pre-conditioned in tanks with sufficient aeration and water drips for 1 or 2 days. The fish are deprived of food during this stage to clear their digestive tracts. This minimizes fouling of the transport system and reduces oxygen consumption. Fish are packed and transported in the early morning when travel can be more comfortable for the fish. It is important to avoid physical damage to the fish during capture, handling, counting, loading and transport to lessen susceptibility to diseases.

For mass, transport holds of big boats called “pituya” that pumps water continuously into the fingerlings for aeration and water exchange during transport is in practice today **(Fig. 20).**

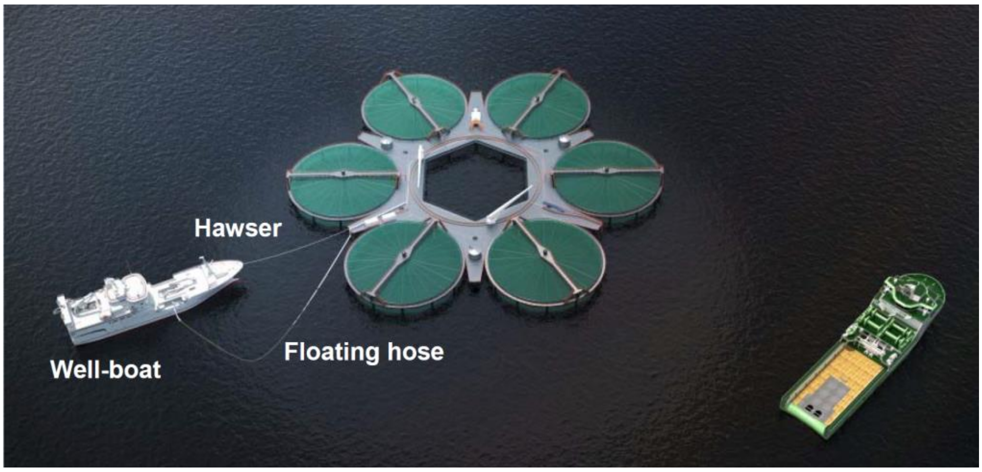

Figure 20: Stocking with a well-boat or a 'pituya' (RHS) for larger quantities (BW FishFarm, 2020).

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5.4.3.3 Feed barge, feeding system and SeaSpine

The feed barge would be fully automated, with a feed capacity of 600 tonnes. The barge can be modified to provide more space for accommodation, welfare, or storage needs. An elevated control room, which houses the feeding and farm control technology, provides extensive 360-degree views **(Fig.21).** The design of the food barge is intended to resemble that of a modern ship, with a tapered bow and stern for excellent sea keeping, while remaining functional for on-site operational needs. The barge's unique design allows for on-board fish treatment and mort processing.

Lilongeni Fish-Farming (Pty) Ltd. is working with leading feed suppliers in South Africa (Hermanus, Western Cape) to source the highest quality feed. The **'Specialized Aquatic Feeds'** is a reputable fish feed producer providing fish feed to current and emerging aquatic farmers.

To ensure minimal waste, the proposed feeding mechanism is fully automated, with an inbuilt pellet detection system and associated feedback loop. This would be aided by cutting-edge underwater cameras that would monitor feeding, general fish health and welfare, and improve equipment safety as illustrated in **Fig. 21** below.

Food and feed equipment for the proposed development's normal operation will be stored on board the Service Vessel in storage facilities and will be delivered directly by boat from the harbour. The estimated number of feed deliveries during the production cycle will be two trips per week based on a Fish Conversion Ratio (FCR) of 1:1.5. This implies that for an annual production of 36 000 tonnes a total of 54 000 tonnes of feed is required. This will effect to a delivery of 4 500 tonnes fish feed per month to the offshore operation. However, with a good feeding regime where waste feed is minimised a FCR of 1:1.2 can be achieved.

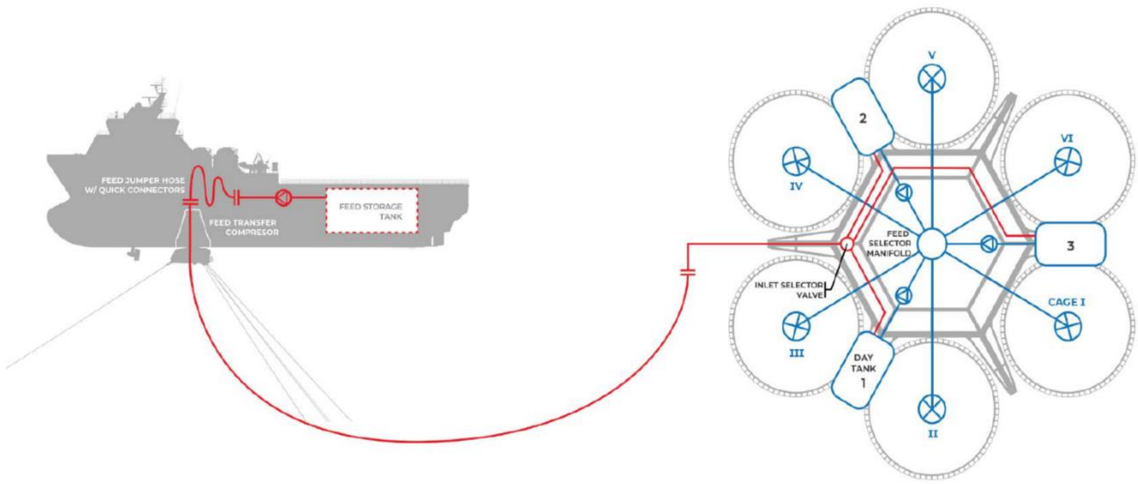

Figure 21: Feed barge and feeding system designed by BW Farm (BW FishFarm, 2020).

5.4.3.4 SeaSpine

A SeaSpine is a central spine that connects the cages to the feed barge, transferring the fish from the barge to the pens. In addition, there are additional (separate) pipes in the spine to allow for mortality recovery. The central spine and pipes are made of high-density polyethylene (HDPE), which has been proven to be a reliable and robust material. This, combined with sensor technology in the system, will reduce the risk of fish being pumped out of the sealed system. The system will be completely 'valved' to ensure that only the open lines are in use.

5.4.3.5 Power and lighting

Navigational lighting requirements for the cages will be agreed upon with Namibia Ports Authority (NAMPORT, Lüderitz Port control). During reduced daylight hours, underwater lighting in the cages may be necessary as part of the production cycle. In the winter of the first marine production cycle, underwater lights are usually used at farm sites. It is suggested that in every cage low, long-life 240W LED lights (equivalent to 1000W of halogen light) to be installed. This illumination is set up at a depth of 6 meters within every fish-stocked cage and is directed downwards into the cages rather than "out-site." The potential effect of those lights is a small underwater light, which is viewed as a green light, with minimal surface visibility. On the proposed development, there will be no unnecessary surface lighting. Reference is to be made to the power and control system as illustrated in **Fig. 22**.

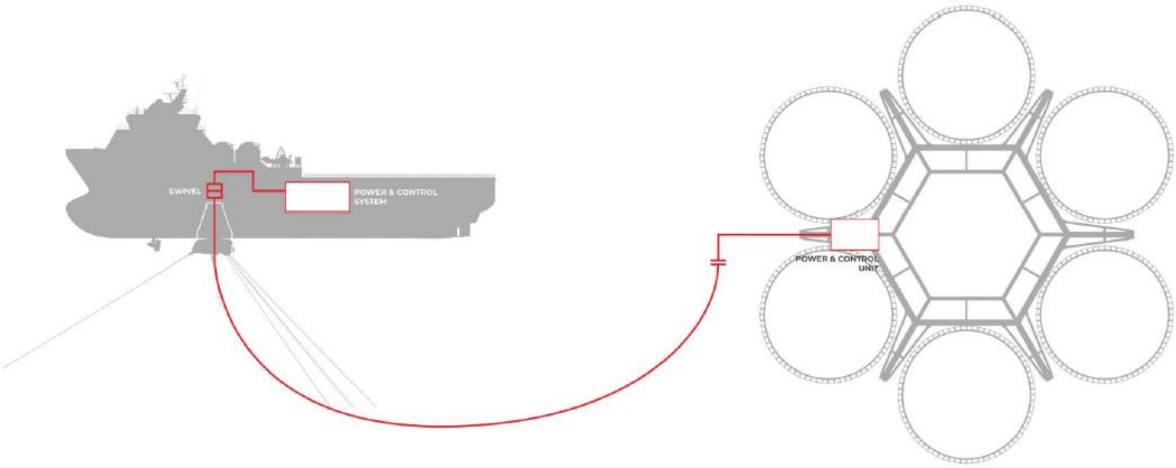

Figure 22: Power and control system operated from the Service Vessel to each cage cluster (BW FishFarm, 2020).

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5.4.3.6 Grading

Grading takes place at critical points in the production cycle to separate different sizes of fish. This is done to ensure a consistent and even growth profile across the entire stocked production, as well as to reduce the risk of aggression developing within the stocked population.

Fish will be transferred to the vessel via the floating horse, where they will pass over a dewatering table, then a grading table with size selectors to separate different sizes of fish. The different sized groups are then returned to separate cages and counted as they exit.

During the production cycle, fish will be graded approximately 2-3 times. Fish Biologist staff will examine the health of the fish before grading operations. While the fish are being graded, they will be constantly monitored to ensure that they are not experiencing unacceptable levels of stress or suffering from welfare issues. The manager will determine whether mitigation measures, such as increasing the amount of space available to the fish, are required to maintain good welfare during grading.

5.4.3.7 Harvesting

Towards the end of the second year of production, harvesting will typically take six months. The harvest boat activity will be around 10 trips per month during these harvesting months, with no activity at all other times. Boat activities during harvesting will have a low impact on maritime traffic near the Proposed Development and are therefore excluded from further evaluation. Each cage is equipped with a movable cover with a net to sort out the fish for harvesting as illustrated in **Fig.23.**

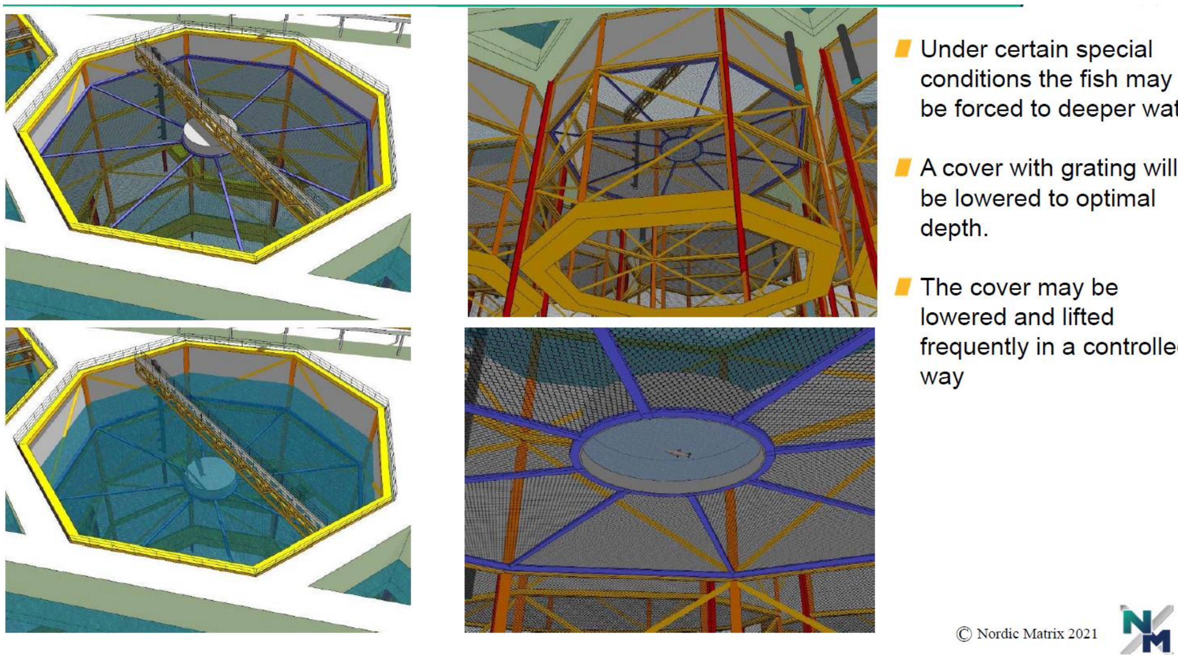

Figure 23: Movable cover for harvesting designed by BW Offshore Farm (BW FishFarm, 2020).

Fish will be transported life to the harvest station once they board the well-boat. A camera monitors the conditions within the wells, and oxygen levels and temperature are controlled. Fish are chilled during transport to reduce stress levels upon arrival at the harvest station. Fish are pumped up onshore and killed by unrecoverable stunning at the harvest station. The stunned fish will then be transported to Lüderitz town's fish processing factory, Seaflower, which will be leased by the Proponent, for primary processing and filleting.

5.5 Farming management

5.5.1 Fish health and welfare

Lilongeni Fish-Farming (Pty) LTD will employ a dedicated team of biologists to be responsible for regular health checks, fish stocking, fish grading and biosecurity monitoring and management of the company's entire project activities. The company will also employ a Fish Veterinarian who will be responsible for veterinary services to ensure a healthy fish at all times with focus on disease prevention through efficient biosecurity controls and ongoing monitoring.

The SeaSpine is designed to allow the farmer to recover fish and return them to the barge, which has been designed to provide a large fish welfare improvement space. This allows fish to be treated in a controlled environment for potential lice and gill disease using multiple in-line and proven non-medicinal solutions. This spine returning the fish to the barge and back to the pens allows for a more passive and reduced impact on the fish while handling because the fish are always at sea level, reducing the need for pumping and heating systems associated with other processes.

5.5.1.1 Medical treatment

The salmon louse is the most common parasite on farmed salmon and one of the aquaculture industry's challenges. Should the need arise, Lilongeni Fish-Farming (Pty) Ltd. only intends to use approved drugs, antibiotics or other medicinal treatment options, as stipulated in the Aquaculture (Licensing) Regulation of 2003 and the approved list of the MAWRL (Veterinary Services).

The worldwide approved and permitted medicinal sea lice treatment options include:

- **The in-feed medicine for sea lice:** Emamectin Benzoate.
- **Topical treatments:** Excis (Cypermethrin), Alphamax (Deltamethrin) and Salmosan (Azamethiphos). Both treatments are performed primarily in full enclosure tarpaulins (either wedge or cone), though treatments may be administered using well-boats (under license) on occasion. Bath treatments may be alternated to.

However, it is observed that sea lice infections occurred on farms where the waters are stagnant to sluggish flowing. At the proposed site at Lüderitz the intense upwelling and pulsating current of the Benguela Current provides an environment which is not conducive for sea lice infections (pers. comm. Atle Ingebrigsten).

5.5.1.2 Nonchemical treatment

To reduce dependence on medicinal treatments, Lilongeni Fish-Farming (Pty) Ltd. will deploy several non-chemical treatments and they will be used where appropriate and necessary. For instance, the use of hydrolases to remove sea lice from salmon, by using low-pressure water. This system reduces the lice burden without the use of medications.

5.5.2 Mortalities

Dead fish are collected in the center at the bottom of the fish cages and will automatically be collected by the dead fish system where it will be processed in the well-boat (Service Vessel 2) as illustrated in **Fig. 24.** Sensors, on the camera systems already in use in fish cages, will ensure that dead fish or smolts will be carried directly to the Well-boat via a network of self-contained pipes.

Following dewatering, the mortalities will be stored in a dead fish processing and storage tank where further processing of dead fish can take place in a safe and sealed environment. The processed waste would then be transferred by boat to a specialist contractor for proper disposal.

Lilongeni management will ensure that the contractor complies with the relevant aquaculture waste management regulations. Lilongeni will also seek to identify the most ecologically friendly method of disposal of dead fish via the company's Environmental Management System. Should a mortality event occur on-site with a mortality rate greater than 100 tonnes of fish per week (which exceeds mortality disposal limits of the farm), Lilongeni will use a specialist contractor to remove and dispose of the fish mortalities.

In addition, a regular diver inspection of the fish cages will be carried out to record mortalities that have not been collected in the basket and to inform the site manager. Then the mortalities are removed, and the dead fish system will also be checked. Mortality details such as suspected cause and number will be recorded by the site staff and regularly reviewed during the production cycle by the fish biologist staff. This and regular health checks help to detect specific health challenges at an early stage.

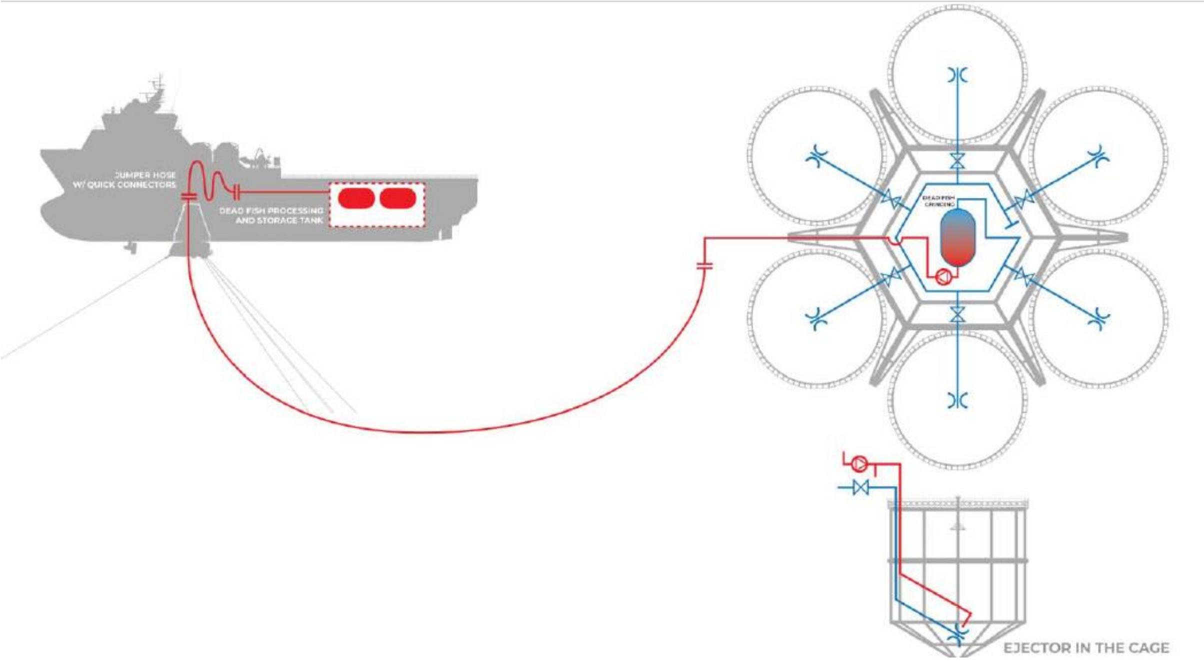

Figure 24: A schematic presentation of the processing of dead fish on the Service Vessel as designed by BW Offshore Farm (BW FishFarm, 2020).

5.5.3 Predator control

The Environmental Management Plan (EMP) details the predation risk and the action taken to minimize the risk of related escapes of the proposed development. At least once per production cycle, this will be reviewed. The measures to be used in the Proposed Development include the selection and design of specific equipment, effective husbandry, and an ongoing assessment of local trends in wildlife. It is believed that seals and sea birds may be a potential predator to the site. Therefore, the site will be equipped with several methods to dissuade the seals and sea birds. Site staff will monitor the measures regularly to evaluate their effectiveness. A key part of the strategy to control predators is the following equipment.

5.5.3.1 Equipment

These include:

- **Seal Pro-nets:** Seal Pro-nets will be used on this site intended to reduce the possibility of seal interactions.

- **Net tensioning:** Net tensioning is recognized as good practice for predator control, and sinker tubes will be used at the proposed development. Net tensioning holds the pen net uniformly taut, presenting a "wall" to any underwater predator, with no slack areas on the net for entanglement or purchase through which a seal can grab or bite fish. The use of a net tensioning system eliminates the need for predator nets and, as a result, the risk of entanglement for predators (both seals and diving birds).
- **Top nets:** Tensioned top nets will be used at the site to protect against bird and animal predation. To reduce predation and the risk of bird entanglement, the site will use tensioned 2" mesh nets in conjunction with bird net supports. These would be placed on top of each cage and held up by high support poles. Poles would be a light grey colour. The nets would be highly tensioned to deter predation from diving birds, and the mesh would be small to reduce the risk of entanglement. Top nets will be inspected and re-tensioned daily, and maintenance will be performed as needed, reducing the potential risk of bird entanglement.
- **Seal blinds:** Seal blinds, which are sections of material hanging down from underwater net panels and acting as a curtain to prevent seals from reaching the fish from below the pen, may also be used on site.

5.5.3.2 Good farm practices

Maintaining effective husbandry practices will aid in reducing the number of birds attracted to the Proposed Development, lowering the risk of interaction and entanglement. The fish cages will be cleaned and inspected regularly **(Fig. 25),** and fish feed will be carefully monitored to ensure that it is not left available, and feed spreaders will be oriented downwards and set to spread the feed evenly, ensuring that there is no available feed source to attract birds. If there is an increase in predatory bird interaction, scarecrows will be used on site. The presence of mortalities is known to attract seals, and an effective mortality removal procedure, such as the one proposed, can reduce the risk of predator attacks.

Biofouling, the attachment of organisms like algae to underwater structures, can occur on cages and associated structures. Divers will inspect each cage regularly, which is cleaned every ten days on average with mechanical net cleaners, Remotely Operated Net Cleaners (RONCs), and Flying Net Cleaners (FNC8s), which use mechanical arms and concentrated jets of water to dislodge weed and other organisms **(Fig. 25).** The cleaning system consist of orifices and brushes for net cleaning, a camera for documentation, automatic and manual FishNet cleaning unit lifting, arrangement and rails for positioning of the FishNet cleaning unit. This efficient 'cleaning' system is designed by BW Farm (BW Fish Farm, 2021).

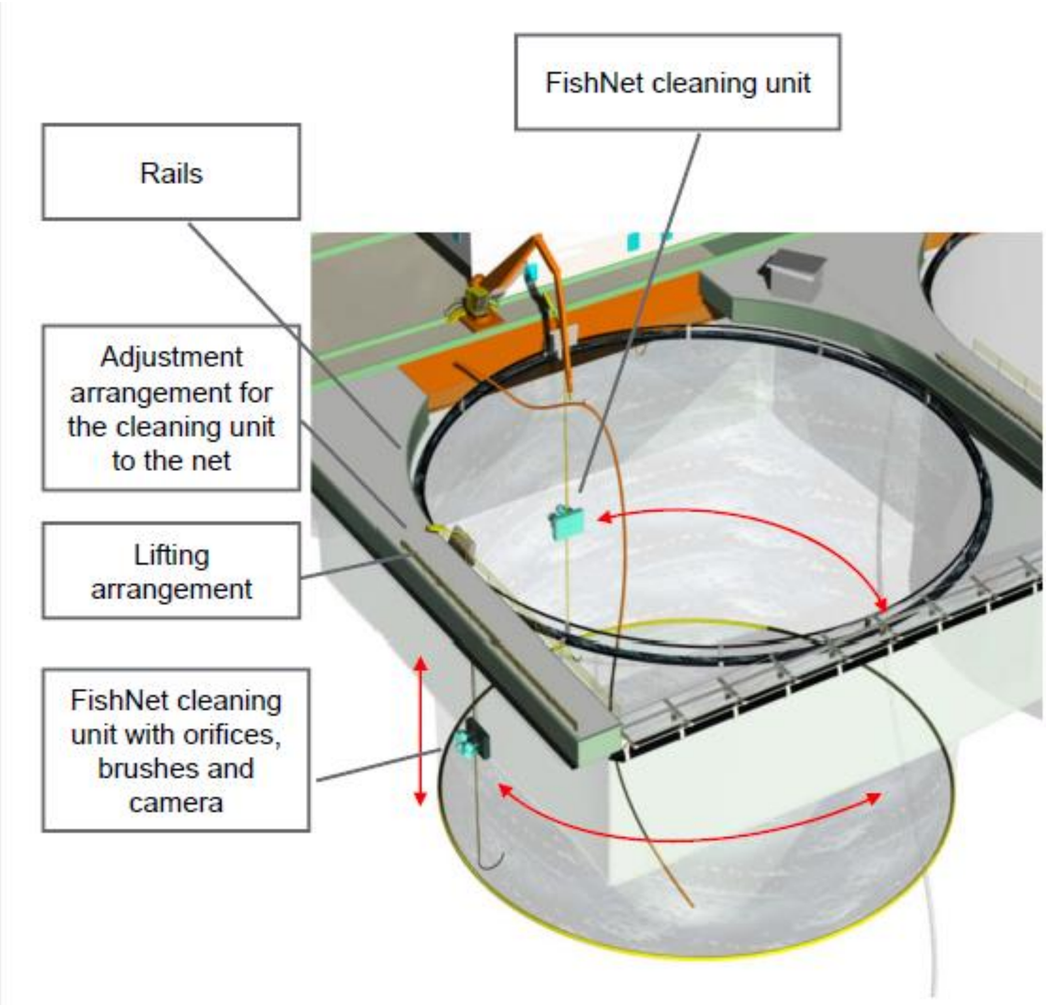

Figure 25: FishNet cleaning unit which includes cameras, brushes and orifices as per design of BW Offshore Farm (BW FishFarm, 2020).

5.5.3.3 Marine animals recording and assessment

The site staff will keep a log of wildlife sightings and interactions with the fish farm to track the frequency of wildlife sightings and interactions with the fish farm. This will aid in determining the need for and effectiveness of site anti-predator devices, as well as informing site and area managers during annual predator control reviews, by developing an understanding of seasonal and longer-term local wildlife trends.

5.6 Access and communication

The Proposed Development offshore will be serviced regularly from the onshore office in Lüderitz, from which staff and workboats will depart for the site (Cii). Staff will be transported to the harbour by vehicle and then by boat to the Proposed Development. It is expected that the staff vehicle (work bus) will be used twice per day between normal working hours (0800 – 1700). Boat trips are expected to include one workboat to reach the site and one smaller rigid-hull Inflatable boat (RIB) to get access to the cage cluster.

The access to the Proposed Development will be via a covered fast boat (seating for 10) or landing craft, which will also transport visitors/divers. A second open boat will be stationed on-site to help with additional work around the farm cages. Considering the challenges of extreme weather and sea conditions, remote monitoring technology **(Fig. 26)** will be used to ensure the safety of staff performing routine husbandry operations, equipment checks, and potential mortalities, as well as other visitors such as divers and government regulators. If the site is rendered inaccessible due to inclement weather, remote monitoring technology will ensure that staff carry out routine feeding and monitoring duties, to ensure that the health and containment of fish on site are not jeopardized by the sea conditions at the location.

The Remote technology system, as depicted in **Fig. 26,** will be installed at the Proposed Development. Cameras installed beneath the water's surface would be used to remotely monitor fish behaviour, feeding, and health. Above-the-surface cameras will be used to monitor sea conditions and feed operations, as well as inspect the overall condition of the environment. This data will be accessible via remote connectivity and transmitted to the shore base.

For effective communication, Lilongeni will establish a line of sight with a relay station that will bounce the signal to the shore base. The Proponent will install the telephony and data communications lines from the shore base to meet the site requirements. Alternatively, 4G and satellite communications could be used as a backup.

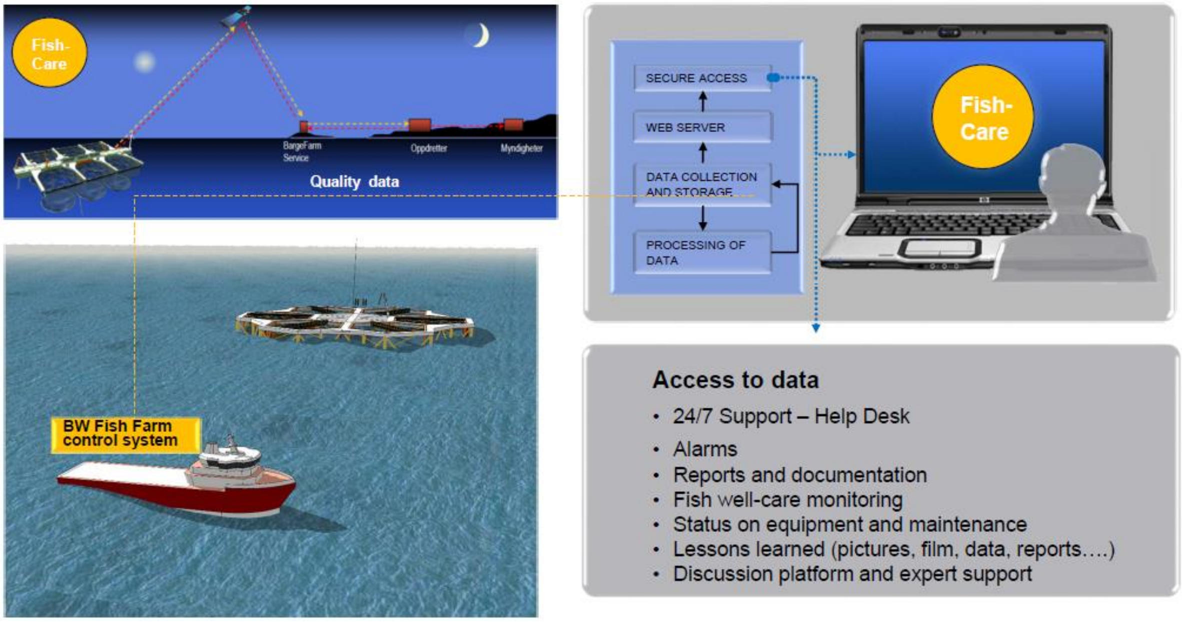

Figure 26: Remote monitoring and logging technology system, designed by BW Offshore Farm, which will be installed (BW FishFarm, 2020).

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5.7 Summary of Lilongeni Fish-Farming innovative technology.

The Table 7 below provides a list of the innovative technology that will be used to develop the proposed Finfish cage culture farm based on BW FishFarm (Annex 7) and InnovaSea (Annex 8).

Table 7: Summary of Lilongeni Fish-Farming (Pty) Ltd. innovative technology.

Innovation	Description	Environmental Benefits
Passive Net Cleaner	Aeration system to ensure automatic cleaning of nets to allow for a good flow-through of water and to reduce algal growth on the netting.	Mitigation of mortalities caused by algae/plankton Reduction in manual handling Reduction in workboats/staff

		deployment, improved O2, reduced Carbon footprint
Mortality recovery	Fast automatic mortality removal from the sea using the LIFT UP technology via the SeaSpine and sent directly to servicing barge via self-contained tubes	Reduction in workboat/staff deployment, reduced Carbon footprint
Mortality processing	Centralised spine to transfer live/dead fish (separately) between pen side and relevant treatment/process facility (on barge).	Reduction in workboat/staff deployment, reduced Carbon footprint, significant stress reduction on fish.
Barge based Fish welfare	Connected to the central spine a fish welfare facility mounted in the barge to passively treat fish (gill, lice etc.) and mortality processing.	Reduction in workboat/staff deployment, reduction on medicinal treatments, reduced Carbon footprint, significant stress reduction on fish

5.8 Site/location alternative

This section provides an overview of the process of choosing this site. Information is provided on alternatives that were considered as appropriate and how environmental and economic costs and benefits have been balanced.

Site selection is a key factor in any aquaculture operation, affecting both success and sustainability. The practical considerations in site selection for cage farming include the physio-chemical parameters like temperature, salinity, oxygen, wave action, pollution, algal blooms, water exchange, etc. that determine whether a species can thrive in an environment. Other criteria which must be considered for site selection are weather conditions, shelter, sea depth, substrate, and finally, legal aspects, access, proximity to hatcheries or fishing harbour, security, economic, social and market considerations etc. to name a few.

According to Lilongeni Fish-Farming (Pty) Ltd, the Species and Site Selection Feasibility Report (InnovaSea, 2020) (www.innovasea.com)**,** four potential sites for fin fish cage culture were selected as feasible (Annex 1). The appointed EAP with the Team of experts evaluated each of the four sites and made presentations of the selected sites at three public meetings held in Walvis Bay (12th January 2021), Swakopmund (13th April) and Lüderitz (23rd February 2021), respectively.

For each site, a brief description of the site, advantages and disadvantages were provided. The affected parties and interested parties gave inputs and recommendations for the selected sites. The three potential sites selected initially are shown in **Fig. 27 and Fig. 29.** This project employed a site/location alternative and a description of the site alternatives is described below:

5.8.1 Site A (north of Walvis Bay)

The site was proposed to be located at 22° 50’ 08’’ Latitude South and 14° 24’ 13’’ Longitude East north of Walvis Bay **(Fig. 27).**

Site A is Proximity to the harbour and is closer to important infrastructures like the harbour, town, railway, good roads in peak condition and an International airport. The town of Walvis Bay and nearby towns have an existing skilled labour force available. Less than 100m sea depth - inshore (ideal for the anchorage of cages)

But the site lies in the proximity of a current oil and gas concession area and the area is prone to periodic algal blooms and sulphur eruptions (Currie, 2010). The site is also in proximity to current offshore Merchant Vessels (MV) parking**.** These concerns were also raised in the public consultation meetings in Walvis Bay and Swakopmund (refer to Chapter 6 on stakeholder consultation). It was recommended that **there is no mitigation** possible for Site A and the risks are too high for an investment of this magnitude. It was recommended to check other site alternatives.

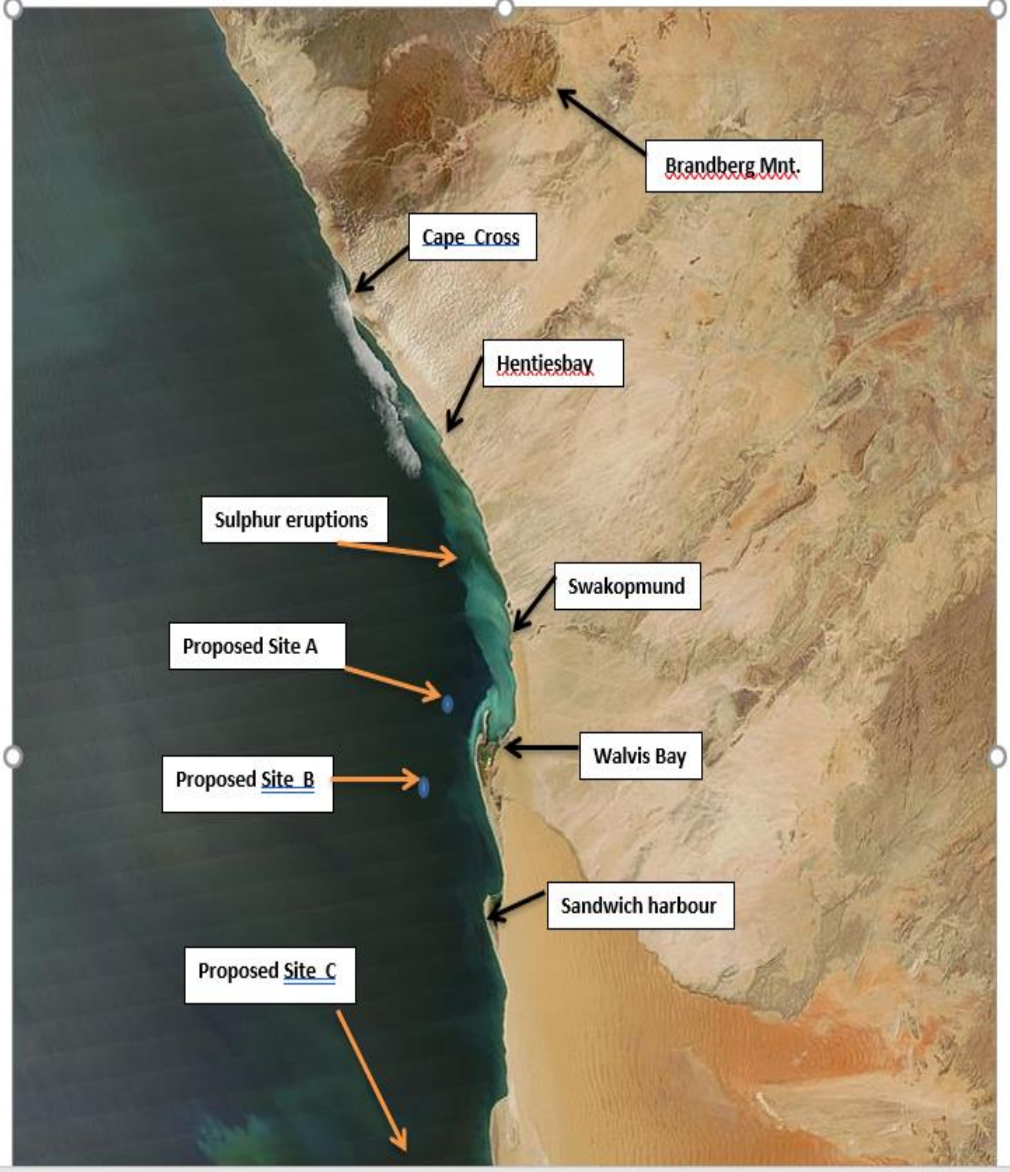


Figure 27: Proposed alternative sites A and B indicating extensive sulphur eruptions represented by the turquoise colour and site C (Lüderitz) in the south.

5.8.2 Site B (south of Walvis Bay)

The site was proposed to be located at 23° 00' 20'' Latitude South and 14° 20' 56'' Longitude East. The site is closer to the harbour, with good infrastructures like the railway, road system, international airport, and Walvis Bay town. The site is also located at a 100 m sea depth which is ideal for the anchorage of cages and best for finfish aquaculture.

However, site B is also prone to severe anoxia during the summer/ and autumn season. The area also experiences sulphur eruptions and red tides (algal blooms) which pose a high risk to the proposed finfish aquaculture farming. Furthermore, site B is near the proposed phosphate mining south of 23° Latitude. The site is also positioned on the long-term environmental monitoring line. The Stakeholder meetings in Walvis Bay and Swakopmund (Annex 9) raised the same concern. It was recommended to move offshore to at least 45nm at site B (ii) at a sea depth of approximately 200m **(Fig. 28).**

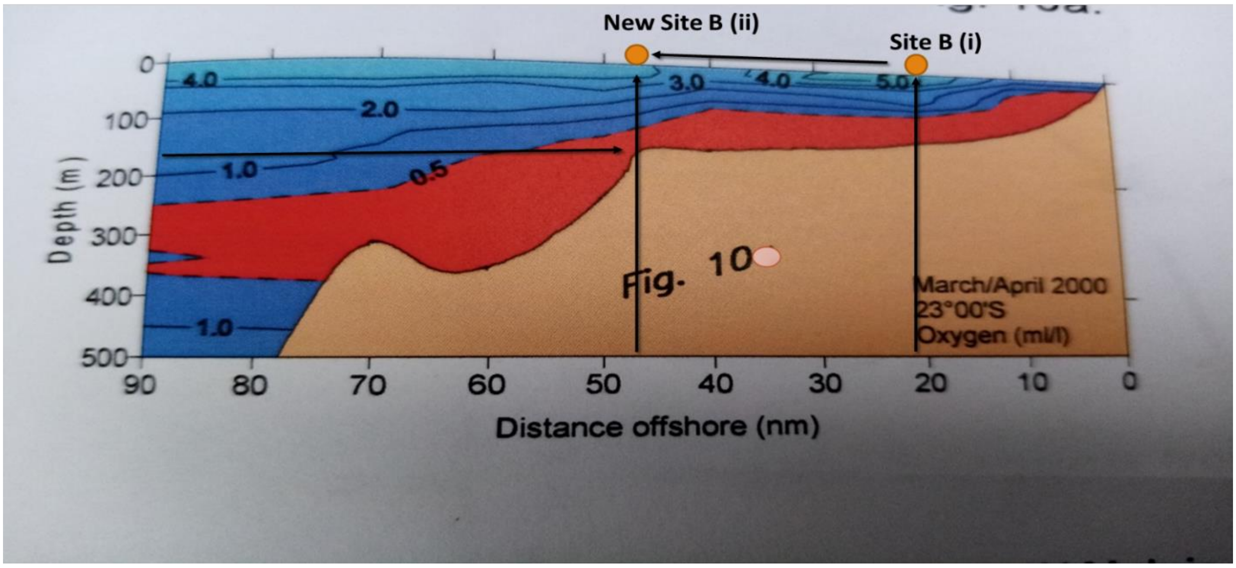


Figure 28: Vertical section off Walvis Bay (23º Latitude) on the 90 nm transect, displaying dissolved oxygen concentrations (ml/l) for March/April (Red zones = Anoxic water) (In: Klingelhoeffer, 2005).

However, the recommended site deemed not to be favourable for finfish farming because the sea depth is deeper (200 m) to anchor the cages. The possible effects of finfish cage farming on the oceanographic parameters on the 23-degree Latitude south monitoring line remain an enigma. Potential negative effects of the proposed

Phosphate mining south of site B may also pose a 'futuristic' threat to the farm. The recommended site B (ii) falls within the southward bound shipping lanes.

Therefore, after further consultations with the public and government officials, the options was to relocate to Lüderitz, referred to as site C(i) **(Fig. 29),** an area that was also considered feasible in the Feasibility Study conducted by InnovaSea (2020).

5.8.3 Site C (Lüderitz)

During the public meeting held in Lüderitz site C (ii), the following was presented:

Site C(i) proposed by the Proponent is located east of Diaz Point at 26°37'00" Latitude south and 14°24'13" Longitude East. The site is in proximity to good infrastructures like the harbour, Lüderitz town, electricity, regional airport, and good road systems. The sea depth of the site is less than 100m which is ideal for the anchorage of cages.

However, during the consultation with MFMR and public meeting, it was raised that the proposed site is in the proximity of Halifax Island and the foraging grounds of the endangered penguin (*Spheniscus demersus*). This site is also positioned on the long-term environmental oceanographic monitoring line of the Ministry of Fisheries and Marine Resources (MFMR) and it is within the Marine Protected Area (MPA). Therefore, it was recommended for the proponent to choose another site. An alternative site C (ii) north- west of Lüderitz was chosen after consultations **(Fig. 29).**

5.8.4 Alternative site (site C(ii))

The proposed alternative site is located north-west of Lüderitz in an expanse open water at 26° 27' 00'' Latitude south and 15° 00' 00'' Longitude east at ca. 70m isobar **(Fig. 29).**

The site is in proximity to good infrastructures such as the harbour, Lüderitz town, electricity, regional airport, and a good road system. Site C (ii) is situated outside the current rock lobster sanctuary as well as way from the proposed line fish and rock lobster sanctuaries north and south of Lüderitz **(Fig. 29).**

The site lies far-away east of the current main shipping lanes but still in proximity to the harbour which makes the day-to-day operations to this site cost-effective and reachable in less than two hours. The site is also situated approximately 10 to 12nm distant from the two (2) important bird islands namely Halifax and Ichaboe which were a concern for site C (i).

The proposed Finfish Farm will also be situated north away from the environmental monitoring line west of Diaz Point. The proposed farm will be positioned within the Lüderitz upwelling cell where sea temperatures range between 12º C to 16º C and oxygen concentration above 3 ml/L which is ideal for the proposed fish species to be farmed.

It is to be noted that as per regulations of Namibia's Island Marine Protected Area (NIMPA) No.316 of 2012, mariculture activities can be operated in this area provided that the activities are not conducted with a 120m radius from each island, impede cetacean migration and adheres to regulations specific to island protection. Therefore, **site C (ii) is regarded as the alternative site** for the proposed Finfish Farming Project at 26° 27' 00'' Latitude south and 15° 00' 00'' Longitude east.

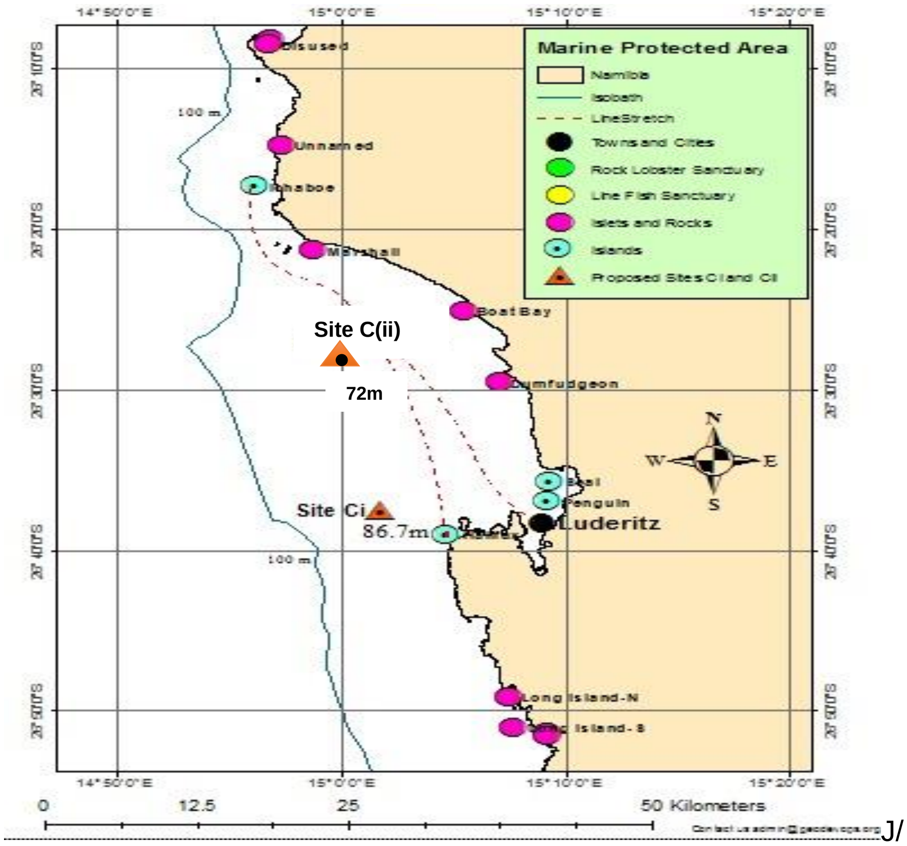


Figure 29: Site C (i) as presented at the public meeting and site C (ii) recommended as the alternative at 26º27'00' Latitude south and 15º00'00'' Longitude east (26.45 and 15.00).

5.8.5 Site D (Oranjemund)

The alternative site D, which is situated at 28° 41' 26'' Latitude south and 16° 17' 24'' Longitude east **(Fig. 30)**, was not considered ideal for the proposed project, due to the following reasons.

- the town has no established harbour facility,
- remote from major Namibian towns,
- no existing fish processing factories,
- falls within the diamond restricted area which could restrict operations
- is positioned within the Ecological or Biological Significant Marine Area (EBSA) / (BCLME)
- dissolved oxygen levels in the area during winter fall below 80% which pose high risks to finfish growth and production
- not connected to a railway network

The above implies that the site is regarded as a high risk to the project investment although it is situated below the 100m isobar and that Oranjemund is becoming an emerging potential town with all its associated facilities.

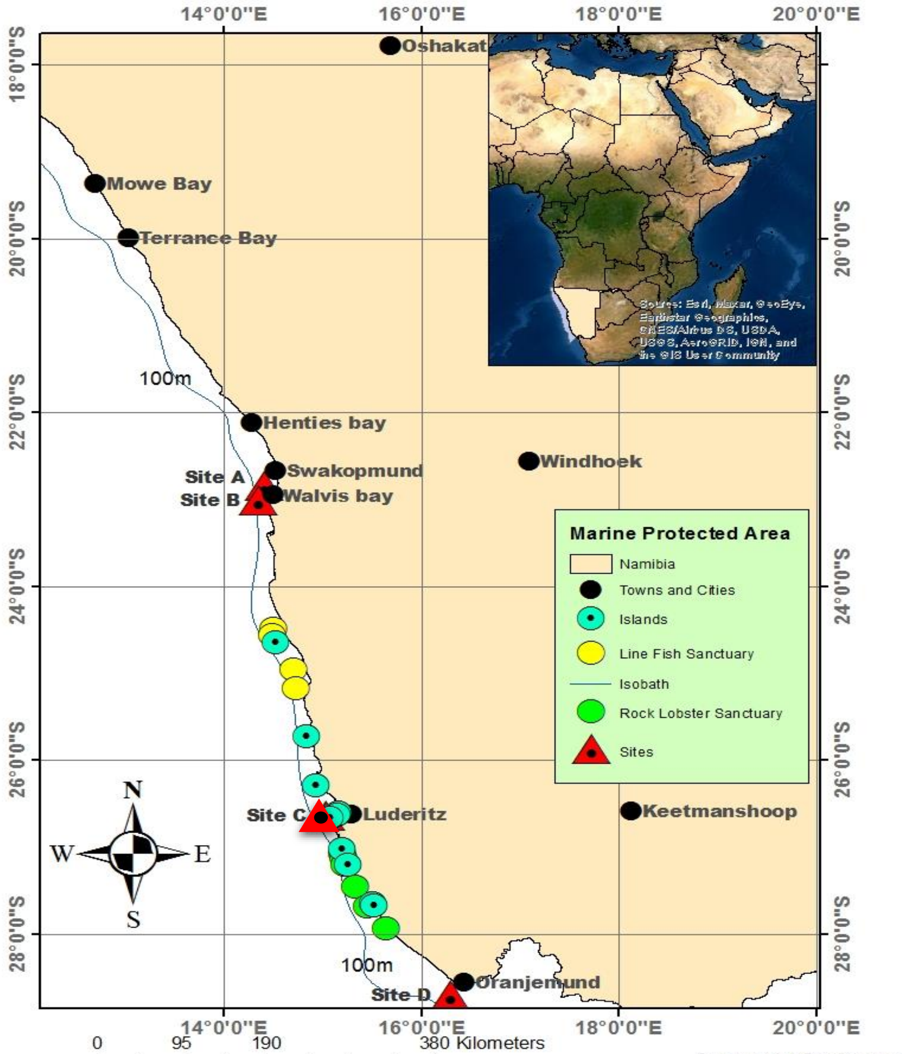


Figure 30: Summary of the 4 alternative sites recommended by the Proponent (InnovaSea, 2020).

6. PUBLIC CONSULTATIONS AND GAP ANALYSIS

6.1 Consultation overview

Public consultation is an important and mandatory aspect of environmental assessments in Namibia, based on the principle that those affected by proposed projects should have an opportunity to provide input to the assessment. The public's legitimate expectations that they are consulted on decisions that could affect them have heightened in Namibia in recent years along with public awareness about major proposed projects.

Namibia's EIA legislation mandates that public meetings are conducted for projects that might impact the environment in one way or another. The EAP together with the Proponent needs to invite those of the public who could be directly or indirectly affected by this marine-based project, as well as key stakeholders in the project area, and others who may be interested in this proposed project.

The objective of public participation and consultation is to provide stakeholders, including the public community, an opportunity to partake in the Environmental Assessment Process, to safeguard that the envisioned 'finfish cage culture' development initiatives consider broad-based concerns. It further improves governance in that the planned development must contemplate a wide variety of issues, e.g., the need to protect the natural environment and the need to uphold an operational ecosystem.

6.2 Consultation

Throughout the development and planning processes, stakeholders have been consulted. The Proponent has attempted to gain stakeholder support at key stages and to provide stakeholders with an opportunity to comment. Although consultation has been ongoing throughout the development phase, it can be divided into three key phases:

- Stage1: Screening and scoping consultation
- Stage 2: Ongoing consultation and
- Stage 3: Planning and EIA results and conclusions.

Consultation approaches have varied depending on the topics under discussion and the needs of stakeholders. As a result, several approaches have been employed, including (but not limited to):

- Key stakeholders were identified from contacts of the Project Team, as well as from the Chairperson of the Mariculture Association, Chairpersons of the Fishing Industry and staff of MFMR based in Swakopmund, Walvis Bay and Lüderitz office.
- Written invitations were sent via e-mail to: chairpersons of the fishing industry associations (hake, midwater trawl, longline, skiboat, monk and sole etc); the Namibia Standard Institute; //Karas regional council; the regional councillor of the !Nami≠Nus constituency; Lüderitz town council; Namport port manager of Walvis Bay and Lüderitz. In addition, the public meeting adverts were sent, and hand delivered to staff within MFMR based at Walvis Bay, Swakopmund and Lüderitz; representatives from Lüderitz mariculture and Five Roses Aquaculture were also consulted and invited. A list of letters to the Fishing Industry and relevant stakeholders inviting them to the coastal public meetings is summarised in Table 8.
- Advertisement notice of the Environmental Assessment Process were placed in the Market Watch section of five (5) national newspapers **(Appendix 7a, b, c, d)**
- A register of I&AP was opened (Table 9), following the placed newspaper adverts.
- An electronic copy of the Background Information Document (BID) was made available via e-mail to all the registered I&AP for comment prior to the public meetings (Annex 2).
- The 14-day comment period on feedback on the BID is presented in Table 9.
- Public attendance list at the three coastal meetings **(Appendix 8a, b, c).**

Table 8: Letters of invitation via email to the fishing industry and relevant stakeholders in the three coastal towns.

TOWN	NAME	ORGANIZATION	POSITION
Walvis Bay and Swakopmund	Mr Stefanus Gariseb	NAMPORT SHREQ	Manager
	Ms Paloma Ellitson	Namibia Standards Institute	CEO
	Mr Stanley Ndara	Observer Agency (MFMR)	Deputy Director
	Mr Stefen Ambabi	MFMR (Surveillance)	Director
	Mr Ron Walters	Demersal Hake association	Chairperson
	Mr Peya Hitula	Demersal Monk & Sole association	Chairperson
	Mr Clive Kambongarera	Midwater-trawl Association	Staff member
	Mr Koos Blaauw	Namibia Mariculture Association	Chairperson
	Dr Tandiwe Gxaba	Benguela Current Commission	Exec. Secretary
	Mr Kakoro	Large Pelagic Association	Chairperson
	Mr Henning du Plessis	Private Busines	Resid. Walvis Bay
	Mr Ivo Gouveia	Beira Investments	Director
	Mr Manuel Romero	Private shellfish farmer	Director
	Mr Peter Carlson	Midwater Trawl Assoc.	Chairperson
	Mr S Anderson	Line Fish – NRSAA	Chairperson
	Mr Isaacs	Benguela Ski-Boat Assoc.	Chairperson
TOWN	**NAME**	**ORGANIZATION**	**POSITION**
Lüderitz	Ms Suzan Ndjaleka	Lüderitz - Regional Council	Hon Reg. Cncl.
	Mr Asser Mukupuli	Lüderitz BCC	Consultant
	Mr Ochs	Lüderitz - Town Council	CEO
	Mr Jason Burgess	Mariculture Association	Member
	Mr Kurt Kessler	Mariculture Association-	Member
	Ms Aina Petrus	Aquaculture	Private
	Mr Max Kooper	NAMPORT, Lüderitz	Port Manager
	Mrs Brigitte Fredericks	Lüderitz Town Council	Member

Note: The newspaper advert announcing the public meetings at the coastal towns, was forwarded to both the deputy directors based at NatMIRC (Swakopmund) and Fishery Research (Lüderitz) to inform their staff to attend the meetings.

Table 9: Registration list of I & AP and 14-day grace period feedback received.

TOWN	NAME	ORGANIZATION	POSITION	FEEDBACK
Walvis Bay	Mr Stefanus Gariseb	NAMPORT SHREQ	Manager	Apology
	Ms T-B Hatutale	NSI	Acting CEO	None
	Ms Katrina Hilundwa	FAO	Staff member	Apology
Swakopmund	Frikkie Botes	Private	Resident	Yes
	Mike & Ann Scott	Private	Resident	Yes
Lüderitz	Ms Kolette Grobler	MFMR	Chief Scientist	Yes
	Ms Jessica Kemper	Private	Resident	Yes
	Ms Aune Natinda	Hanga Abalone	Gen. Manager	Yes
	Mr Reinhard Cloete	Reinesme Trad. Ent. Cc	Director	None
	Mr Kalsen Neliwa	Marco Fishing	Manager	None
	Mr Feridie de Villiers	Novaship Log. (Pty) Ltd	Area Manager	None
	Ms Lynne Steenkamp	Metcalfe Beukes Attor.	PA	Yes
	Mr Greater Makumbira	Kelp Blue	Manager	None
	Dr Lima Maartens	Enviro. Consulting	Director	Yes
	Ms Estelle Fleidl	Private	Resident	None

Stage 1 included consultation and agreement on study specifications such as baseline condition as well as consultation on certain technical aspects.

Through discussions held with stakeholders and the Proponent a proposed approach was introduced. The scope and methodology for studies, as well as the approach to the EIAR, were agreed upon where applicable. The meetings also provided an opportunity to identify key concerns and issues addressed as part of the EIA.

Additional one-on-one meetings at all three coastal towns were held with government officials (Inspectorate and Fisheries biologists), Parastatals (e.g. NAMPORT), Town Councillors, Fishing Associations, the Public and the Mariculture Association.

6.2.1 Stakeholder Scoping summary for Statutory Consultees

Summary of meetings held with staff of MFMR in Windhoek (HQ), Swakopmund (NatMIRC) and other stakeholders is listed below:

6.2.1.1 Ministry of Fisheries and Marine Resources (MFMR) – Windhoek

Visit 1: As per the request of the EC (MEFT office) a letter of "consent" for the support of Finfish farming in the Atlantic Ocean, was submitted to the ED office by email and by hand on the 23rd of November 2020 and once again on 12th April 2021, after the three coastal Public consultation meetings held **(Appendix 3).**

Visit 2: On Wednesday the 16th December 2020, Windhoek Head Office (Directorate of Aquaculture & Directorate of Policy, Planning and Economics), the EAP made a presentation to Mr R Cloete (Director), Mr J Hamukwaya (Deputy Director) and Mr T Mahango (Acting Deputy Director), regards to the License Applications for the fish to be farmed with. The Proponent Mr T. Mausberg was present during the presentation (Annex 10). The following comments were made by the government officials:

- An Environmental Clearance Certificate needs to be attached to each License application.
- Each license application to indicate exact coordinates of the onshore and offshore operation.
- To make use of the revised application form (new format and summary of conditions) – refer to **Appendix 9.**
- The Proponent needs to focus on the indigenous species; however, the Aquaculture Act of 2002 does make provision to farm with foreign species if all potential risks are being mitigated.
- The Ministry welcomes this initiative which will be the 1st finfish cage culture in the Atlantic Ocean of Namibia.

Visit 3: On Monday-18th January 2021, the EAP, Ms N Kauluma and Ms M Shimhanda met with the Competent Authority of MFMR Ms Graca de Almeida (Director of Resource Management) to determine the status of the letter of support from the ED office submitted on 23rd November 2020. The Director provided the Team with the following information:

- ✓ A consent / support letter will only be issued once proof of an Environmental Clearance Certificate is issued by the EC office of MEFT – which is a catch 22 situation

- ✓ The Directorate of Resource Management is the Competent Authority of MFMR that deals with all Aqua related EIA's

- ✓ That the EAP should work closely with staff at NatMIRC who will study the EIA and provide their inputs; by engaging with the staff at NatMIRC all issues can be resolved prior that the EIA is submitted to the EC office of MEFT for final approval. This will minimize unnecessary delays.

On the same day a courtesy visit was made to update the Director and Deputy Director of Aquaculture and provided an update on progress made to date.

6.2.1.2 Ministry of Environment, Forestry and Tourism at DEAF

On the 12th December 2020 the EC office was visited to:

- ✓ Hand in a hard copy of the Background Information Document (BID)
- ✓ Provide an update on the way forward regarding public meetings and scoping stage 2

On the 18th January 2021:

- ✓ To submit a copy of the letter, that had been submitted to the ED of MFMR requesting for consent / support to the proposed finfish farm (**Appendix 3)**
- ✓ To provide an update on the coastal public meetings held at Walvis Bay and Swakopmund

The EAP was requested by the EC office to:

- ✓ Provide a detailed map indicating the 4 x alternative sites (Co-ordinates) proposed by the Proponent
- ✓ To proceed to Lüderitz to hold a public meeting to engage the community and major stakeholders on the proposed project of finfish farming in the ocean by Lilongeni Fish-Farming (Pty) Ltd. – the alternative <u>site C(ii)</u> at 26°27'00'' Latitude south and 15°00'00'' Longitude east

On the 30th January:

- ✓ to submit the Scoping Report – Stage 2 and
- ✓ to inform that a 3rd Public meeting will be held at Lüderitz in February 2021

6.2.1.3 Ministry of Fisheries and Marine Resources – Swakopmund (NatMIRC)

On Friday, the 18th and 22nd December 2020, Staff of the Oceanographic and Environmental Sections were met to inform them of the upcoming public meeting in January and to provide an overview on the pending EIA on finfish cage culture in the Atlantic Ocean of Namibia.

On the 22nd of December 2021, the Proponent Mr. T. Mausberg accompanied the EAP at these follow-discussions. The main points for discussion included:

- Sporadic anoxic conditions during the summer months along the inshore Central coast of Namibia (Anja van der Plas) (Chris Bartholomae)
  - ✓ Recommend moving further offshore at site B to avoid anoxic conditions in surface waters i.e., > 3ml/L
- Seasonal occurrence of Sulphur eruptions between 24º and 21º Latitude south (Bronwen Currie)
  - ✓ Recommends that the Proponent avoid inshore areas of the Central Namibian ocean
- Chief Mariculture Scientist responsible for all onshore and offshore Aquaculture related farming operations (Heidi Scrpetzyk)
  - ✓ Valuable information on future mariculture in Namibia was received. It was recommended to contact the Namibia Standard Institute (NSI)

In addition, on Monday the 11th January 2021 before the public / stakeholder meetings on the 13th + 14th January 2021, the EAP met once again with various staff of NatMIRC to obtain additional oceanographic inputs pertaining to the Central offshore regions of Namibia.

6.2.1.4 Meetings and e-mails held with the Chair of the Namibia Mariculture Association (NMA)

On Wednesday the 23rd December 2020, the Chairperson of the Namibia Mariculture Association (NMA) was met. Subsequent emails followed in December 2020 and January 2021. The following topics were raised:

- The EAP provided a summary background on the intentions of Lilongeni Fish-Farming (Pty) Ltd. regards to finfish cage farming in the sea.
- The upcoming public meetings to be held in Walvis Bay and Swakopmund.
- The proponent to join the NMA.
- Current aquaculture license procedures in place when requesting to farm with aquatic organisms

6.2.1.5 Meeting with Beira Investments

On 9th January 2021, a meeting was held with Mr Ivo de Gouveia who is well known to the Proponent for the past 3 decades. The meeting touched base on various issues with a focus on the proposed salmon farming by a company from Norway referred to as a BW Fish Farm (Offshore).

Mr de Gouveia was approached last year by the company to assist in facilitating a salmon operation in Namibia. Mr de Gouveia recommended, that the company the EAP was working for (Lilongeni Fish-Farming (Pty) Ltd) in conducting the EIA, should take the lead and possibly join in a partnership with BW Fish Farm.

On the 16th of January 2021, Mr de Gouveia provided the EAP with all relevant documents on the BW FishFarm such as goals, objectives**,** fish farm solutions**.**

The EAP handed over all relevant Documents of BW FishFarm to the Proponent and requested that they make direct contact with both Mr de Gouveia and the company referred to a BW Fish Farm.

6.2.1.6 Albatros Task Force (ATF)

Via Email correspondence between the EAP and ATF (Ms S. Mattjiila and Mr T. Shaanika) the following potential impacts were raised:

- the Cape gannet, which breed on some of the islands off Lüderitz, are divers and could be attracted to the cage nest
- this can also apply to the Black-browed albatross, Yellow-nosed albatross, Shy albatross, petrels, and Tristan albatross
- will the harvested fish be processed on board the Service Vessel and what becomes of this waste (discards)? will it find its way into the water?

<u>Mitigation:</u> Bird distracters to be installed; cages mostly will be submerged; all waste (dead fish and fouling) will be sucked up and stored at the Service vessel and disposed onshore; no processing of fish will take place at sea – all fish will be harvested via ‘suction pipes’ from the cages directly on board to the Service Vessel and transported for processing onshore.

The birds listed above are recorded as the main bycatch species found on longlines and fishing trawlers (refer to Table 15).

6.2.1.7 Stakeholder met at Lüderitz on a one-on-one

During the public meeting held on 23rd February 2021 the opportunity was taken to meet with other officials that could have an interest to know more on the proposed cage culture of finfish. The target group included members of the Namibian Mariculture Association, Regional Council, and private sector.

All persons met were in support of the proposed finfish cage culture and stated that this would provide the town the much-needed economic stimulus. Summary of meetings held, and its outcomes is presented in Table 10.

Table 10: Summary - list of relevant stakeholders met on a one - on-one in Lüderitz.

No.	NAME	ORGANIZATION	OUTCOME
1	Mrs B Fredericks	Lüderitz Town Council	In full support
2	Mr W Henok	Namport, Lüderitz	See no obstruction
3	Ms A Nintinda	Hangana Abalone	In full support
4	Ms F Nghoongalobi	Maricultre (MFMR)	Welcome this initiative
5	Mr A Mukuouli	BCC	In full support
6	Mr K Kessler	Lüderitz Oyster	In full support
7	Ms Suzan Ndjaleka	Councillor	In full support
8	Mr J Burgees	Fisherman	In full support
9	Mrs A Petrus	Private	Welcome the initiative

6.3 Public meetings at coastal towns

The Proponent had proposed four (4) alternative sites for the proposed finfish cage farming which is to be operated along the coast of Namibia. It is for this reason that public meetings had to be conducted at all three major towns namely Swakopmund, Walvis Bay and Lüderitz. These public meetings were advertised on Friday the 18 December 2021 in the Namibian and The Namib Times for both Walvis Bay and Swakopmund **(Appendix 7a)** and the Allgemeine Zeitung, Republican and SUN Newspaper for Lüderitz on the 29th January **(Appendix 7b)** and on Wednesday the 3rd February 2021 in The Namibian, **(Appendix 7c).**

Public meetings were held on the following days at the following towns:

- Walvis Bay at Pelican Bay Hotel on the 12th of January 2021
- Swakopmund at NatMIRC, MFMR on the 13th January 2021
- Lüderitz at Nest Hotel on the 23rd of February 2021

Minutes of meetings for both Walvis Bay and Swakopmund including participant name, signature, and affiliation, have been presented in the Scoping Report submitted to the EC office of MEFT on 30th January 2021. However, part of meeting outcomes will be resubmitted in this report and detail Minutes of the three coastal meetings are presented as Annex 9a (Walvis Bay), Annex 9b (Swakopmund) and Annex 9c (Lüderitz).

6.3.1 Walvis Bay at Pelican Bay Hotel and Swakopmund at NatMIRC

Presentations held on Tuesday the 13th and Wednesday 14th January 2021 were to provide the public with information on the two (2) main sites A and B which were provided by the Proponent to conduct a finfish farm operation in the Atlantic Ocean, in the vicinity of Walvis Bay. The future extension to Lüderitz (site C) was also presented including the alternative 4th site D at Oranjemund (Annex 10a).

The focus of the public meetings was to introduce the project to the public. The envisaged Finfish farming at the four (4) proposed sites, listed below, was provided.

- **Site A – north of Walvis Bay** (22° 50' 8'' Latitude south and 14° 24' 13'' Longitude east) – detailed presentation
- **Site B – south of Walvis Bay** (23° 00' 20'' Latitude south and 14° 20' 56'' Longitude east) – detailed presentation
- **Site C – west of Lüderitz** (26°37'40'' Latitude south and 15°01'53'' Longitude east)- referred to
- **Site D – inshore true west of Oranjemund** (28°41'27'' Latitude south and 16°17'25'' Longitude east) – referred to but not an option

Summary of minutes of both meetings are presented in Table 11(Walvis Bay) and Table 12 (Swakopmund). Both meetings were professionally chaired by Mr Frikkie Botes (the previous Chief of Mariculture of NatMIRC – MFMR prior to him going on pension last year).

Public participation was “lively” at times; all concerns and inputs were meticulously documented by Ms Ndamononghenda Kauluma (Secretary). All the inputs received were documented and are appropriately addressed in this EIA Report (Stage 3).

Registration, presentation and comments

- *Registration:* In Walvis Bay 12 persons from the public attended **(Appendix 8a)** and at Swakopmund 32 persons **(Appendix 8b).**
  Presentation: The same presentation was made by the EAP at both venues (Annex 10a).
- *Comments and inputs:*
  - Walvis Bay: The participants comprised mainly of members of the fishing industry, mariculture farmers, NSI, NAMPORT, government fishery inspectorate, who were all in support of the proposed finfish project and welcomed this initiative which will provide confidence to the Namibian Mariculture Association; however, lessons learnt by the mariculture oyster farmers need to be considered. The sporadic anoxic conditions prevailing in the Walvis Bay inshore regions could be a limiting factor to farm in this inshore area. A summary of points raised at Walvis Bay are presented in Table 11.
  - Swakopmund: The participants were comprised of fishery scientists (MFMR), private individuals and the fishing industry. A summary of points raised at Swakopmund are presented in Table 12.
  - Presentations made in both Walvis Bay and Swakopmund appear in the hard copy (Annex 10a).

Table 11: Stakeholder scoping summary: major points raised at the public meeting on 12 January 2021 in Walvis Bay.

Organization	Question / Comment	Response
Zeist Invest	Mr Henning du Plessis: emphasised that this is a project of high magnitude thus the proponent should start small by doing a pilot study at least for the first three (3) years.	The advice and caution of Mr HduP was duly noted and will be taken into consideration.

Namibia Mariculture Association	Mr Koos Blaauw: it is reported that the Norwegian Salmon has a skin disease; what is the probability of salmon infecting other fish and shellfish at the proposed sites?	The regulations for the import and export states that all live animals imported into the country should be disease free (strict protocols are in place to avoid this). The smolt will be quarantined for observation before released into the Namibian environment. The cold waters and pulsating current is not a conducive environment for bacteria to
MFMR	Mr Ivory Uriab: advised the Environmental Assessment Practitioner (EAP) to engage with the Minister and the Executive Director (ED) of MFMR from an early stage. Commented that both MFMR inspectors and NSI officials will be present during time of harvesting.	The EAP responded that this was ongoing and the ED and Deputy Minister are being kept abreast of progress made regards to the EIA. The EAP confirmed that their presence will be a necessity to ensure that all procedures are followed which will enable the company to export fish products of highest quality.
Proponent	Mr Ranga Haikali: SGS is the world's leading inspection, verification, testing and certification company – should Namibia not affiliate to this company?	NSI officials advised that using their services will cut cost as compared to using SGS. There was no need to engage with SGS as the NSI is the registered competent authority that will deal with all export of fish products.

	Does the Ministry of Agriculture, Water and Land Reform (MAWLR) approve any imported feed and seedlings?	Any fish feed imported into the country has to be approved and registered by the Ministry of Agriculture (MAWLR); the import of fry/smolt/fingerlings will need to be placed into quarantine for at least 1 month and tested for potential pathogens by MAWLR of the Directorate of Veterinary Services.

Table 12: Stakeholder scoping summary: major points raised at the public meeting on 13 January 2021 in Swakopmund (NatMIRC).

Organization	Question / Comment	Response
MFMR	Dr Anja Kreiner: if site B is to be chosen which will be at 45 nm offshore at a 200m sea depth the proponent will need to take into consideration the impacts this operation will have on the oceanographic parameters (chemical and biological) on the long-term monitoring line on 23 degree Latitude. Will the mega cage culture change environmental parameters in this region and if so to what extent? Will the proponent be able to ID the possible effects that the cage culture will have on the environment?	The points raised by Dr Kreiner on the potential impacts that the operation will have on the 23 degree monitoring line were recognized by the EAP and noted.

Benguela Ski Boat Fishing Association	Mr Tony Raw: is there any pollution contingency plan that will guide against the pollution of waters and what will the possible impacts on the project be?	the pollution aspect e.g. eutrophication will be addressed in the EIA report
MFMR	Dr Beau Tjizoo: What is the source of feed for the proposed fish species?	The source will be from Hermanus Feeding Company (South Africa); they specialize in tailor made feed for each particular fish species and age. Once the Ministry of Agriculture has approved the feed it will be listed on their register.
Mr Victor Libuku	On the issue of medication, how will the medication be monitored and will a baseline be established beforehand regarding the impact of vaccines and chemicals that will be used by the project? How will it affect the other fish in the natural ecosystem? Mr. Libuku's concern is that the proponents need to consider the waste impact on the environment from feeding the fishes.	After 2 to 3 years the mariculture farmers relocate their cages to a new location. Our ocean is very dynamic thus the waste will drift off with the currents and will not remain in one position. Baseline studies will be done over a period of two years by PhD students to determine waste effects, however, literature states that approved fish feed that ends up as waste gets

	The proponent should also be able to calculate how 40,000MT of feed will affect the bottom dwellers.	dispersed and taken up by the system.
MFMR	Mr Ferdinand Hamukwaya: What procedures will be used when vaccinating the fish?	The vaccines will be administered via the water or through the feed. With the advancement of technology, a computerized system will be used to administer the vaccine
African Conservation Services	Mr and Mrs Scott: How will the cages deter birds from getting entangled in the nets? They advised that, if not already approached, to consider including the Albatross Task Force for their inputs.	The inputs have been noted down and for appropriate action to be taken the proponent should contact the Albatross Task Force. The cages to be installed have bird and marine mammal repellents in place.

Details of the minutes on both meetings are presented under Annex 9a (Walvis Bay) and Annex 9b (Swakopmund).

6.3.1.1 Summary recommendations and action points proposed by the EAP based on public and stakeholder inputs at Walvis Bay and Swakopmund

- ✓ **Site A** not to be considered due to sporadic Sulphur eruptions and toxic algal blooms; this area is known to be anoxic and thus not conducive to cage farming; in addition it is a busy 'parking area' for merchant vessels who are to dock at Walvis Bay harbour.
- ✓ **Site B** on the 23º latitude south could be an option if the proposed site B(i) could be relocated further offshore to ca 45nm at 200m sea depth referred to as site B(ii); this would imply that the site B(ii) – refer to **Fig. 28** in Section 5.8.2, will fall outside the high risk anoxic zone; however, the following aspects count against it:
  - Increased north / south bound shipping lanes in this vicinity
  - Proposed phosphate mining due south of 23º Latitude south could negatively impact on the proposed finfish cage culture
  - Sea depth of ca 200m to anchor the cages is excessive

- ✓ In addition, due to the complexity in addressing the possible effects that the finfish cage culture could have on the *"Long-term Oceanographic Environmental Monitoring Line" on* 23° 00' 20'' Latitude south and 14° 20' 56'' Longitude east (site B), it is recommended to move the entire finfish operation to Lüderitz; the main issues raised by the Ministry (MFMR) scientists include:
  - What effects will the mega finfish cage farm have on the physical and chemical properties of current long term monitoring line (40+ years of oceanographic research) and spawning grounds of pelagic and demersal fish: this question to date could not be answered by the Sandpiper Project for phosphate mining.

- ✓ To convene a public meeting in Lüderitz (site C) during the month of February 2021.
- ✓ To make all necessary arrangements for the public meeting (venue, catering, transport, accommodation, newspaper adverts, contacts with relevant stakeholders that are based in Lüderitz etc.).

- ✓ To consult with Lüderitz Namport CEO and MFMR scientists based in Lüderitz on the possible impacts of this finfish cage culture (shipping lanes, bathymetry, cetacean migration routes and other sea mammals and birds).
- ✓ To consult with the competent authority of MFMR for permission to conduct an aquaculture activity within the Marine Protected Area (MPA).
- ✓ To identify an onshore site from which the finfish cage farming will operate; a warehouse which is to house a fish feed store, hatchery, quarantine unit, fish processing facility and an administration office.
- ✓ To meet with farmers of the mariculture sector operating at Lüderitz.
- ✓ To continue with ongoing consultations with the major stakeholders of MEFT, MFMR, MAWLR, NAMPORT, Lüderitz town council and the fishing industry.

6.3.2 Lüderitz public meeting at the Nest Hotel

The EAP provided a brief overview on outcomes of public meetings held at Walvis Bay and Swakopmund and the reason for coming to Lüderitz to make this presentation on the proposed finfish cage culture. The presentation provided to the public is presented in Annex10b.

Site C– west of Lüderitz at, 26°37’40’’ Latitude south and 15°01’53’’ Longitude east, west of Diaz Point and Halifax Island was the proposed alternative site for this mariculture project.

The main issues raised include:

- The proposed site C referred to as C(i) is:
  - In the proximity of the Halifax Island which has a colony of endangered jackass penguins (*Spheniscus demersus*)
  - Falls within the main foraging grounds of the jackass penguins
  - Is centered on the long term monitoring oceanographic line conducted by the scientists based at MFMR, Lüderitz
  - Why farm with a foreign species
  - The potential of escapees e.g. Atlantic salmon which could migrate up the Orange River
  - Potential pollution from the service vessel
  - The spraying of ‘chemicals’ at the fish farm to combat potential diseases

Table 13: Stakeholder scoping summary: major points raised at the public meeting in Lüderitz on 23rd February 2021.

Organi-zation	Question /Comment	Response
ACHA	Mr Sackias Shimuandi: salmon species prefer to breed in freshwater, if they escape into the freshwater bodies e.g. the Orange River what measures have been put in place for escapees ?	The cages have an inner net which is protected by a strong wire mesh which has a durability life span of 14 years. Worst case scenario -- should escapees take place these fish will be taken by the strong current offshore in a north westerly direction 100's km north of the Orange river.
MFMR	Dr Jessica Kemper: considering that six (6) km from Diaz Point there is a high risk in bird populations and migratory roots for the dolphins, seals colonies are also found on the nearby islands Her main concern is that Easter Bay is close to Halifax and Mercury Islands, the two islands are home to a variety of endangered bird colonies. Putting up a finfish farm will attract the birds to the fish cages as this is close to the birds feeding grounds and this becomes a danger zone to the birds as they might get entangled into the cage nets.	Dr Kemper's concerns have been noted down and they will be addressed.
MFMR	Dr Kollett Grobler: 1.Halifax Island has high numbers of penguins.	Dr Grobler's concerns have been noted down and will be taken into considerations.

	2.Not in support of the proponents wanting to bring in salmon as one of the proposed species. 3.The vaccines and the growth hormones that are used all end up into the marine environment. 4.Fish pathogens and diseases cannot be contained in a fish tank/cages. 5.The proposed area is very rich in jellyfish and they end up causing harm to the salmon species. 6.Five (5) km east of the proposed site is a major feeding and breeding area for the bird colonies. 7.The EAP in his presentation has outlined the mitigations but has not stated how these mitigations will be resolved.	The comment on mitigations have been duly noted and the EAP will write them down clearly in the final report.
MFMR	Ms Diina Mwaale: Some of the chemicals that will be used are dangerous to shellfish that are dwelling at the bottom of the ocean.	1. The proponents want to farm organically, the fish feed is the only thing that will go into the ocean. 2. There are procedures that will be taken into consideration with regards to the feed that will be used. 3. The proponents will only use fish feed which has been approved by the Namibia Standard Institute (NSI) that they do not

		cause harm to other aquatic organisms. Thus no harm will be brought upon the shellfish or any other organisms that live at the bottom of the ocean. 4. Faeces accumulation in the ocean will be broken down into small nano-particles, therefore they will not have any effect on the shellfish species either. Namibia is known to produce natural organic products. The fish will be naturally grown; through the health food programme no growth hormones will be allowed into Namibia.
MFMR	Ms Diina Mwaale: What will happen when the fingerlings contract diseases while they are put in cages?	Fingerlings will be kept onshore in the quarantine facility until they are big enough to be moved to the cages offshore. During the fingerling stages ongoing monitoring will be conducted to make sure that the fingerlings have no pathogens or diseases by MAWLR Directorate of Veterinary Services.

6.3.2.1 Summary recommendations and action points proposed by the EAP based on public and stakeholder inputs at Lüderitz

On the 23rd February 2021 following the public meeting, based on inputs received, the following decision was taken:

- The alternative site referred to a site C(i) was not suitable due to its proximity to Halifax Island and the long term oceanographic monitoring line of MFMR (Lüderitz office)

- To relocate the proposed site C (i) to an alternative location:
  - inshore north west of Lüderitz and
  - at least 10nm distant from Halifax Island

- To meet with:
  - Lüderitz Town Council
  - Members of NMA
  - Lüderitz Port control
  - MFMR Lüderitz based staff and the public

6.3.3 Major outcomes

Following the three public meetings at the coastal towns, including one-on-one stakeholder engagements and meetings held with officials of the competent authority (MFMR), the following decision was taken after all inputs received were carefully considered and evaluated by the EAP and his team of experts:

- All issues raised were considered and addressed
- To relocate to an alternative site C (ii) offshore north west of Lüderitz to conduct the operation at 27° 17' 00'' Latitude south and 15° 00' 00'' Longitude east
- To provide inputs on mitigation on potential impacts

7. THE RECEIVING ENVIRONMENT

7.1 Overview

The marine waters of Lüderitz are part of the Namibian Islands' Marine Protected Area (NIMPA). This chapter provides a summary of the onshore and offshore baseline conditions. The potential impacts of the proposed development on the components of the receiving environment (climate, physical, ecological, and socio-economic) are described in greater detail in Annex 11.

The 'baseline study' was compiled from notes extracted to a large extent from the:

- PhD Thesis (Klingelhoeffer, 2005),
- Namibian Islands' Marine Protected Area (NIMPA) by document (Currie, Grobler, Kemper, 2008),
- the Spatial Biodiversity Assessment (BCC-SBA) and Spatial Management, including the Marine Protected Areas BEH 09-0 1
- the Conservation Assessment Technical report (Holness *et al*., 2014) and
- the Oceanic and Fish research surveys conducted since Namibian independence in 1990 by MFMR
- Ecological and Biological Sensitive Areas - EBSA Report (2020)
- Published papers on the marine ecosystem of Namibia

7.2 Climatic Parameters

7.2.1 Temperature

Namibia's ocean temperature is typical of subtropical or warmer temperate waters. The South Atlantic Ocean's counter clockwise gyre brings cold water from a current that meets the Antarctic circumpolar current to form the Benguela Current. Coldwater from the depths also rises well as it is pushed up against the continental shelf, resulting in cold, nutrient-rich water masses near shore (Shannon, 1985).

The warmer tropical waters of the Angola Current converge with the colder Benguela Current further north, between 10-20° Latitude, to form the Angola-Benguela frontal zone, which can occasionally shift further south near Walvis Bay during extreme "El Niño" events. Surface runoff is minimal and does not affect the area's oceanographic parameters (Shannon, 1985).

During winter/spring, north of the Lüderitz cell, become less stratified, with the thermocline extending to 50m due to an increase in wind stress which enhances upwelling. During summer/autumn the surface waters are well stratified due to a decrease in wind stress. These conditions are typical for summer and are associated with a relaxation of the southerly winds, increased solar radiation and the movement of warm and more saline Angola Current Water southwards mixing with the cooler water of the Benguela Current. This leads to stably stratified conditions with relatively shallow well-defined thermoclines forming in the upper layers of the ocean. The surface water temperature during this period (in the central Benguela Current) can rise to between 17° and 24°C **(Fig. 31).**

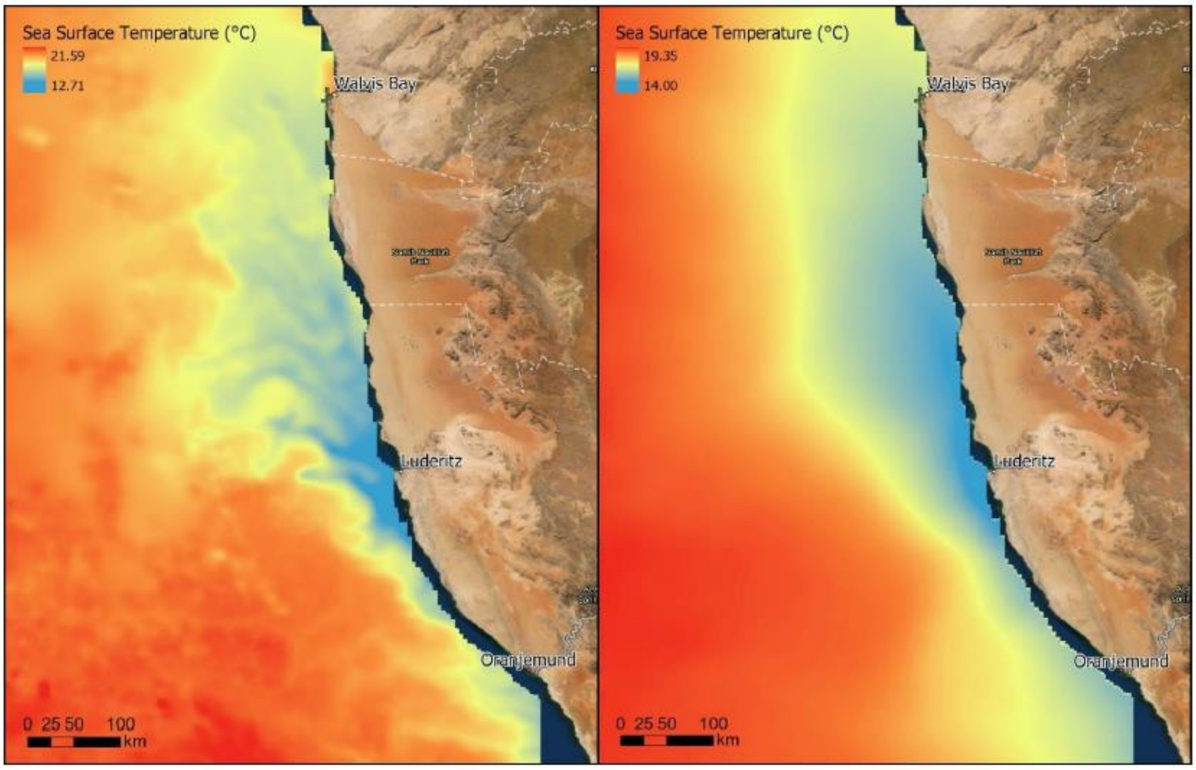


Figure 31: Sea Surface temperature in the area of interest on January 1st, 2019 (left) and the annual mean temperature for 2018-2019 (right).

Sea surface temperature at the alternative site C (ii) on 1st January 2019, according to InnovaSea (2020) was recorded to be in the range of 12 – 13°C and the annual mean temperature for 2018 and 2019 recorded as 14°C **(Fig. 31).** It has been shown that water temperatures in the range of 14 - 19 °C are suitable for several open ocean species including all three species that are being considered by Lilongeni. Salmon show optimal growth at 10 – 16°C and will show thermal stress above 18°C. This can be mitigated by using submersible cages **(Fig. 13 in Chapter 5).**

Both yellowtail kingfish and the silver cob show commercially viable growth rates at these temperatures, however, with higher temperatures growth rates would increase but be more susceptible to lice and other related infections. **Fig. 32** shows the daily sea surface temperature profiles at the proposed grid locations near each coastal town as well as monthly temperatures from Port Lincoln, Australia where yellowtail kingfish are produced in net pens and a salmon farm in Chile and a salmon farm in Norway.

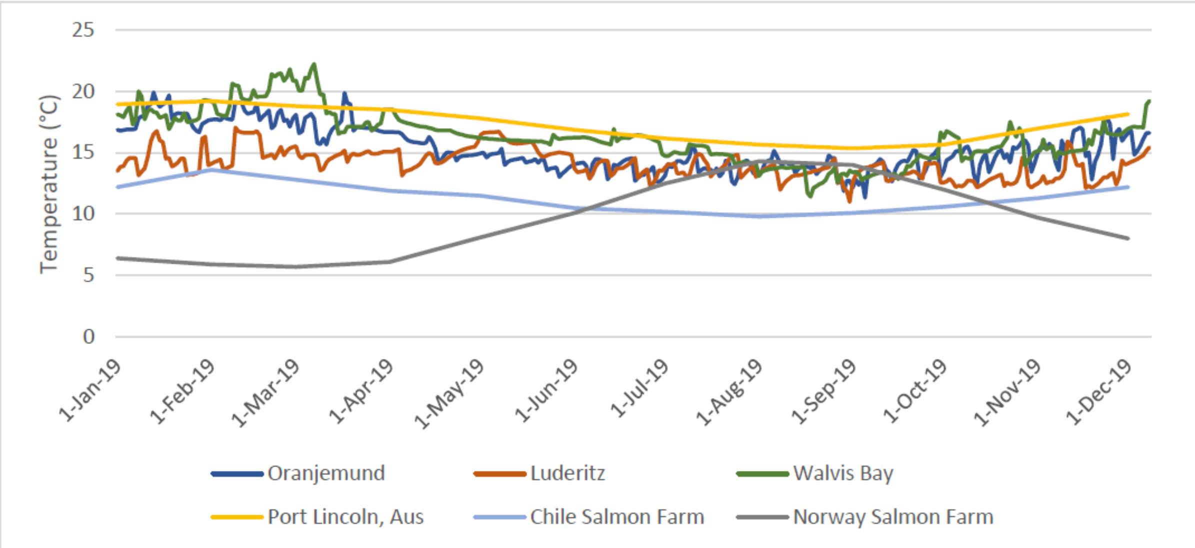


Figure 32: A time series of daily sea surface temperature at the proposed grid locations near Walvis Bay, Lüderitz and Oranjemund along with the reported monthly temperatures from Port Lincoln, Australia, a salmon farm in Chile and a salmon farm in Norway.

7.2.2 Current velocity

Ocean currents in the areas of interest flow predominantly from south to north with occasional eddy formation and upwelling creating currents in other directions. The strongest currents are further offshore **(Fig. 33)** with nearshore currents staying around 0.1 m/s or less most of the time.

Currents in this range do not pose a challenge or significant cost for the grid and system design. Drag forces on the system at these currents remain moderate to low. The three species under consideration are all active, free-swimming species that prefer moderate current velocities. Currents above 0.05 m/s are important to flush and disperse fish waste and bring in clean, highly oxygenated water. All species can handle currents over 0.5 m/s for short periods and 0.3 m/s for extended periods without excessive energetic costs.

The ocean off Lüderitz, indicates currents that would create a healthy environment for the species under consideration and do not create engineering concerns **(Fig. 33)**.

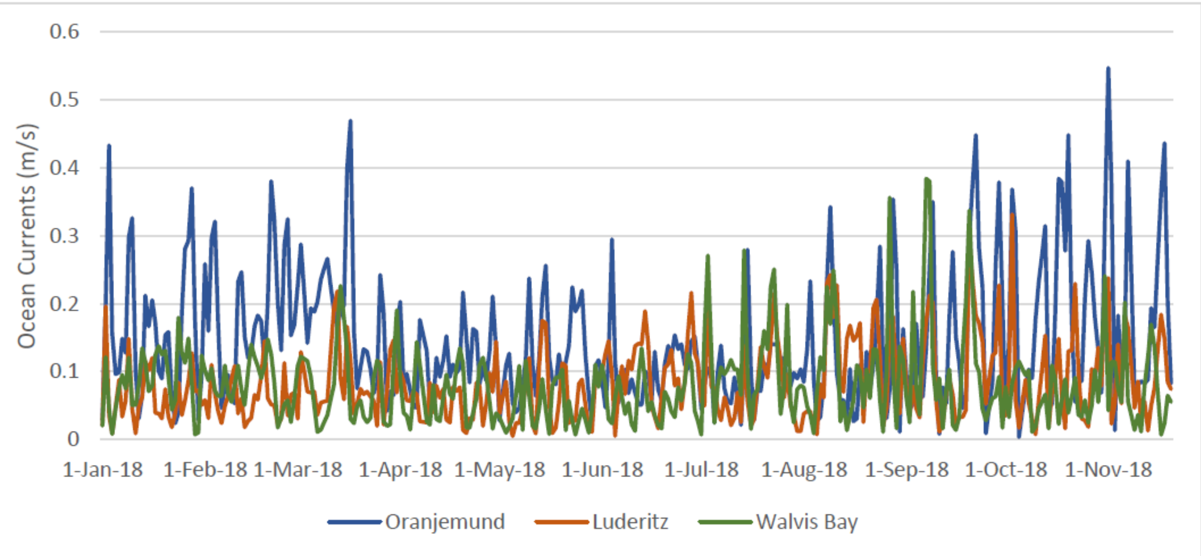


Figure 33: Time series of current at 15 m of depth at the centre of the proposed location for the three sites consideration.

7.2.3 Waves

The wave environment in the area of interest is highly exposed **(Fig. 34).** Throughout the entire southern Atlantic Ocean, waves are unimpeded until they begin to interact with the seafloor near the coast of Africa. The South Atlantic does not experience hurricanes/typhoons or other extreme storm systems, which reduces the extreme waves observed at other locations.

Significant wave heights above 2m are considered to be high energy sites requiring submerged pens and grids. Innovasea's SeaStation pens have been successfully operated at sites with a mean significant wave height of 1.5m and extended periods with waves above 3m without issue. Fish in submerged pens do not experience the wave energy at this magnitude as the energy dissipates with depth.

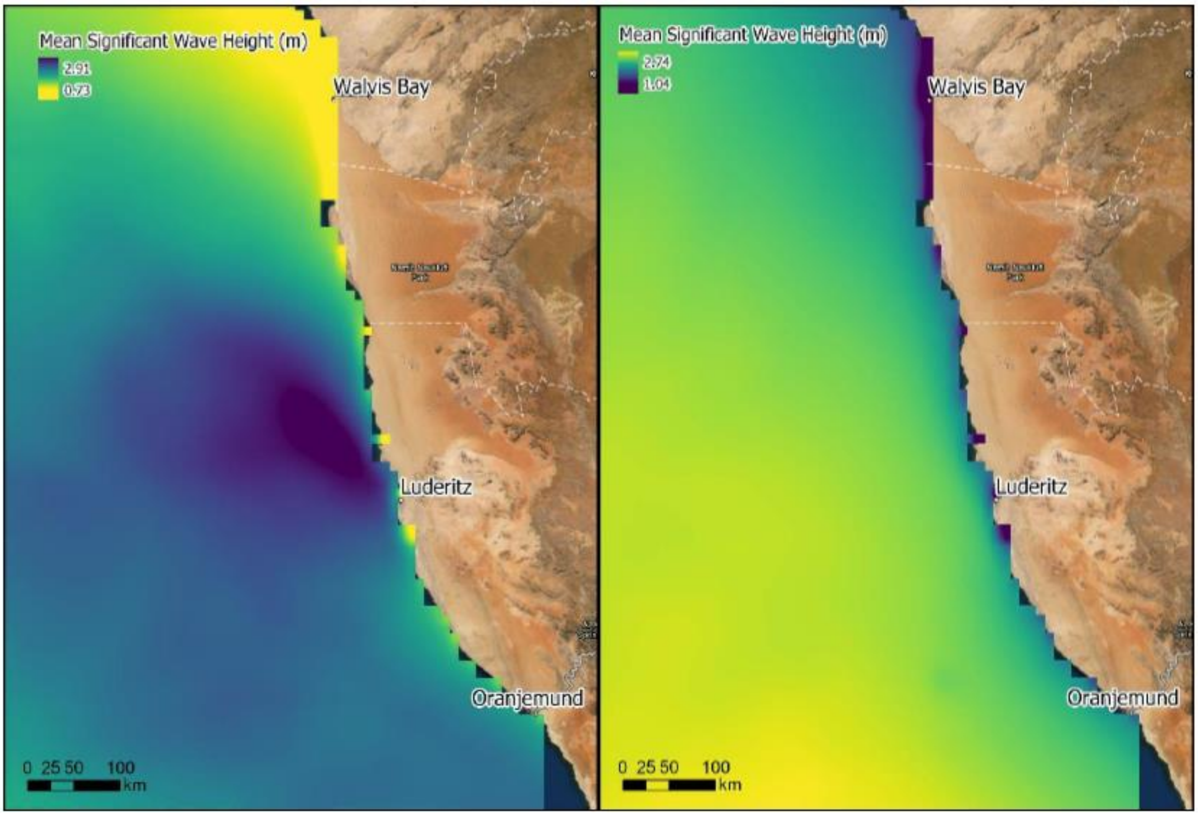


Figure 34: Mean significant wave height on January 1st, 2018 (left) and the annual mean height for 2018 (right).

7.2.4 Dissolved oxygen

Most open ocean environments show little variation in dissolved oxygen levels, which are usually near or slightly below fully saturated. Namibia is unique in that the upwelling of nutrient-rich water causes low oxygen (anoxic) events. These are usually episodic, lasting days at a time, and affect the benthic environment more than the mid- or upper levels of the water column.

From a location perspective, there is spatial variability in oxygen levels although the coarse spatial resolution of the data makes the trends less reliable. The data artefacts from the data format are visible **(Fig. 35),** although the data layer still indicates areas that frequently have low oxygen levels and offer guidance on location preference.

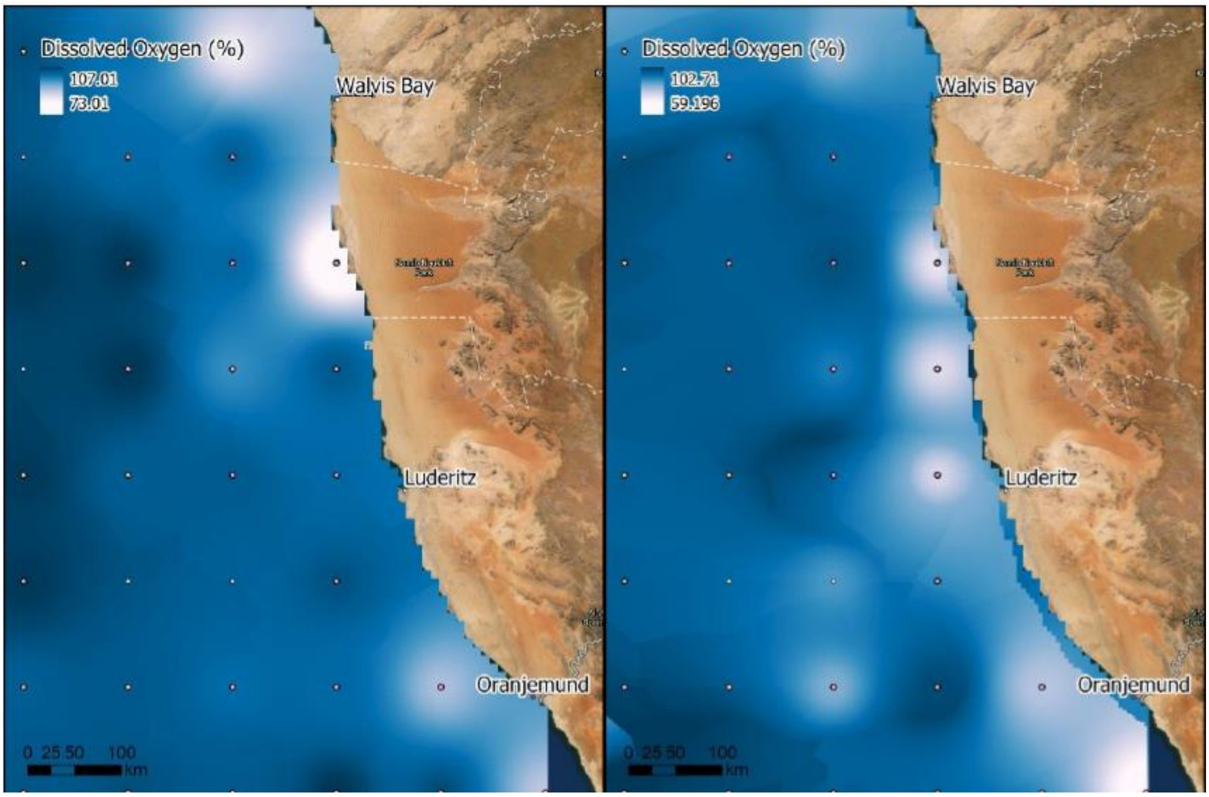


Figure 35: Percent saturation of dissolved oxygen on average in January 2018 (left) and an annual mean for all of 2018 (right). The white dots indicate the data model output points that were extrapolated to create a continuous data layer.

The species being considered are all active fish with high metabolic demands. Saturation levels below 80% will start to impact fish performance (growth and FCR) and levels below 60% will impact fish health and may cause mortality. All areas with an annual mean saturation level below 80% were considered unsuitable for the project and removed from consideration.

This threshold impacted sites around Oranjemund only, as the lower oxygen areas around Lüderitz are further offshore. Research suggests that the anoxic events do occur close to shore, so the trends shown in **Fig. 36** are being impacted by the availability of spatial data on this parameter and do not fully capture the risk. This data layer still functions as a critical site selection criterion but does not guarantee that the recommended sites are free from periodic anoxia. This will have to be confirmed with*in situ* studies and further work with local oceanographers.

The monthly average dissolved oxygen per cent saturation at the centre of the seven proposed grid locations near each town is illustrated in **Fig. 36.** Since the data shows monthly averages, the extreme lows are not captured.

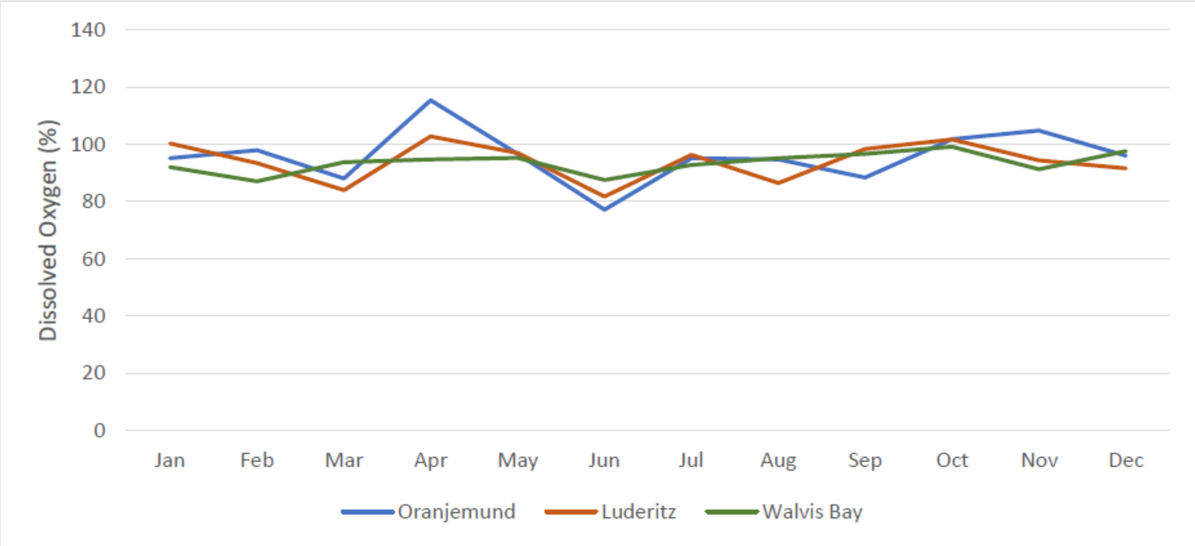


Figure 36: Time series of dissolved oxygen for the proposed grid locations at each site in 2018.

Most open ocean environments show little variation in dissolved oxygen levels, which are usually near or slightly below fully saturated **(Fig. 36).** Namibia is unique in that the upwelling of nutrient-rich water causes low oxygen (anoxic) events. These are usually episodic, lasting days at a time, and affect the benthic environment as well as the mid and upper levels of the water column when bottom upwelled waters are brought to the surface. The three (3) species being considered are all active fish with high metabolic demands. Saturation levels below 80% will start to impact fish performance (growth and FCR) and levels below 60% will impact fish health and may cause mortality.

In the South-East Atlantic Ocean surface waters, up to 50m depth commonly contain between 4-5 ml/l dissolved oxygen. However, the shelf waters of the Benguela Current ecosystem frequently contain lower levels and are anoxic at times (Shannon, 1985; Bailey, 1998; Woodhead, Hamukuaya, O'Toole, Stroemme and Kristmannsson, 1998a; Woodhead, Hamukuaya, O'Toole, Stroemme, Saetersdal and Reiss, 1998b; Stroemme and Hamukuaya, 2001). Hypoxic conditions develop annually in the southern Benguela Current Upwelling System, between February and April, north of Lüderitz, following the onset of a peak in the vertical flux of particulate organic matter from mid to late summer (Bailey, 1991).

Areas of low dissolved oxygen concentrations are major features of the bottom boundary flow in the Benguela region. Chapman and Shannon (1985) have suggested that there are two aspects to this phenomenon:

- a wedge-shaped mass of low oxygen water at about 300m depth that flows south from a source area off Angola and
- oxygen-depleted near-bottom water which occurs on the shelf due to biochemical action, mostly found between the Cunene River (17°15' Lat S) and north of Spencer bay (25°30’ Lat S).

In the central and northern Benguela Current Upwelling System the situation is somewhat different in that bottom waters are permanently hypoxic at the shelf break off Walvis Bay, possibly as a result of a combination of both poleward advection of oxygen-deficient water (Stander, 1964; Nelson, 1989) and local decomposition of detritus derived from the year-round high production of phytoplankton abundance in the euphotic zone (Bailey, 1991).

The occurrence of low oxygenated bottom water (<0.5 m $l0_2$ l^{-1}) off central (Walvis Bay) and northern Namibia is a characteristic seasonal feature of local coastal oceanographic processes. This occurs on the inshore and offshore shelf especially during summer and autumn months when upwelling is reduced which favours primary production. Associated with high productivity in the Namibian surface waters is the sinking and decay of large numbers of microscopic planktonic organisms. Decaying organic matter consumes oxygen, so that bottom waters over much of the Namibian continental shelf, extending out to a depth of 100 to 150m or more have low oxygen concentrations (Chapman and Shannon, 1985) as illustrated in **Fig.37.**

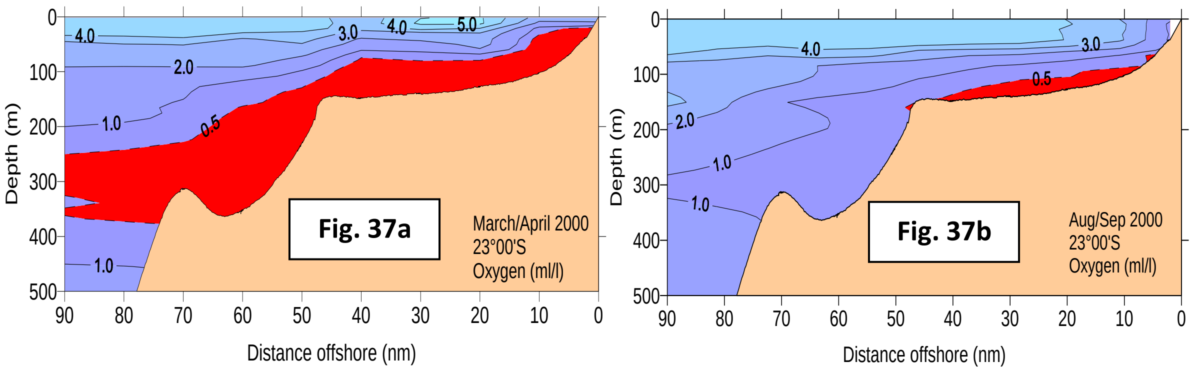


Figure 37: Vertical sections off Walvis Bay (23° Lat S) on the 90nm offshore transect, displaying dissolved oxygen concentrations (<0.5 m l0_2 l^{-1}) for March/April of 2000 (a) and August/September 2000 (b) (Red zones = anoxic water) (IN: Klingelhoeffer, 2005)

Low oxygen levels are particularly pronounced in the region from Conception Bay (24° S) to Cape Cross (21°45' S) within the 100m isobath. With the onset of winter and spring, upwelling intensifies, and oxygen levels tend to rise as a result of the influx of water with a higher oxygen content **(Fig.36 & Fig.37b)** (Namibia, 2000b).

7.2.5 Chlorophyll-α

Chlorophyll-α is not relevant itself to aquaculture operations but it is used as an indicator for the biological productivity of an environment and correlates with varying degrees of strength with bacterial loads, risk of eutrophication, risk of harmful algal blooms, and parasite densities. The site selection model prefers low chlorophyll-α levels, but this parameter is given a low weight. None of the fish species considered have a particular preference or tolerance for chlorophyll-α (InnovaSea, 2020).

Chlorophyll-α concentrations are highest near shore where upwelling brings nutrient-rich water into the warmer shallows and in range of the sun's rays **(Fig. 38).** This pattern is common to most coastal regions although the chlorophyll-α levels are higher than average in Namibia.

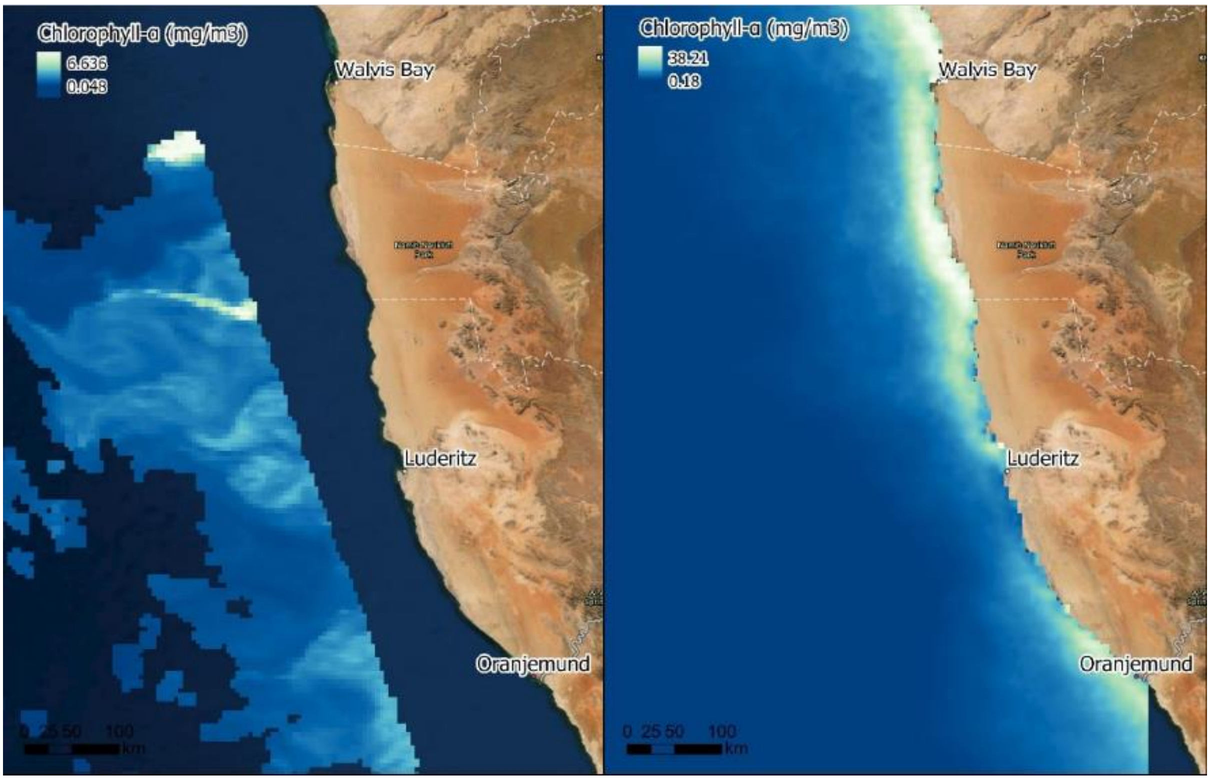


Figure 38: Chlorophyll-α concentrations (mg/m3) on January 1st, 2018 (left) and annual mean chlorophyll-α concentrations for 2018 (right).

The left image shows incomplete coverage as the data is collected by the Aqua MODIS satellite, which can only view the area of the earth below it and is blocked occasionally by cloud cover.

7.2.6 Precipitation

The Namibia coast in general has very low rainfall at around 15-20 mm/year. Fog is common in the northern half of the coast (Walvis Bay, Swakopmund and Henties Bay) receiving >125 fog days per year, while Lüderitz in the south having substantially less fog days.

7.2.7 The Benguela Current

Namibia's marine environment falls entirely within the boundaries of the Benguela Current Upwelling System **(Fig. 39).** The oceanography off the west coast of Namibia is dominated by coastal upwelling (Shannon, 1985) which is characterized by the upwelling of nutrient-rich cold water to the pelagic zone. These upwelling zones facilitate plankton production which supports a diverse pelagic and demersal fishery (Sako, 1998).

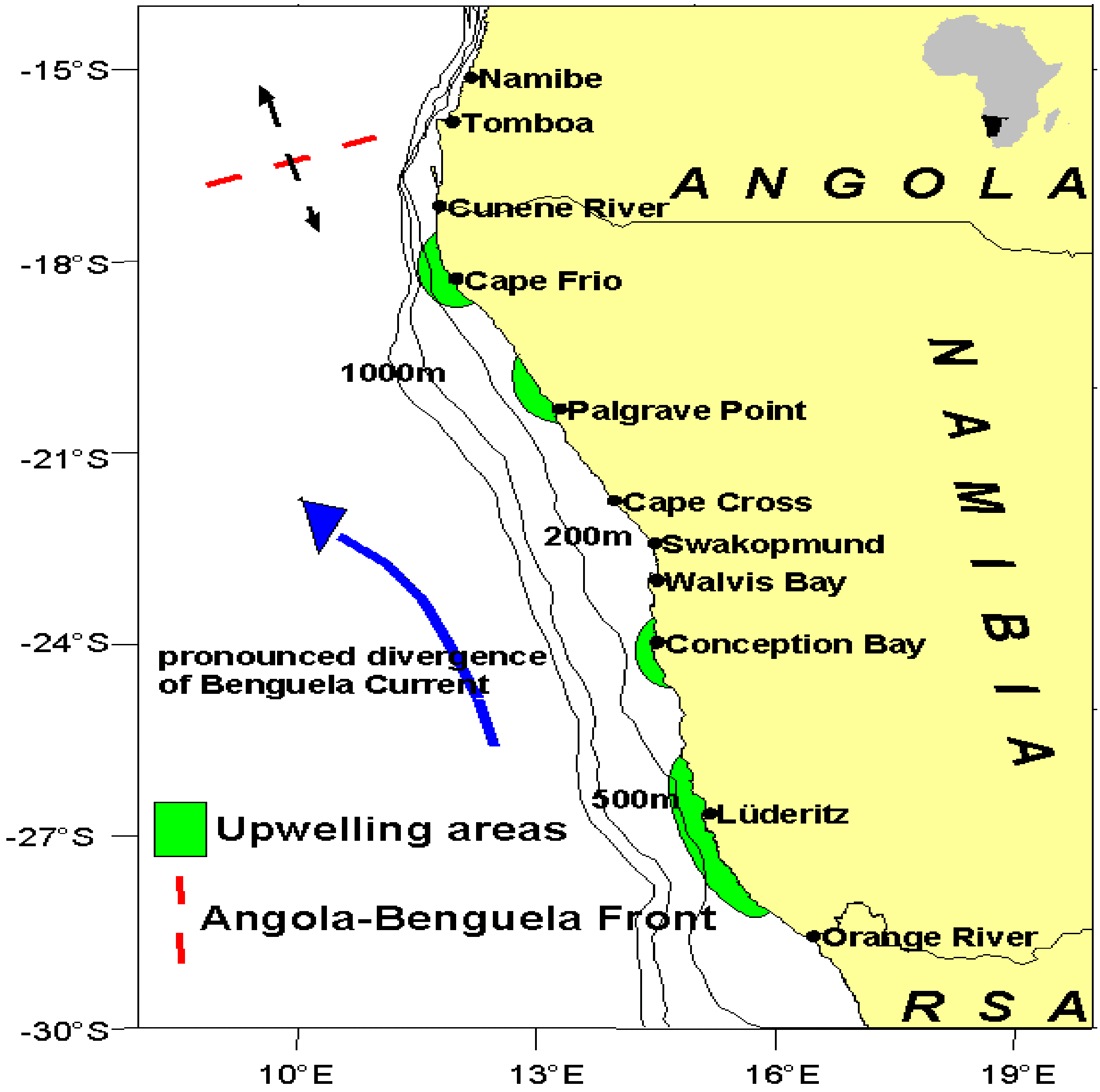


Figure 39: The northern Benguela Current upwelling system, indicating the <u>four major upwelling centres</u> and the position of the Benguela-Angola Front (modified after Shannon,1985; Le Clus, 1992; Shannon and Nelson, 1996).

According to Shannon (1985) and Shannon and Hampton (1997), the Benguela Current ecosystem has been divided into two main ecological regions based on biological, geographical, and oceanographic features:

- The southern Benguela Current ecosystem (Cape Town to Lüderitz) and
- The northern Benguela Current ecosystem (Lüderitz to Namibe in Angola)

The most prominent feature which separates the southern and northern Benguela Current Ecosystem from each other is the upwelling cell at Lüderitz (Shannon and Agenbag, 1987). This upwelling cell, which is the most intense along the west coast of southern Africa, is also seen as a barrier to the mixing of pelagic and other fish from the southern and northern Benguela Current ecosystem (Shannon, 1985; Boyd, 1987).

The northern boundary of the northern Benguela Current ecosystem is the Benguela-Angola Frontal Zone. The position of this frontal zone, which fluctuates seasonally between 14° to 18° S, is maintained by a combination of factors such as bathymetry, coastal orientation, stratification, wind-stress and opposing flows of the Angola-Benguela Currents (Kostianoy and Lutjeharms, 1999).

7.2.8 Wind stress and upwelling filaments

According to Shannon (1985), Le Clus (1985), Boyd (1987), and Schumann (1989) wind stress is a major driving force causing horizontal and vertical motion of water along the west coast of South Africa, Namibia, and southern Angola. The term upwelling is used to describe the process when wind stress leads to a divergence of surface water and deeper water rises to take its place (Bearman, 1989).

The extent and intensity of coastal upwelling throughout the Benguela Current ecosystem are primarily determined by the wind-pressure field. Winds in the region are controlled by anti-cyclonic motion round the South Atlantic High-Pressure System, the pressure field over the sub-continent and by eastward-moving cyclones produced by the perturbations in the subtropical jet stream (Shannon *et al.* 1990a).

The primary perennial centre of upwelling occurs at Lüderitz between 25° and 28° Latitude south (Shannon, 1985), with a secondary centre near Cape Frio at 18°30' Latitude south (Le Clus, 1992) with two additional minor cells in-between at Conception Bay at 24° Lat south and Palgrave at 20°30" Lat south **(Fig. 39)**

(Shannon and Nelson, 1996). The intensity of upwelling at Lüderitz gives rise to ***upwelling filaments*** that are ribbon-like features **(Fig. 40),** which in this region extend up to 300km from the coast and occasionally can reach 1300km (Lutjeharms, Shillington and Duncombe-Rae, 1991).

The intensity of upwelling fluctuates between a maximum in summer and a minimum in winter at Lüderitz (Shannon, 1985) whereas the periods of maximum upwelling north of Lüderitz occur during winter and early spring (Le Clus, 1992; Shannon and Nelson (1996). According to Shannon (1985), this is due to the seasonal shift in the South Atlantic High-Pressure System.

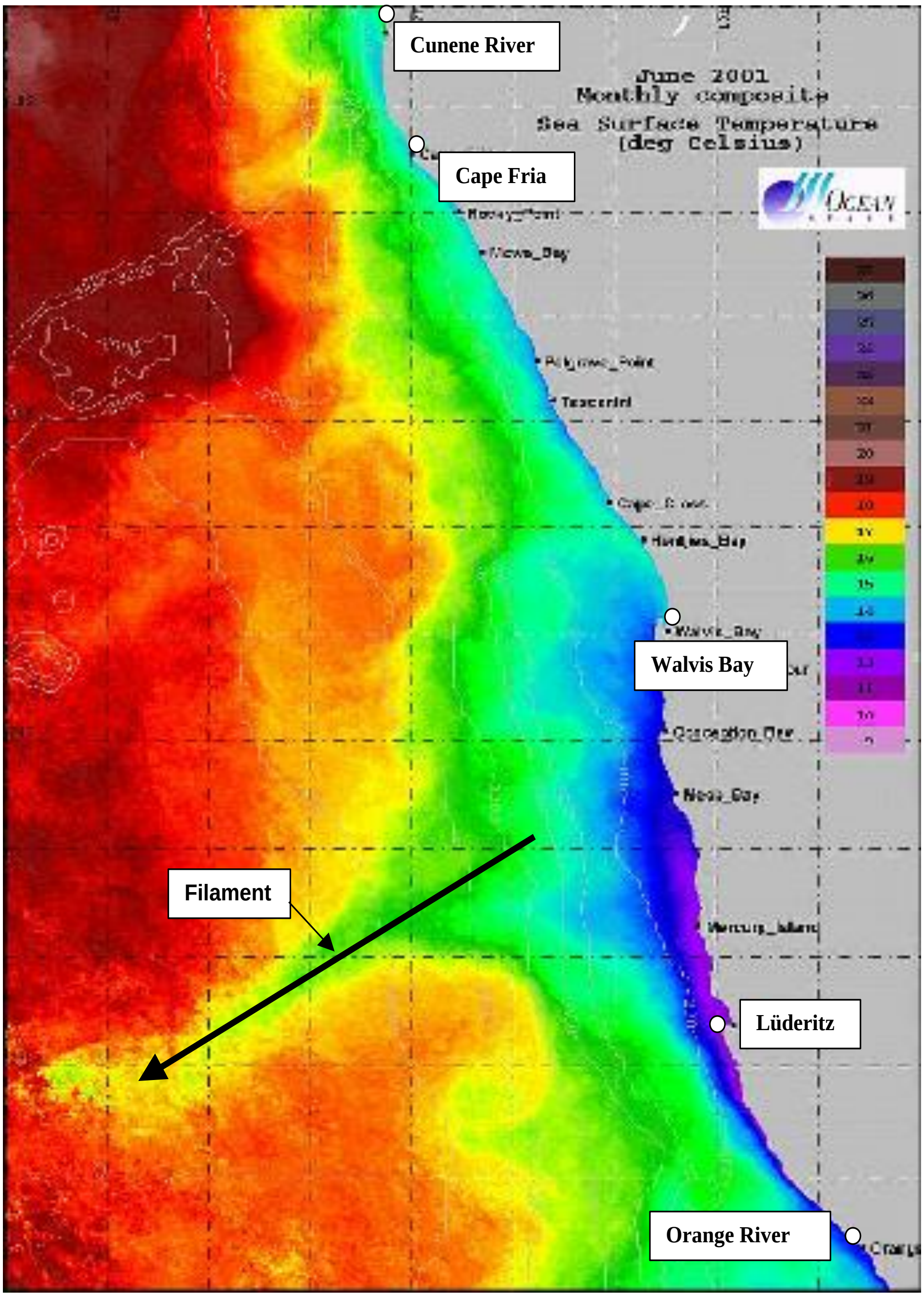


Figure 40: NOAA 14 satellite imagery (monthly composite) for June 2001 indicating the filament cell west off Lüderitz, extending 160 nautical miles offshore in a south-westerly direction, (after Weeks, 2001; In: Klingelhoeffer, 2005).

7.2.9 Bathymetry

The bathymetry for the proposed Lüderitz site C includes the area south (Ci) and north (Cii) of Lüderitz harbour with sea depth ranging from 50 to 70m **(Fig.41).** The bathymetry of the western continental margin of southern Africa is variable with the shelf break at the 200m isobath. The shape of this shelf has a significant impact on the circulation and thus on the fish distribution. The shelf is narrow off southern Angola with a shelf width of no more than 20km, widening gradually southwards to about 75km off Walvis Bay, narrowing to 30km at Lüderitz, 180km off the Orange River and 120km off Cape Town. To the west of the shelf break, lie the Angola and Cape Basins, separated by the Walvis Ridge, (Shannon, 1985).

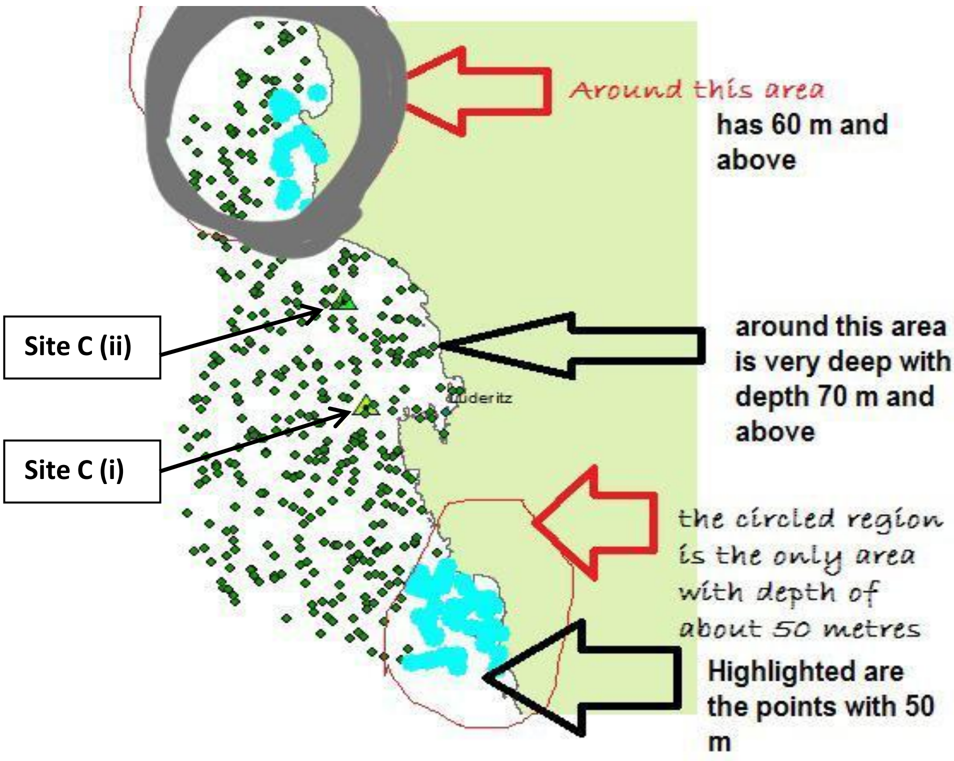


Figure 41: The bathymetry north at site C(i) and south at site C(ii) of Lüderitz ranging from 50m sea depth in the south and 60m and above sea depth, north of Lüderitz.

7.2.10 Sulphur eruptions

Sulphur eruptions have always occurred inshore off the central coast (Conception to Cape Cross) of the northern Benguela Current ecosystem of Namibia (24° to 21°). The most dramatic sulphur eruption occurred on 31st May 1900 and was so severe that an island was formed off Pelican Point near Walvis Bay. The island was 20m long, 2m wide and 7m high. However, after three days the island submerged due to the eroding action of waves (Green, 1981). Sulphur eruptions are annual occurrence from mid-summer to autumn and varying in intensity from year to year (Currie, 1999).

According to Rogers and Bremner (1991), the shelf waters off the central coast of the northern Benguela region are comprised of diatomaceous muds, with high concentrations of decaying organic matter and sulphur, which support little or no marine life. These diatomaceous muds, which have accumulated over time, are the result of excessive production of plankton, especially during the summer months. Due to the absence of upwelling, mass mortalities set in and the planktonic organisms sink to the sea bottom forming a compost heap on the shelf where bacterial decay takes place. Certain species of bacteria which have adapted to these anoxic diatomaceous muds produce hydrogen sulphide. Occasionally bubbles of this gas accumulate in the sediment, burst free and rise to the surface resulting in a "sulphur outbreak". Water in the vicinity of the eruption is a milky turquoise colour (Currie, 1999; Weeks, Currie and Bakun, 2002) **(Fig.42).**

The presence of sulphide is fatal for many animals; proof of this is the wash-up of dead animals onto the beach following these sulphur eruptions (Currie, 1999). The main toxic effect of sulphide is similar to that of free cyanide (Weeks *et al*. 2002).

However, within a day or two, the toxic sulphides are rapidly oxidized in the presence of sufficient oxygen near the sea surface and through wave-mixing. The effects of sulphur eruptions on marine life are thus short-lived (Currie, 1999) but have catastrophic consequences to organisms that are immobile e.g., fish in cage culture.

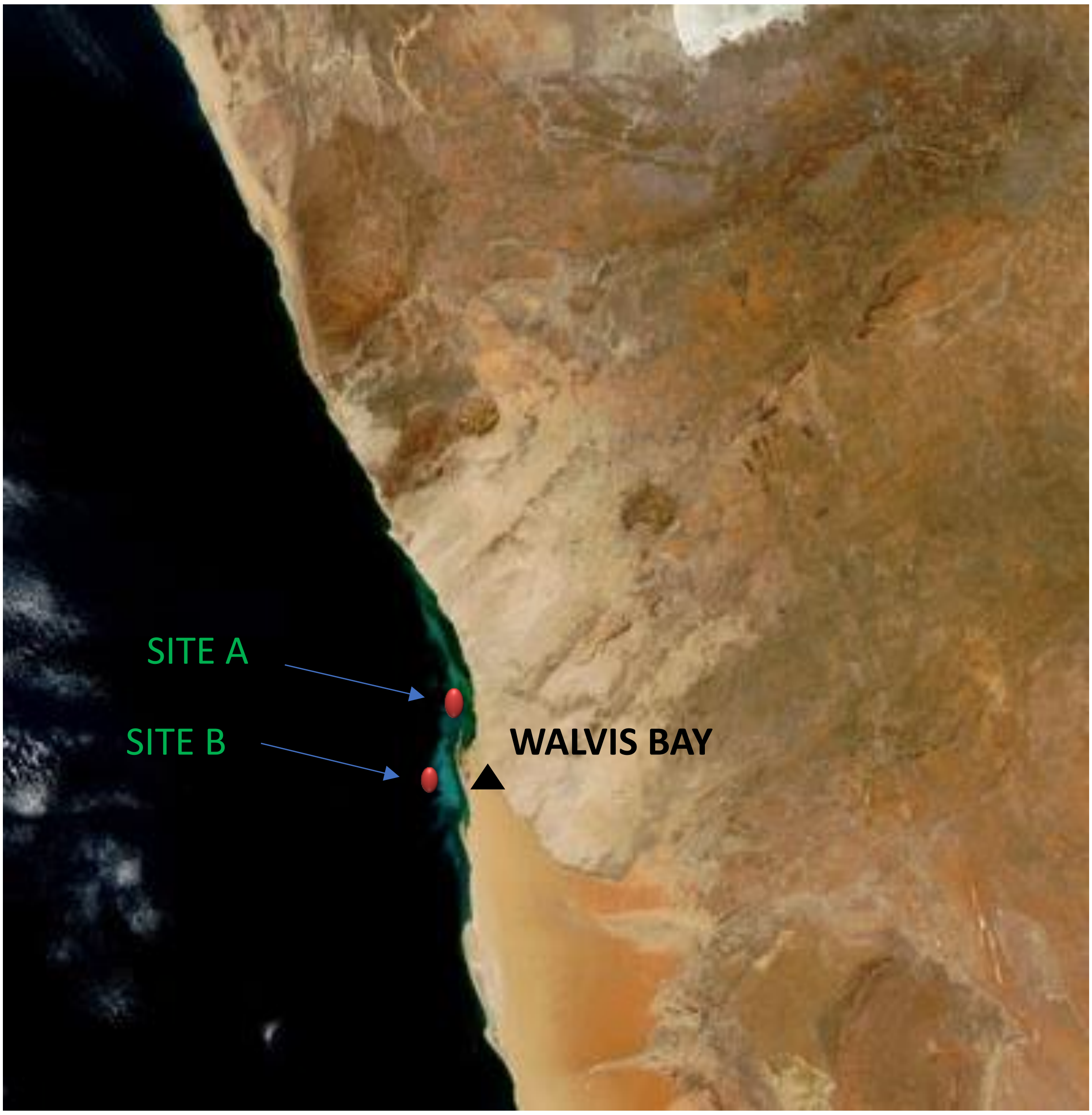


Figure 42: State imagery (NOOA 14) May 2001 indicating excessive sulphur eruptions along the inshore central coast of Namibia. (Alternative sites: site A and site B proposed for finfish cage culture) (Weeks, 2000) .

In summer/autumn the southerly winds relax off central and northern Namibia and upwelling weakens. Together with an increase in solar radiation and the movement of warm and more saline Angolan Current water southwards, mixing with the cooler water of the Benguela Current ecosystem leads to stably stratified conditions with relatively shallow well-defined thermoclines forming the upper layers of the ocean where warm water (18° to 23° C) are distributed over much of the northern and central shelf.

In winter/spring the south to south-westerly winds reaches a maximum along the central and northern Namibian coastline and induce upwelling. During upwelling surface water along the coast is blown offshore and replaced by underlying, colder nutrient-rich water. This, together with weak winter solar radiation, will result in cool sea surface temperatures ranging between 12° to 15°C. EAnother seasonal phenomenon is the hot, dry "berg winds" (adiabatic winds from the mountains of the interior in winter) which also influence the coastal marine environment by locally suppressing upwelling and occasionally transporting large quantities of dust and sand far out to sea.

7.2.11 Hypoxic conditions

Prolonged hypoxic anomalous events (i.e., < 1.0 m lO_2 l^{-1}) have been linked to long-term changes in the central Benguela Current off Walvis Bay, with resultant changes in the area of benthic habitat suitable to hake and sole. The Benguela Current Upwelling system off Namibia is an oxygen-depleted ecosystem where severe hypoxia (< 1ml/l) may become widespread over large areas of the Namibian shelves and persist for weeks or months as was the case from 1992 to 1995 (Pollock and Shannon, 1987; Mas- Riera, Lombarte and Gordoa, 1990; Bailey, 1995 and 1998; Hamukuaya *et a*l. 1998; Stroemme and Hamukuaya, 2001; Woodhead *et al*. 1998a and 1998b). For example, these hypoxic conditions in the Central region persisted throughout 1994 to autumn 1995 with oxygen levels <0.5ml O_2 l^{-1} in bottom water over much of the continental shelf.

7.3 Environmental oceanographic cruises

Since 1990 oceanographic cruises off the coast of Namibia were carried out by the Research Vessel (RV) *Dr Fridtjof Nansen, RV Benguela* and RV *Welwitschia, RV Anchiba,* RV *Matsuyama-Maru, RV Meteor* and most recently by the RV *Mirabilis.* The objectives of these cruises were to monitor the three basics environmental parameters such as temperature, salinity, and oxygen levels in coastal waters and along the continental shelf and to use these data as supportive information for fisheries research (O'Toole and Bartholomae, 1995).

The two long-term oceanographic monitoring lines are located at:

- Walvis Bay (Paaltjies): 23°00'00''Latitude south and
- Lüderitz (Diaz Point): 27°37'00'' Latitude south

These monitoring lines are being surveyed on a bi-annual basis and are located at the alternative sites B and C proposed for the finfish cage culture. Each monitoring line extends from the coast at 2nm to offshore 90nm in a westerly direction on the 23°00'00''latidude south and 27°37'00'' latitude south.

7.4 Lüderitz Coastal and Marine Sensitive Marine Environment

7.4.1 Overview

The site for the Proposed Project site C (ii) was chosen following public hearings held in Swakopmund, Walvis Bay and Lüderitz (see **Fig. 43**). The site is ideally suited for the following reasons:

- In the centre of the Lüderitz upwelling cell
- Near to Lüderitz harbour
- At least 10nm from two major islands namely Ichaboe and Halifax Islands i.e., 19.1km and 21.7km respectively

7.4.2 Marine fauna and associated Islands, Islets and Rocks

7.4.2.1 Seabirds and important bird areas

The proposed development is located near some of the Namibia islands that are recognised as an Important Bird Area for their seabird colonies by Birdlife International. The closest islands to the proposed development as illustrated in **Fig. 43** are:

- Ichaboe Island **(19.1km)**,
- Halifax Island **(21.7km)**,
- Lüderitz harbour (**22.9km)**,
- Seal and Penguin Island **(20.2km),**
- Marshall Rocks north of site C (ii) **(10.6km)**,
- The coast from site C (ii) **(9.1km)**.

The islands and the surrounding areas are dominated by the following important bird species Table 14.

Table 14: Important marine mammals and birds that are either resident or frequent the Namibian coast.

Bird species	**Current IUCN Red list Category**
African jackass penguin (*Spheniscus demersus*)	Endangered
Cape gannet (*Morus capensis*)	Endangered
Crowned cormorant *(Microcarbo coronatus)*	Not threatened
Cape cormorants (*Phalacrocorax capeensis)*	Endangered
Bank cormorant (*Phalacrocorax neglectus)*	Endangered

Source : (BirdLife International, 2021) and (NIMPA, 2007)

The proposed project is located near Halifax Island (distance) which is home to colonies of Kelp gulls, Crowned cormorant, Greater crested tern and Hartlaub's gull. While Ichaboe Island in the north is one of the most important and densely packed coastal seabird breeding islands in the world. It regularly supports over 50,000 seabirds of at least eight species, including large numbers of *Spheniscus demersus, Morus capensis, Phalacrocorax capensis, P. neglectus and P. coronatus* (BirdLife International, 2021).

Smaller numbers of *Larus dominicanus and Haematopus moquini* also breed at Ichabaoe, which is the most important location for *Phalacrocorax neglectus* in the world, which comprises 65% of this globally near-threatened species' population.The island may also harbour from time to time thousands of roosting terns, particularly *Sterna hirundo* and *Chlidonias niger* (BirdLife International, 2021).

Small islands immediately offshore the Namibian coast, principally Mercury Island, Ichaboe Island, Halifax Island and Possession Island, support the entire Namibian breeding population of Cape gannets (*Morus capensis*), 96% of the Namibian population of the endangered African penguin (*Spheniscus demersus*), and nearly one-quarter of the global breeding population of Crowned cormorants (*Phalacrocorax coronatus*). Approximately 80% of the global population of the endangered Bank cormorant (*Phalacrocorax neglectus*) breeds on Mercury and Ichaboe Islands (UNESCO, 2021).

These seabirds breed on the islands from where they range tens of kilometres out to sea before returning. Mercury Island alone, which is ca. 3 hectares in size, is home to an estimated 16,000 penguins, 1,200 Cape Gannets and 5,000 cormorants. The endemic Heaviside's Dolphin (*Cephalorhynchus heavisidii*) and a considerable number of whale species are regularly encountered at sea while vast colonies of Cape Fur Seal (*Arctocephalus pusillus pusillus*) occur near upwelling centres along the coast, e.g., near Lüderitz, Cape Cross and Cape Frio. Almost 70% of the global population of Cape Fur Seals occur in these Namibian colonies (UNESCO, 2021).

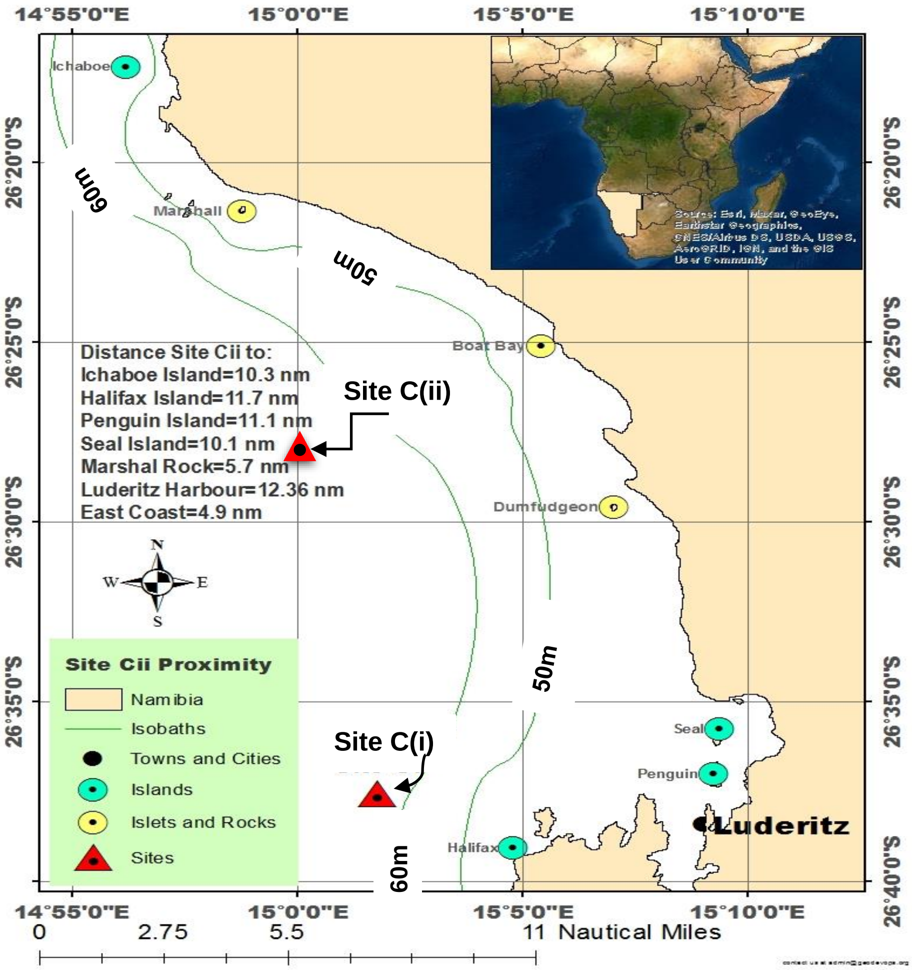


Figure 43: Site C (ii) proposed for the finfish cage culture in relation to the four main bird islands in its proximity.

Many of the bird species disperse from their ‘breeding islands’ in the southern oceans (Antarctic region) in late summer and follow the cold Benguela Current northwards along the southwestern coast of Africa into Namibian waters during the winter months. These bird species tend to be more common during the winter months, with a few individuals that may remain throughout the year.

On the other hand, a few species arrive during the summer months from the north, while others occur throughout the year. Virtually all pelagic seabirds follow fishing vessels and scavenge offal and discarded fish. Otherwise, their diet consists of krill, fish, squid, and virtually anything else that is available (EBSA, 2020).

African penguins are endemic to southern Africa and breeds on islands off South Africa and Namibia; non-breeders and juvenile occasionally disperse as far as into Angola. They can be seen to congregate around the islands and rarely seen to venture further than 10 to 15 km offshore (Bianchi et al., 1999). The Jackass penguin feeds predominantly on pilchard (*Sardinops ocellatus*) but since the collapse of the pilchard stocks, penguins feed mainly on pelagic (bearded) goby (*Sufflogobius bibarbatus*) and cephalopods. Penguins are preyed upon by sharks, fur seals, and killer whales, and kelp gulls prey upon chicks and eggs at the colonies.

7.4.3 Marine mammals

7.4.3.1 Whales and dolphins

The cetacean fauna of southern Namibia comprises at least 33 species of whales and dolphins known (from historical sightings or strandings and recent surveys) or likely (habitat projections based on known species parameters) to occur in Namibia waters (Table 15). The majority of these occur in offshore waters, near the shelf edge and are highly unlikely to be present on the inner shelf and the project area.

The most abundant of the migratory mysticete (baleen) whales frequenting the inner shelf habitat are the humpback whales and southern right whales. In the last decade, both species have been increasingly observed to remain along the west coast of southern Africa well after the 'traditional' southern African whale season (June - November) into spring and summer (October - February) where they have been observed feeding in upwelling zones, especially off Saldanha and St Helena Bays in South Africa. Increasing numbers of summer records of both species in Namibia suggest that animals may also be feeding in the southern half of the country near the Lüderitz upwelling cell and may therefore occur in or pass through the Lüderitz Bay area throughout the year.

While globally ranked in the "Least Concern" category by the IUCN (due to the growing population and adequate conservation measures) it should be noted that the global population is still only ~10% of the estimated original pre-whaling levels. Still rare in Namibian waters, this species has a high value for marine tourism as demonstrated with the development of a multi-million dollars whale watching industry in the Cape Province of South Africa in the last three decades.

Table 15: Summary of whales and dolphin Species either resident or frequent the Namibian coast

Whales and Dolphin species	Common name	Current IUCN Red list Category	Potential threats to species
Eubalaena australis	Southern right whale	Endangered	Nets, moorings, noise
Balaenoptera acutorostrata	Minke whale	Vulnerable	Ship strike, nets, noise
Megapterano vaeangliae	Humpback whale	Vulnerable	Ecotourism
Orcinus orca	Orca, Killer whale	Data deficient	Ship strike, nets, noise
Lagenorhynchus obscurus	Dusky dolphin	Potential risk	Fishing gear (nets)
Cephalorhynchus heavisidii	Heaviside dolphin	Potential risk	Fishing gear (nets)

Source : (BirdLife International, 2021) and (NIMPA, 2007)

7.4.3.2 Seals

South African fur seal *Arctocephalus pusillus pusillus* breeds on the Namibian coast (Bianchi et al., 1999). Common in the Benguela system, the South African fur seal can be seen up to 200 km offshore but is mostly concentrated over the shelf and inshore areas. It breeds in dense colonies on rocky islands and on the mainland between mid-November and the beginning of January. The pups are weaned at about 10 months of age. It is preyed upon by sharks and killer whales at sea and by jackals and brown hyenas on the mainland (Bianchi et al., 1999). The diet includes at least 11 species of fish, some crustaceans, and squids. Some individual seals prey on sea birds (particularly jackass penguins). The diet composition varies regionally, seasonally, and inter-annually depending on the abundance and availability of local prey.

In the Lüderitz region fur seal colonies are found at Dolphin Head (Spencer Bay), Little Ichaboe, Marshall Reef, Staple, Boat Bay and Dumfudgeon Rocks, Seal Island (Lüderitz Bay), Wolf Bay, Atlas Bay, Long Island and North Reef (Possession Island). Of those, a complex of three colonies (Wolf Bay, Atlas Bay and Long Island) about 18 km south of Lüderitz comprise the bulk of the population of the southern Namibian fur seal population. The species is ranked “least concern” as a conservation status by the IUCN.

7.5 Ecologically and biologically significant marine areas

The original boundary of the Namibian Islands EBSA (Ecological Bio-sensitive Areas) has been extended to include key seabird foraging areas (Institute for Coastal and Marine Research, 2021). It extends alongshore for about 400 km from Meob to Chameis Bay and, on average, 30 km offshore from the high-water mark. It is located between the latitudes of 24°S and 28°S, within the national jurisdiction of Namibia

The Namibian Islands EBSA is described for both benthic and pelagic features, primarily as key breeding, and foraging area for threatened seabirds, but also as breeding, nursery or foraging areas for several other species that are iconic, threatened or of commercial importance. Eleven seabird species breed on the islands, of which eight are endemic to southern Africa (Kemper *et al*., 2007). Of these, the African jackass penguin (*Spheniscus demersus*), Bank cormorant (*Phalacrocorax neglectus*) and the Cape cormorant (*P. capensis*) are listed as globally endangered; the Cape gannet (*Morus capensis*) is listed as globally vulnerable and locally critically endangered (Simmons *et al*., 2015, IUCN 2016). The Namibian populations of African jackass penguins, Cape gannets and Bank cormorants breed exclusively within this EBSA. Productivity at this region is also particularly high because it is situated in the Lüderitz Upwelling Cell in the Benguela Current, which plays a significant role in regulating the biomass of fish stocks of central Namibia. However, the depletion of small pelagic fish stocks in the late 1960s and 1970’s through over-fishing, particularly in southern Namibia, has negatively impacted this area (Roux *et al*., 2013). This provides special justification for protecting of this region to conserve the important threatened species that are dependent on it.

The key ecological value of this region (between the latitudes of 24°S and 28°S), was recognised before the EBSA process, and in 2008, the Namibian Ministry of Fisheries and Marine Resources (MFMR) gazetted the Namibian Islands Marine Protected Area (NIMPA). The NIMPA covers nearly 1 million ha of coastal waters that encompass all the natural seabird breeding islands in Namibia and the key supporting seabird foraging areas in the surrounding sea. It was later recognised that the original EBSA delineation had focussed on only the breeding islands and had omitted the critical foraging grounds surrounding the islands that provide fish for the adult birds and as they provide for their chicks. Consequently, the EBSA boundary was revised to include the full extent of this significant ecological feature, following a similar delineation process to how the NIMPA was defined. Because this site comprises a collection of features and ecosystems that are connected by the same ecological processes, it is proposed as a Type 2 EBSA.

A lack of quality food poses the greatest threat to seabird populations breeding on Namibia's islands (Ludynia *et al*., 2010b, Simmons *et al*., 2015 as cited by (Institute for Coastal and Marine Research, 2021)). The collapse of sardine stocks in the 1960s and 1970's and anchovy populations in the 1990s (Roux *et al*., 2013 as cited by (Institute for Coastal and Marine Research, 2021)), both significant prey species, threaten the viability of African penguin, Cape gannet and Cape cormorant populations in particular. The recovery of small pelagic fish stocks in southern Namibia is therefore crucial to the continued survival of these species.

The coast is vulnerable to marine pollution, especially oil spills, and even a small oil spill at a key breeding site such as Mercury Island could put a significant proportion of the global population of African penguin, Cape gannet and Bank cormorants at risk. Namibia's National Oil Spill Contingency Plan is currently being updated, and a process to draft the Oil Spill Sensitivity Mapping is underway for improved monitoring and prevention. Breeding habitat degradation and associated disturbance (e.g., from guano harvesting) have further rendered breeding seabirds, particularly African penguins and Cape gannets, at risk. An increasing emphasis on marine mining, including inshore and coastal mining south of Lüderitz may pose additional threats to seabirds, rock lobsters and marine mammals, such as prey displacement and modification of key marine habitats.

The region of Namibia's Islands are being rated at 91% and classified to be in good condition, which is consistent with the inclusion of the entire area in the NIMPA as part of the EBSA's boundary revision. (Institute for Coastal and Marine Research, 2021)

7.6 Namibian Islands' Marine Protected Area (NIMPA)

The harbour town of Lüderitz is the only town situated adjacent to the NIMPA. Namibia has a range of Islands, Islets and Rock outcrops north and south of Lüderitz which are important breeding grounds for rare and endangered bird species. There are ten Islands, one Islets and twelve Rock outcrops.

The proposed finfish cage culture by Lilongeni Fish-Farming (Pty) Ltd. falls with the MPA. However, the document does not exclude activities such as mining, fishing, and aquaculture if procedures are followed as stipulated in the MPA and elaborated on above in **Section 5.2.**

According to NIMPA (2008), to minimize any interference with existing resource-extracting and navigational activities, the suggested buffer zone could be classified according to the IUCN's category VI, so-called 'Management Resource Protected Area'. This area is to be managed mainly to ensure the sustainable use of natural resources, i.e., to ensure the long-term protection and maintenance of biological diversity whilst simultaneously providing for a sustained flow of natural products and services to meet local and national development needs.

Within the broader IUCN category VI buffer zone, further smaller zonation was identified in the Namibia MPA. In this manner, increasing levels of protection are 'narrowed down' as they apply to more specific and stricter- controlled areas, within the broader buffer zone. The zones as proposed by NIMPA's (2008 and 20012) are defined as follows **(Fig. 44)**:

- *Zone 1:* Consists of general conditions applicable to all the island, rocks and other areas specifically mentioned in the MPA.
- *Zone 2:* Consists of stricter conditions that apply to the proposed lobster-sanctuary areas and proposed existing land-based mining restrictions.
- *Zone 3 and 4:* Are both Island specific, with Zone 3 containing conditions applicable around each island (radius 120m) while Zone 4 consists of the highest degree of protection on each Island itself.

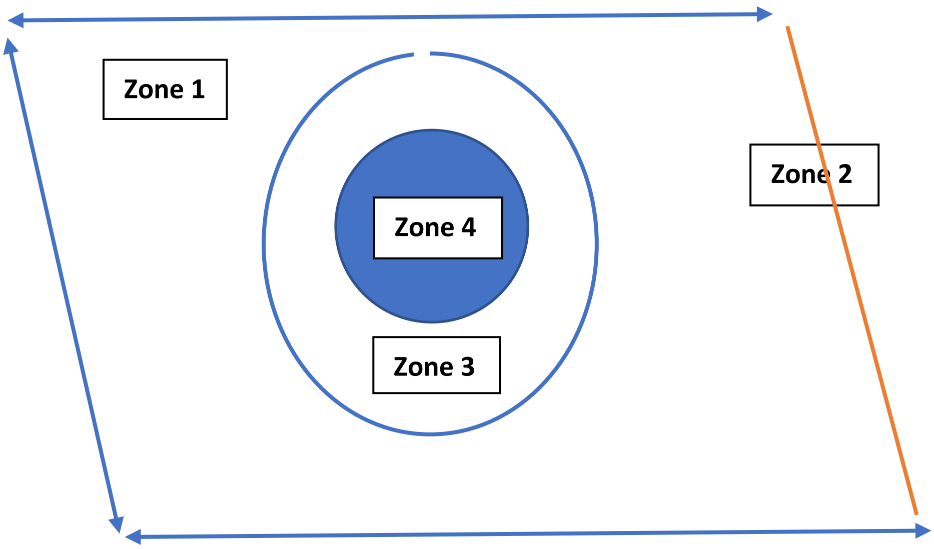


Figure 44: Schematic zonation within the MPA indicting the 4 major zones 1 to 4.

Note: Zone 4= an island, rock or islet; zone 3= 120m from an island; zone 2= the coast; zone 1= a buffer zone.

As per NIMPA (2008) the aquaculture industry is increasingly being promoted as an alternative to fishing. Mariculture activities, which entails the operation of finfish in cages, can be operated within the MPA on condition that the operation is:

- Carefully monitored on a day-to-day basis
- Ensure that entanglements are minimized (turtles, seabirds, cetaceans)
- No release of supplements into the sea
- To ensure no escapees into the sea occur

It is concluded that through close consultations between the Aquaculture Industry and the Directorate of Aquaculture (MFMR), the potential issues mentioned above will not result in conflicts regarding the MPA.

Summary of restrictions imposed on and near islands and rocks near the proposed cage culture (C ii).

Ichaboe Island
Position: Danger Point between Hottentot Bay and Boat Bay

- No activities within Zone 3 (120m radius) + Zone 4 (on the Island)
- The proposed cage culture is 19.1km south of Ichaboe Island

Halifax Island
Position: Diaz Point

- No activities within Zone 3 (120m radius) + Zone 4 (on the island)
- The proposed cage culture is 21.7km north of Halifax Island

Staple and Marshall Rocks
Position: Between Hottentot Bay and Boat Bay

- No activities within Zone 3 (120m radius) + Zone 4 (on the island)
- The proposed cage culture is 10.6km north of the above-mentioned rocks

Dumfudgeon and Boat Bay Rocks
Position: West of Kegelberg

- No activities within Zone 3 (120m radius) + Zone 4 (on the island)
- Proposed cage culture is ca 5km north of the above-mentioned rocks

Seal and Penguin Islands
Position: Lüderitz harbour

- No activities within Zone 3 (120m radius) + Zone 4 (on the island)
- Proposed cage culture is 20.2km north of the two islands

7.7 Socio-economic environment

7.7.1 Overview

Lüderitz is a smaller sized town of roughly 15,000 people located further south on the coast from Walvis Bay. It is an eight-hour drive from Lüderitz to Windhoek. There is a small domestic airport outside the town with Air Namibia flights to Windhoek and Oranjemund. The waterfront is developed with commercial businesses and fisheries including Seaflower Industries which has a lobster and fishing enterprise, a wet processing plant and cold storage facility. There are limited amenities with a handful of hotels, restaurants, and schools as well as the Lüderitz State Hospital.

7.7.2 Demographic

From 2001 to 2011, the //Karas Region has shown a population increase from 69,329 to 77,421 with an annual growth rate of 1.1% respectively, thus making it less than the Namibian intercensal growth rate of 1.4 %. Throughout the same period, Lüderitz showed a decline in population size of 13,859 as illustrated in Table 16 (NSA, 2011).

Table 16: Demographic characteristics of Lüderitz at a town, regional and national level.

Population Characteristics	Lüderitz	//Karas Region	Namibia Totals
Population (Males)	6,972	39,407	1,011,912
Population (Females)	6,887	38,014	1,091,165
Population (Total)	13,859	77,421	2,103,077
Unemployment (15+ years)	28%	32%	36.9%
Literacy (15+years) (%)	98.4%	96.6%	85.3 %
Education at Secondary Level (15+years)	50%	55.2 %	51.2 %
Household considered poor	5%	9%	15%

Source: (Namibia Statistic Agency, 2011).

Lüderitz's remoteness and the lack of employment due to the COVID-19 pandemic and economic diversification opportunities contribute to the population decline. Since the COVID-19 pandemic inhabitants have been relocating to their home regions and others relocated to other urban centres offering better prospects. Lüderitz's unemployment rate falls at 28.2% which is slightly lower than the rate of 32.2% of the //Karas Region (NSA, 2011).

7.7.3 Infrastructure and industries

Lüderitz developed in the early 20th century mainly because of the diamond mining industry. Today, however, the sustaining industries in Lüderitz are fishing and mariculture, mining, and tourism. Most of the employment is provided by the fishing industry which mainly exports fisheries products to Europe. Rock lobsters are one of the key fisheries products. Mariculture of abalone and oysters are also actively pursued in Lüderitz. Diamond mining used to be a major part of the mining industry with zinc mining being the other major component.

The Port of Lüderitz, as operated by Namport, is central to the fishing and mining industries. During the period April 2016 to March 2017 156,458 tonnes of zinc product and 15,070 tonnes of lead concentrate were exported via the Port of Lüderitz. zinc oxide is also imported in small quantities for refining purposes at the Rosh Pinah mines. The Rosh Pinah mines require sulphur for their refining process and during the 2016/2017 period, 92,078 tonnnes of sulphur was imported via the port. In 2019 the export of manganese ore via Lüderitz, originating from South Africa, was initiated. The anticipated export volumes are in the range of 80,000 to 90,000 tonnes per month in three separate shipments.

Tourism plays an important part in the local economy, unfortunately, a very small percentage of tourists visiting Namibia also visits Lüderitz. This is because Lüderitz is essentially situated at the end of a *cul de sac*. The main attractions are Kolmanskop, Diaz Point and the historic buildings of the town. Passenger liners call in the Port of Lüderitz from time to time with approximately 35 calling in port over the last four years (2015-2018).

Implications and Impacts

- The onshore aquaculture facility will initially employ approximately 30 full-time employees and to be increased to at least 100 when in full production. Some skills development and training will benefit employees during the operational phase.
- Increased employment opportunities will have a positive impact on Lüderitz. The additional mariculture farms in Lüderitz will result in an increase in revenue generation for the town as well as Namibia in general. The project will therefore have a positive contribution to the demographic and economic aspects of Lüderitz.

7.7.4 Community health

Developments attract job seekers, and this may lead to in-migration and growth in informal settlements. The various components of the port are reliant on a relatively large labour force during operational and construction phases. Being an existing port, a change in the demographic profile of the local community is not likely in the immediate future. Community health impacts may include factors such as a communicable disease like HIV/AIDS and alcoholism and drug abuse. This is typically associated with trucking and shipping (transport of products to markets). The presence of foreign people in the area may potentially increase the risk of criminal and social and cultural deviant behaviour.

The proposed project will attract several people from other areas leading to an increase in population. To prevent the in-migration and growth in informal settlements, the spread of communicable diseases and prevent and discourage socially deviant behaviour, the proponents should:

- Employ only local people from the area, deviations from this practise should be justified appropriately.
- Provide suitable housing for employees, especially when employing non-local staff.
- Adhere to all municipal by-laws relating to environmental health which includes but is not limited to sanitation requirement

The proponents should follow the mitigations as outlined below:

- Educational programmes for employees on HIV/AIDs and general upliftment of employees' social status.
- Appointment of reputable contractors.

7.7.5 Port of Lüderitz

Although Lüderitz Bay was first visited by Bartholomew Diaz in the late 15th century, apart from the Khoisan moving through, it remained uninhabited until 1883 when it was founded as a trading post (Robertson *et al*. 2012). Eventually, it would be the discovery of diamonds and the lucrative fishing and crayfish industry that would lead to the growth of the town to what is established there today. Lüderitz was thus ultimately first established as a harbour town, with the port being central to its economic activities and resource imports and exports. Road and rail infrastructure were historically constructed with the main aim of serving the port.

Today the port remains central to the mining and fishing industries of southern Namibia and is one of the main direct and indirect economic drivers of the town. A total of 92 people are directly employed by Namport in Lüderitz. The current available bulk cargo handling capacity of the port is a bit more than 1,000,000 tonnes per annum. This translates to about three additional 30,000-tonnes bulk cargo ships per month that can be handled in the port.

The proposed project Implications and Impacts

- The port currently operates at about a third of its capacity in terms of bulk cargo handling.
- Initiating the Manganese export project will allow the port to operate at full capacity. This will generate increased revenue and contribution to the national treasury.

Shipping lanes and traffic

The two coastal harbours of both Walvis Bay and Lüderitz have in the past decade become a hub activity for merchant vessels. However, site C (ii) lies below the 100m isobar, which falls outside the major north-bound shipping lanes (**Fig. 45).**

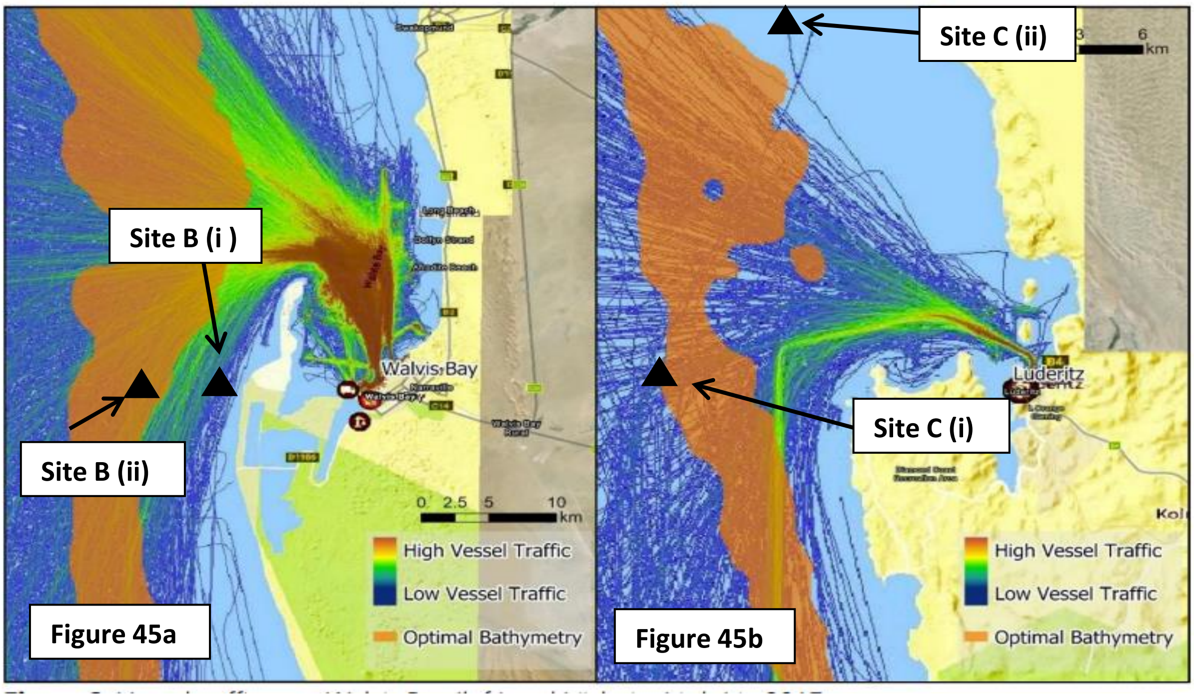


Figure 45: shipping traffic to and from Walvis Bay and Lüderitz harbour (INNOVASEA, 2020).

7.7.6 Mining

Lüderitz thrived in the early 20th century mainly because of the diamond mining industry. Today, however, the sustaining industries in Lüderitz include fishing, mariculture and tourism. Diamond mining continues to be a major part of the mining industry in southern Namibia and employs a significant portion of the region's population. However, Namdeb recently decided to put the Elisabeth Bay mine, the diamond mining operations closest to Lüderitz, under care and maintenance. As a result, approximately 85 families who were dependent on Namdeb employment at Elisabeth Bay, had to be relocated from Lüderitz. Similarly, subcontractors working at and for the mine became redundant, which in turn led to retrenchments. As such, a number of Lüderitz inhabitants fear that the loss in business opportunities from the mine, coupled with the reduction in the population with expendable income, will have significant economic impacts on the town's welfare. Presently, the future of the mine is not known, but Namdeb intends to sell the mine should a buyer emerge.

Second to diamond mining is zinc and lead mining activities at Rosh Pinah. During the period April 2016 to March 2017 156,458 tonnes of zinc product and 15,070 tonnes of lead concentrate were exported via the Port of Lüderitz. Zinc oxide is also imported in small quantities for refining purposes at the Rosh Pinah mines. The Rosh Pinah mines require sulphur for their refining process and during the 2016/2017 period, 92,078 tonnes of sulphur was imported via the port. The Port of Lüderitz, therefore, plays an essential role in the mining sector of southern Namibia.

Implications and Impacts

- Since all mining products are transported to the Port of Lüderitz with trucks, a cumulative impact by traffic on the B4 Main Road and streets within Lüderitz is expected.

7.7.7 Fishing and Mariculture

Currently, most of the employment in Lüderitz is provided by the fishing industry, which mainly exports fisheries products to Europe. Lüderitz is well known for its rock lobsters, which is one of the key fisheries resources exploited here. The Namibian mariculture industry is centred on Walvis Bay and Lüderitz. In Lüderitz, abalone and oysters are farmed mainly for international markets. During the 2016/2017 period, 21,034 tons of frozen fish was exported from the Port of Lüderitz.

Based on the 2011 census results (NSA, 2011), 2,211 residents of the Lüderitz Constituency are employed in the agricultural and fisheries industry. Since agriculture is practised in a very small area of this constituency, it is safe to say that most of the 2,211 workers are employed in the fishing industry.

Implications and impacts

- The project will attract a number of people from other areas leading to an increase in population. The prevention of in-migration, the growth of informal settlements and the prevention of the spread of communicable diseases and socially deviant behaviour must be emphasised.

7.7.8 Tourism

Lüderitz continues to mainly depend on the same economic sectors as when it was established, namely, mining and fishing. However, tourism plays an important part in the local economy. The uniqueness of the town, the rich heritage of the old buildings, and, most importantly, the ghost town of Kolmanskop, are the main factors drawing tourists to Lüderitz. Unfortunately, the town is situated 300km from the national Windhoek to Cape town road which deters many tourists from visiting this unique coastal town.

Namibia in its entirety is increasingly focussing on tourism and many residents of Lüderitz have turned to the tourism and hospitality sector. This includes operating various types of accommodation including backpackers, self-catering, bed and breakfast, and hotel accommodation, as well as day excursions to Kolmanskop and the Sperrgebiet, dolphin cruises, and guided trips to the restricted areas of the historic diamond mining areas.

During the period April 2015 to March 2016, 19 passenger ships called at the Port of Lüderitz. For the same period 2016/2017 it was seven and in 2017/2018 nine-passenger ships. These cruise liners either enter and berth inside the Port of Lüderitz or anchor outside in deeper waters and transport passengers with smaller crafts to the port. Lüderitz is now hosting to an annual international speed sailing event that attracts speed sailors from around the world who attempt to break various records for six weeks. The crayfish festival, to boost local enterprise and investment, is another annual event aimed at locals and tourists.

Based on the 2011 census results (Namibia Statistics Agency, 2011), 229 residents of the Lüderitz Constituency are employed in the accommodation and foodservice industry. Due to the growth in the tourism sector, this number is now expected to be higher. However, due to COVID 19, losses in jobs has occurred in Lüderitz and impacted negatively on the community in 2020 and 2021.

7.7.9 Rock lobster sanctuary and line fish sanctuary

Rock lobster sanctuary

Due to the collapse of the rock lobster industry, which was the backbone industry to Lüderitz, two sanctuaries for the lobster were proclaimed in 1990, which include:
Ichaboe sanctuary (between Danger Point Douglas Point) the centre being Ichaboe Island at 26° 17’ 20’’ Latitude south and 14° 56’ 16’’ Longitude east and Lüderitz sanctuary (between Diaz Point and south of Boat Bay) approximately along the 30-50m bathymetry.

An additional lobster sanctuary is being proposed between Prince Wales Bay to Chamais Bay, south of Lüderitz, along with the 30m bathymetry.

Linefish sanctuary

The proposed line fish sanctuary south of Walvis Bay will be between Meob Bay and Sylvia Hill and to extend 6nm offshore. In this area, all types of fishing will be prohibited (i.e., neither commercial nor recreational fishing will be permitted). In all cases, the proposed cage culture does not infringe on any of the existing and proposed sanctuaries.

7.8 Cultural, heritage and archaeological aspects

Many buildings in Lüderitz town are of heritage value requiring protection (SPC, 2015). The Town Centre, Kolmanskop, relic mining sites and stranded ships, as well as the nearby islands, are of cultural and historic value.
Implications and impacts:

- The facility will not impact any of the cultural or historically significant areas or buildings.

8. PROJECT POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Chapter 8 provides the potential ecological effects associated with farming finfish in Lüderitz at 26 °27' south and 15° 00' 00" east which is approximately 21 km north from Halifax Island and the long-term monitoring line and approximately 19km and ca 24km south of Ichaboe and Mercury Islands respectively.

The potential impacts were based on existing commercially farmed yellowtail kingfish (*Seriola lalandi*), silver cob (*Argyrosomus inodorus)*, and Atlantic salmon (*Salmo salar*). The proposed mariculture farm will be the first finfish farm to be operated offshore in Namibia and therefore a due diligent process needs to be conducted. Readers are referred to the literature review for additional information and source references.

8.1 Farm design and construction phase

8.1.1 Disturbance of benthic habitats

Installation of the proposed development offshore cluster cages (quays) may result in some localised disturbance of the seabed, including the movement and suspension of sediment and substrate materials within the water column. During the installation phase, three moorings would be micro-sited to avoid potentially sensitive benthic habitats and species. Remotely operated vehicles (ROVs) would be utilised to carefully place the mooring anchors on the seabed and limit seabed disturbance. Good practice measures will be implemented to minimise the potential for impacts. The magnitude of the effect is considered likely to be low. Therefore, the installation effects on benthic communities are considered to be **not significant.**

8.1.2 Deployment of cage clusters

The three moorings to be deployed (Appendix 5 and Annex 3), to which the three cage clusters will be connected to, could possibly impact on the benthic substrate as follows:

- disturbance of fauna and flora (turbidity in the water column)
- marine mammal and avian obstruction and possible attraction

***Note:* the impact will be very localised and distant from important bird islands.**

8.2 Farm operation and management phase

8.2.1 Ecological Effects Predicted

Farmed finfish require the addition of artificial diets in the form of fish feed pallets. Therefore, most ecological effects on the water column are related to the finfish waste products such as faeces, uneaten feed and excreted ammonia entering the marine system and changing the concentrations of nutrients. Particulate wastes expelled into the water column are also expected to settle onto the seabed in proximity to the farm. Therefore, this section should be read in close conjunction with the Benthic Effects Chapter 7 (Baseline condition – the receiving environment) and **Fig. 46** as well as Section 8.4 (Benthic effects).

In aquaculture, nutrient loading is defined as the difference between nutrients supplied with fertilizers and feed and nutrients harvested in the form of finfish (Verdegem, 2013). On average, the production of finfish results in a net nutrient loading. In marine and brackish water aquaculture, on a global scale, more nutrients are extracted than added to the environment compared to freshwater aquaculture (Verdegem, 2013).

In 2008, the global aquaculture production of finfish and crustaceans resulted in an environmental loading of 1.7 million metric tonnes of nitrogen (N) and 0.46 million metric tonnes of phosphorus (P). This nitrogen loading represents 0.9% of the human input to the nitrogen cycle and 0.4% of the global nitrogen cycle. For phosphorus, the loading from finfish and crustacean aquaculture represents 2.3% of the global annual fertilizer supply. With cage aquaculture, nutrients are directly discharged into the environment.

8.2.2 Nutrient enrichment effects

Finfish farms contribute both particulate (solid) and dissolved nutrients to the environment. Particulate organic (containing carbon-hydrogen bonds) nitrogen and phosphorus are primarily deposited onto the seabed as fish faeces, but also as waste feed pellets and particles. As this organic material is broken down, dissolved forms of nutrients may be released back into the water column and oxygen is removed from the water. The farmed fish also excrete dissolved inorganic nutrients such as ammonium (NH4). The dissolved inorganic nutrients from finfish farms, combined with nutrient inputs from other sources (such as oceanic and terrestrial inputs), stimulate the growth of phytoplankton and seaweeds**.**

In Lüderitz temperate waters, nitrogen (N) is likely to be the nutrient potentially limiting phytoplankton growth under most conditions. Therefore, the amount of nitrogen released during fish production is important, especially dissolved inorganic nitrogen (as this is the most biologically available form of nitrogen). Complicating matters is the fact that finfish farms are only one source of nutrients in the marine environment, and, like other sources, their inputs vary over time. Lüderitz water has a water temperature range of 12º C to 16º C with an annual average water temperature of around 14º C.

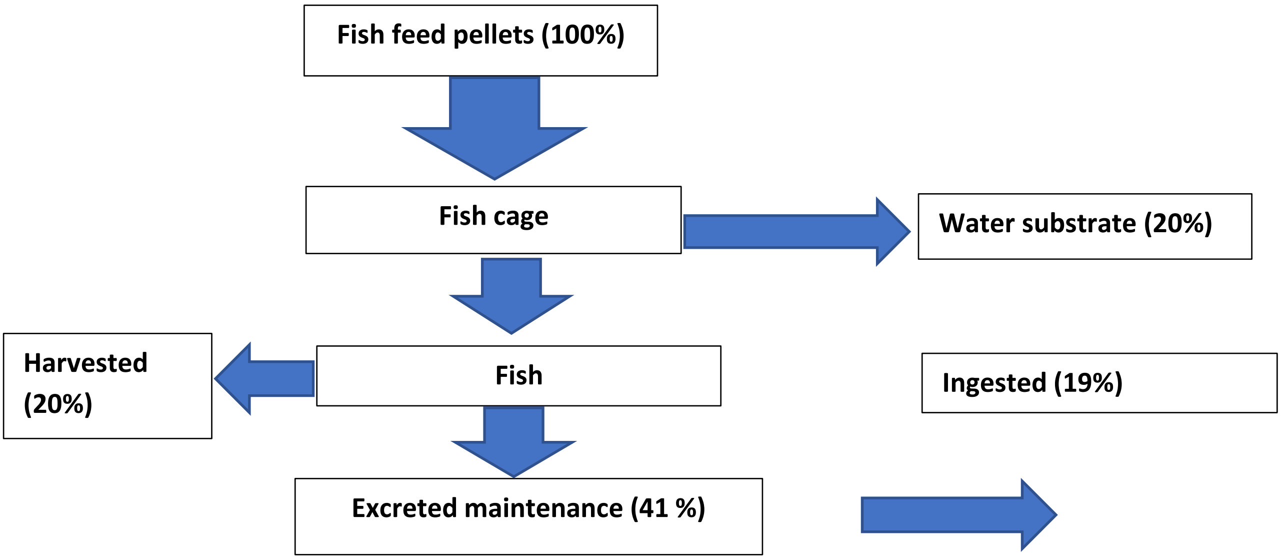


Figure 46: Estimates average flux of nutrient in the proposed finfish cages, a method adopted from Nunes and Parson (1998).

A concern with water column nutrient enrichment is the potential for an increased occurrence of harmful algal blooms (HABs), including blooms of species that produce bio-toxins. Some bio-toxins can be directly toxic to fish, and others can accumulate in shellfish and affect consumers, often leading to restrictions in harvesting shellfish. However, there have been no recorded HABs south of 25º Latitude and due to the intense upwelling and the continuous offshore transport of water masses, nutrient loading in this vicinity of site C(ii) will be minimal. Therefore, the impact is **not significant** in the Lüderitz region.

Furthermore, phytoplankton blooms have been recorded in oceans where finfish farming does not exist; however, these appear to be regional phenomena driven by oceanic processes not finfish farming activities. Nutrient enrichment may also lead to changes in phytoplankton species composition by changing the ratios of nutrients such as an increase in nitrogen which may favour the growth of dinoflagellates rather than diatoms. This could potentially lead to changes to the food web.

While the number of nutrients released, and their physical, chemical and biological characteristics are likely to be similar in sub-tropical zones, the nutrient assimilation capacity is much higher in the tropics. Lüderitz offshore is considered a temperate region. According to Angel et al, (1996), the capacity of sediments to absorb organic matter may be three to four times higher in warm than in temperate water. A typical nutrient budget for finfish cage culture is presented in **Fig. 47,** where 80% of the food provided may be released to the environment in one form or another.

The primary potential effects to water quality associated with marine cage culture include dissolved nitrogen and phosphorus, turbidity, lipids and dissolved oxygen fluxes (Price et al., 2013). Usually, there are no measurable effects 30 meters beyond the cages when farms are sited in well-flushed upwelled waters.

Nutrient spikes and declines in dissolved oxygen sometimes are seen following feeding events, but there are few reports of long-term risk to water quality from marine aquaculture (Price et al., 2015) The trend of numerous studies at cage culture farms, over the past two decades, indicates that improvements in feed formulation and feeding efficiency are the major reasons for decreased nutrient loading and acceptable water quality in and near farms, and explains why significant enrichment to the water column at offshore farms is generally not detected. Impaired water quality may be observed around farms in nearshore or intertidal habitats where flushing is minimal and at farms using feeds that include unprocessed raw fish rather than formulated feeds. Protection of water quality will be best achieved by locating farms in well-flushed waters.

According to a study done by Price et al. (2013), it was found that modern operating conditions have minimized the impacts of individual fish farms on marine water quality. Effects on dissolved oxygen and turbidity are largely eliminated through better management. Nutrient enrichment of the near-field water column is not detectable beyond 100m of a farm when formulated feeds are used, and feed waste is minimized. The role of placing fish farms in deep waters with sufficient current has been initiated to disperse nutrients and prevent ‘poor’ water quality impacts.

Significant effects:

Elevated nutrient concentrations in the water column are most evident **in proximity** to the finfish farm and rapidly decrease with increasing distance from the farm cages. The intensity and spatial extent of enrichment depend on on-site location, with high flow, deep sites producing larger but more diluted footprints. The proposed aquaculture development will be established in deep well-flushed waters at about 65m depth in the centre of the Lüderitz upwelling cell.

8.2.3 Depletion of dissolved Oxygen

Depletion of dissolved oxygen can occur within and around finfish farms due to the respiratory activities of the farmed fish and microbial degradation of phytoplankton or waste materials in sediments and the water column. This effect is significant to the farmer, as oxygen is critical for the survival and good performance of farmed fish.

Excessive oxygen depletion in the water column could potentially stress or kill the fish and other marine animals within and around the farm cages. Depletion of oxygen in sediments can result in the release of toxic by-products such as hydrogen sulphide and methane from the seabed into the water (out-gassing), which can also have adverse effects on the farmed fish and other marine organisms

Significant effects:

The significance of the effects of nutrient enrichment or oxygen depletion depends on the nature of the receiving environment (Verdegem, 2013). In shallow areas with slow and sluggish currents, the localised effects will be more pronounced compared to a deep site with a strong flow and good flushing. Reduced oxygen levels in the immediate water column in and around finfish farms have been observed in international studies when cages are heavily stocked or where they are located in shallow sites with weak flushing (Milewski, n.d.; Ministry for Primary Industries, 2013; Price, Black, Hargrave, & James, 2015; Verdegem, 2013). In reference to the proposed finfish cage culture at site C(ii) north of Lüderitz, the proposed farm is well positioned in an area with sufficient water flushing and > 3 ml/L dissolved oxygen concentrations. Therefore, the effects are **not significant.**

8.2.4 Management practices and mitigations measures for water column impacts

8.2.4.1 Site selection

Effects on the water column have been mitigated during site selection as the proposed at site C(ii) is situated in deep, well-oxygenated areas that have sufficient flushing to widely disperse farm wastes. The baseline study revealed that waters off Lüderitz are flushed up to 160nm (250+ km) offshore. Site C(ii) is located at approximately 65 meters depth while the recommended water depth stipulated by the (Ministry for Primary Industries, 2013), is recommended at >25 metres.

8.2.4.2 Farm management practices

Advanced automated fish feeders will be installed. The fish feeders are shut off via signals linked to underwater cameras that detect waste feed (Annex 3 and Appendix 5). These automated feeders will result in significantly less feed waste. Similar technology is used by farmers in New Zealand and Chile, which resulted in a reduction in feed wastage at Marlborough Sounds salmon farms which achieved better seabed and water column conditions (Ministry for Primary Industries, 2013).

Higher-quality feed led to an improvement in the Fish Conversion Ratio (FCRs) meaning that less feed is needed to grow the same number of fish. Feeds will be tailor-made (Specialized Aquatic Feeds Company from Hermanus, South Africa) with improvement in FCRs and certified or inspected by the Ministry of Fisheries and Marine. These mitigation strategies will also mitigate effects on wild fish populations by reducing the amount of waste feed available for consumption.

8.2.5 Ongoing Monitoring Programmes

8.2.5.1 Water column key parameter monitoring programme

This programme will include the water column key parameters of nutrient enrichment to support farm management practices to ensure that the water quality is maintained. Data generated from these programmes would also assist to calibrate and validate regional models and improve their accuracy.

8.2.5.2 Baseline compliance monitoring

Before the establishment of the proposed finfish farm, a desk top baseline condition assessment was done to understand the quality of the water in the Lüderitz upwelling cell. Therefore, baseline monitoring would be undertaken continuously over a period of five years to address at least the seasonal, temporal, and spatial variations in nutrient concentrations and phytoplankton that naturally occur. Once the farm is operational, monitoring of water quality will be undertaken based on appropriate **thresholds and trigger levels**. All monitoring results that exceed the water quality thresholds and trigger levels will be intensively investigated to establish a cause-and-effect relationship and to inform the need for an appropriate mitigation response. The baseline and compliance monitoring of the farm-scale water column for water quality parameters will cover phytoplankton (chlorophyll α, phytoplankton abundance, species composition), dissolved oxygen, nutrient concentrations (dissolved carbon, nitrogen and phosphorous) and macro-algal biomass.

8.3 Benthic effects

This section is to predict potential ecological impacts to the seabed beneath and adjacent to the farm arising from the deposition of organic waste (faeces and uneaten feed) from the farmed fish and resulting from accumulated trace contaminants (from nutritional additives or anti-foulants). Impacts, if any, on the fauna and flora on the seafloor around the cages will be very localized as faeces and waste feed will be flushed out by the pulsating Benguela Current and Ekman Transport.

8.3.1 Deposition of operational organic waste on benthic habitats

During production, organic waste from feed and faeces can be deposited on the seabed immediately around fish farm cages. This increase in the organic matter has the potential to impact the local benthic environment and can reduce the diversity of animals living there. The type of animals living within the sediment (infauna) may also change, with a reduction in diversity and elevated numbers of a few common opportunistic species.

Where waste deposition forms a 'footprint' of impact this can result in anoxia (oxygen depletion), eutrophication, growth of bacterial mats and lead to changes in the faunal community. Furthermore, it has the potential to prevent filter-feeding organisms, such as cnidarians (e.g., jelly fish, hydras, sea cucumber and sea anemones), from effectively feeding.

According to the Ministry for Primary Industries, 2013, the depositional footprint of only one proposed finfish farm will extend 10 to 100 metres from the fish cages. The effects are likely to be most evident directly beneath the farm cages and exhibit a strong gradient of decreasing effect with increasing distance, which is consistent with other organic enrichment gradients.

If the waste is re-suspended and transported elsewhere in the marine environment, this may reduce the effect of the deposition on benthic habitats directly under the cages and in the immediate surroundings. Waste dispersion and deposition are dependent on local hydrographic conditions and coastal processes in the location, which can either result in the direct deposition of waste under the cages, or re-suspension and transportation of waste elsewhere by near-bed currents. Out with the mixing zone, organic waste is carried away by currents, sometimes over considerable distances, usually diluting it to the extent that it has no detectible effect on the marine environment, however, fish farm operators must manage their sites so that there is no significant adverse impact on benthos beyond the edge of the mixing zone.

In addition to the management practices by the fish farm operators, the volumes of organic waste, such as faeces and fish feed wastage, is regulated by the Ministry of Fisheries and Marine Resources, who must grant an aquaculture license for any operating fish farm once they are satisfied that good farm practices will be maintained and adhered to.

As most of the matter deposited is organic it is absorbed into the environment by natural biological processes, and the particles deposited are subject to natural decay over time. The fish feed to be used will be imported from the reputable company named Specialized Aquatic Feeds (Pty) Ltd. at Hermanus, South Africa. Prior to import the MAWLR, will test the feed to ensure that it passes the 'safe' threshold as an animal feed.

It is also important to note that following the completion of the production cycle, the proposed development will be left fallow for a minimum of 2 months to allow potential if any waste deposited on the seabed to be dispersed or become chemically inactive, allowing the benthos to recover from any temporary effects of deposition.

Therefore, the operational effects on the seabed and proximity of the three cluster cages at site C(ii) as well as other benthic species, are considered to be **not significant.**

8.3.1.1 Cumulative effects:

Suffocating of benthic organisms by bio-deposition can occur in accordance with the accumulation of organic enrichment effects on the seabed. Suffocation effects tend to be more localised than enrichment effects because they are more prevalent at low flow sites that have smaller, more concentrated depositional footprint. The predicted, and the maximum extent of perceptible impacts associated with the development is limited within the fish cages and no significant cumulative effects on the benthic species from the proposed development are predicted.

Significance of the impacts:

Benthic habitats in proximity to the proposed development were confirmed to be dominated by habitats and species of low conservation priority and no literature was found which state the contrary. Potential development-related impacts at site C (ii) were assessed as likely to be localised, temporary and of low magnitude. Furthermore, it is considered that the implementation of the embedded mitigation measures and adherence to national regulation of MFMR, would further reduce the likelihood of detrimental effects arising on the wider benthos. Therefore, both individually and cumulatively, the impact is **not significant** in terms of the EIA and MFMR Regulations.

8.3.2 Biofouling drop-off and debris

Drop-off of biofouling organisms to the seabed is most obvious beneath net sides around the perimeter of farm cages. This can occur naturally (sloughing and natural drop-off) and via net cleaning operations. Biofouling drop-off and debris can potentially contribute substantially to organic enrichment in those localised areas. Biofouling drop-off and elevated bio-deposition can lead to aggregations of scavenging or predatory organisms, such as sea cucumbers, sea stars, crabs, and sea-lice (isopods). These faunas tend to be displaced under highly enriched conditions and instead they often aggregate around the perimeter of the farm. However, the excess food and waste released from fish cages may be food for wild fish, especially benthic feeders (Price et al., 2013).

8.3.3 Seabed shading by structures

The presence of farm structures reduces water clarity which could potentially reduce the amount of natural light reaching the seabed, thereby reducing algae productivity. Changes would be most evident when situated in naturally clear waters. Although identified as a potential effect, no studies exist which separate the effects of shading from the benthic enrichment effect. Besides, cages may also provide shelter and foraging habitat for wild fish. These characteristics may be beneficial to the local and regional environment. Wild fish and other marine life often aggregate around fish cages and this may be considered a beneficial impact on marine life at some locations (Price et al., 2013).

8.3.4 Widespread bio- deposition

Widespread but very diffuse benthic enrichment is possible outside of the primary footprint in nearby natural depositional areas such as blind bays. In most cases, the rate of deposition is likely to be low enough to be naturally assimilated. Any effects are likely to be subtle and difficult to detect (Milewski, n.d.; Price et al., 2015; Price et al., 2013; Verdegem, 2013). Such effects could be cumulative across multiple farms in an area. However, the proposed finfish farming at site C(ii), refer to **Fig. 29 & Fig. 41**, is the only source of deposition and nutrient enrichment offshore of Lüderitz. Therefore, the effects are **not significant**.

Significance of the impacts:

The deposition of organic waste resulting in seabed enrichment and degradation is the main effect on the seabed from finfish farming. This enrichment can have pronounced, localised effects directly beneath the finfish cages, but there is typically a rapid improvement in environmental conditions with increasing distance from farm structures over 10m to 100m. With the proposed development at site C(ii), located at 65m and due to the pulsating Benguela Current, the seas on the west coast of Southern Africa are some of the most productive in the world. The current flows north from the Southern Ocean and offshore winds drive the surface water away from the coast. Water rises from depths of hundreds of metres and at speeds of up to 12m per minute bringing nutrients to the surface.

How great these effects are, depend mainly on the flushing characteristics at the site as well as the farming intensity (namely fis stocking density, feed level, feed digestibility and biomass). Contrasts in seabed effects between high- and low-flow environments are evident in the case of salmon farming in the Marlborough Sounds and are fully described in the literature review. The effects are substantially less intense with high-flow (dispersive) sites in comparison with low-flow sites. For example, organic accumulation tends to be minimal at high-flow sites due to the increased levels of resuspension and the export of particles elsewhere (although faunal communities will still noticeably change).

According to (Milewski, n.d.; Ministry for Primary Industries, 2013; Price et al., 2013), benthic effects are largely reversible, although recovery is likely to take many months or years, depending on water flushing characteristics. The seabed is mostly recovered in the medium- to long-term, within the time-frame of months to years; an estimated five to ten years occurred in low-flow sites in finfish farming in New Zealand (Ministry for Primary Industries, 2013).

8.3.5 Management practices and mitigation for benthic effects

8.3.5.1 Site Selection

The proposed finfish farm site offshore north-west from Lüderitz is located at approximately 65m isobar meters at a deeper, well-flushed area due to the ever-pulsating Benguela Current. The seabed nutrient enrichment is partially mitigated as well-flushed environments have less intense localised enrichment of the seabed. Due to the Benguela Current, the current flows north from the Southern Ocean and offshore winds drive the surface water away from the coast. Water rises from depths of hundreds of metres and at speeds of up to 12m per minute bringing nutrients to the surface and transport them away in a north-westerly direction. The proposed finfish cages will be placed taking into consideration the direction of the current flow to ensure faeces and uneaten fish pellets are flushed away by the current and not contaminating the other cluster cages.

8.3.6.2 Farm management practices

To reduce effects of waste feed and faeces to the seabed**,** the proposed finfish farm management practices will include:

- **Tailor-made and higher quality feed**:

To ensure an increase in FCR advanced automated feeders are installed. According to (Milewski, n.d.; Ministry for Primary Industries, 2013), the mentioned practices have improved seabed quality at Marlborough Sounds salmon farms. For the proposed salmon species to be farmed, a primary driver of the level of seabed impact is the mass of feed used which ends up as 'waste feed'. Adjustments to the annual feed limit between 20 to 30 per cent will be possible due to:

- Automated feeders and
- Monitoring by camera feeding activity of the fish

- **Feed calculation:**

Scientists calculated the predicted sustainable feed level (PSFL) considering each site's physical characteristics such as depth and water currents, and then set the recommended initial feed level at 75 per cent of the PSFL (Ministry for Primary Industries, 2013). A similar approach will be used to prevent the waste accumulation on the seabed.

- **Farm fallowing and rotation:**

To mitigate the effects of the farming activity on the immediate environment, the rotation of finfish cages between positions within the site C(ii) area over a regular period will be employed to allow the seabed to recover (at least partially) before the farm is re-established. This is called fallowing. Fallowing can be employed, either as an extreme response to excessive (or non-compliant) levels of enrichment effect on the seabed or as part of a farm rotation schedule.

Fallowing proved to be effective in finfish farming in countries like New Zealand where the effects of nutrients enrichment from finfish cages are well minimised (Ministry for Primary Industries, 2013). The benefits of fallowing and cage rotation have been demonstrated to a limited extent overseas at sites where seabed recovery can occur within less than six months. Other overseas examples, and experience at salmon farm sites in the Marlborough Sounds, indicate that seabed recovery may take many years, whereas enrichment effects can become well advanced within a matter of a few months from the time a farm is restocked (Ministry of Primary Industries, 2013; Price et al., 2013).

The effectiveness of a fallowing strategy is high when allocated a larger surface area, made which is a viable practise that will reduce fish feed loading. However, it may be preferable to confine seabed effects to a single site rather than spread the effects over a greater area. The suitability of fallowing and rotation as a farming strategy is case-specific, depending on cage design, feed intensity, environmental characteristics, and the area available for farming.

The suitability of fallowing and rotation as a farming strategy is case-specific, depending on cage design, feed intensity, environmental characteristics, currents and the area available for farming. However, at site C (ii) it may be preferable to confine seabed effects to a single site rather than spread the effects over a greater area. This can be done as follows:

- fish feed loadings can be reduced (based on fish feeding activities that are constantly monitored)
- allow a cage to be empty for at least 2 months (after harvesting) to enable the currents to flush out any accumulation of waste feed and faeces .

The fallowing strategy proved to be successful in Tasmania and Australia, where polar circle finfish cages are rotated within large (typically 20 to 25 hectares) consented areas. The benthic effects are monitored within and outside the lease areas and managed within approved standards.

8.3.6.3 Monitoring and ongoing adaptive management

Regular monitoring of seabed health, combined with adaptive farm management responses based on the monitoring results, ensure benthic effects are minimised and spatially contained. Acceptable limits are generally specified in resource consent conditions. It is international best practice to prohibit seabed conditions from becoming anoxic and azoic beneath finfish farms.

Monitoring of the seabed health beneath the existing or proposed finfish farms will be carried out after each production cycle. This will be done by the farm manager by taking measurements of sediment properties inside and outside the farm site, to predict the level and the spatial extent of enrichment effects. The animals living in the sediment are well-recognised indicators of seabed health or enrichment status while sulphide concentrations (µM) and redox potential (EhNHE, mV) will be used to indicate the toxic status of the sediment. Moreover, the composition of the sediment also indicates seabed health, using measurements of proportion of fine mud, sand, and shell/gravel, the organic matter content, and the redox depth (an approximation of the depth at which sediment becomes anoxic). These values will be compared to the average values for other sediments in the region, including at control sites beyond the influence of the proposed aquaculture development.

Depositional modelling can be used to predict the spatial extent and magnitude of depositional effects on the seabed. These models estimate the distance and direction fish farm wastes could travel before reaching the seabed, considering local water current speed, water depth, and the time it takes for particles to settle to the seabed. These models also estimate the amount of deposition that would be likely to occur at increasing distances from the farm and can be used to predict levels of resuspension and redistribution of particles.

Seabed health will be managed using a “zones approach”, which defines spatial zones of enrichment around a finfish farm. The zone boundaries will be drawn skewed in the direction of prevailing currents to reflect the depositional footprint more accurately. The zone approach will be adopted from the Ministry for Primary Industries (2013) based on Keeley (2012) (**Fig. 47)**.

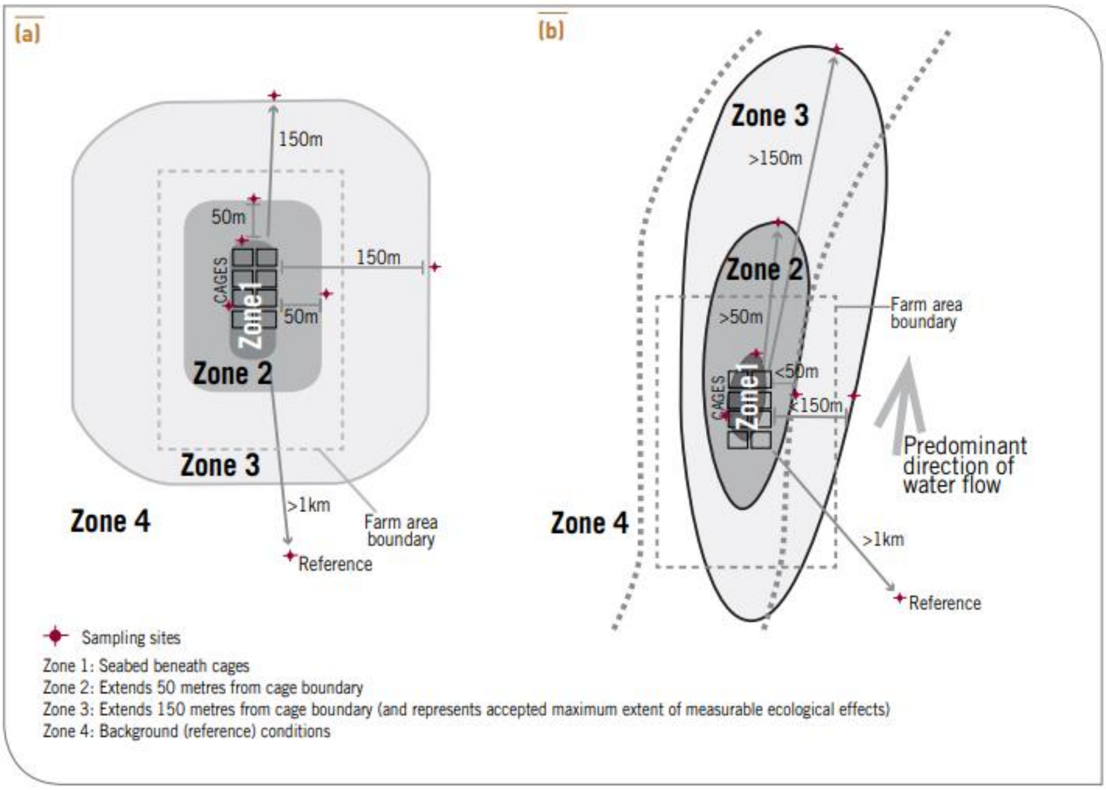


Figure 47: Schematic presentation of zone sampling around a finfish cage culture for monitoring purposes based on Keeley,(2012 in the Ministry for Primary Industries, 2013).

8.4 Marine bird and mammal interactions

Interactions between marine mammals and the proposed development may result from an overlap between the spatial location of the farm structures and the habitats and migration routes of the species. Such interactions have been relatively minor issues given the small scale and location of the current proposed finfish farming activities here (refer to Chapter 7). Table 17 summarises the list of important conservational marine mammals and birds that are resident within the MPA.

Table 17: Summary of marine birds and mammals that occur in the Namibia Marine Protected Area (MPA) and likely to be impacted or impact the proposed project.

Marine bird and mammal species	Common Name	IUCN Status Conservation	Resident migratory	Main area of activity	Potential threats
Speniscus demersus	Jackass penguin	Endangered	Resident	Halifax + Mercury Islands	Seals, kelp gulls, oil spill
Morus capensis	Cape gannet	Endangered	Resident	Ichaboe, Mercury, Possession Island	Seals, kelp gulls, oil spill
Phalacrocorax lucidus	White-breasted cormorant	Least concern	Resident	Forage close to shore	Entanglement in nets/fish line
Phalacrocorax neglectus	Bank cormorant	Endangered	Endemic	Forage inshore (Mercury Island)	Lack of prey; kelp gulls
Phalacrocorax coronatus	Crowned cormorant	Vulnerable	Endemic	Ichaboe Island	Kelp gulls; plastic pollution
Larus dominicanus vetrula	Kelp gull	Least concern	Endemic	Coastal area - Lüderitz	Egg collection
Larus hartlaubii	Hartlaub's gull	Least concern	Endemic	Coastal area - Lüderitz	Coastal development
Thalassarche cauta	Albatross	Endangered	Migrant	MPA	Long line fishing sector
Arctocephalus pusillus	Cape fur seal	Least concern	Resident	Entire coastal region of Namibia	None
Eubalaena australis	Southern right whale	Endangered	Migrant	MPA, south of Lüderitz	Trawl nets, moorings, noise
Balaenoptera acutorostrata	Mink whale	Vulnerable	Migrant	MPA, mainly offshore	Ship strike, trawl nets, noise
Megaptera novaeangliae	Humpback whale	Vulnerable	Migrant	MPA	Ecotourism

Orcinus orca	Orca, killer whale	Data deficient	Resident	MPA	Ship strike, trawl nets, noise
Lagenorhynchus obscurus	Dusky dolphin	Potential risk	Resident	MPA	Fishing gear (trawl nets)
Cephalorhynchus heavisidii	Heaviside dolphin	Potential risk	Endemic	MPA	Fishing gear (trawl nets)
Tursiops truncatus	Bottlenose dolphin	Bottlenose dolphin	Endemic	MPA	Fishing gear (trawl nets)

Source : (BirdLife International, 2021) and (NIMPA, 2007)

Note: It is evident that seals and the commercial fishery (long liners and net entanglement) are a major threat to the endangered and vulnerable bird populations and trawling to the marine mammals.

8.4.1 Habitat modification or exclusion

The presence of the proposed farm structures and their associated aquaculture activities can potentially exclude or modify how particular species of marine mammals use critical and sensitive habitats, including foraging or feeding areas, resting or nursery areas, and migration routes. Research (Callier et al., 2018; Milewski, n.d.; Ministry for Primary Industries, 2013; Price et al., 2013), highlighted that the nature of the exclusion greatly depends on the type and scale of the farming method and how in particular marine mammal species will be affected.

Whales and dusky dolphins tend to be more sensitive to habitat modification and exclusion. While seals and other dolphin species such as common and bottlenose dolphins may be attracted to the modified habitat and the food source in the form of uneaten fish feed pallets and farmed fish, there has been little overlap between aquaculture and the migratory paths of large whales in waters recorded to date (Callier et al., 2018; Milewski, n.d.; Ministry for Primary Industries, 2013; Price et al., 2013). The development of large offshore finfish farms and the recovery of certain populations, notably humpback whales, may result in greater overlap with whale migration routes.

The five important and closest bird islands to the proposed development are Ichaboe Island (19.1 km north), Seal and Penguin Islands (20.2 km south), Halifax Island (21.7 km south) and Mercury Island (ca 25km). Bird Life International recognizes Ichaboe Island along with other islands such as Mercury Island (north of Ichaboe Island) and the nearby coast as an Important Bird Area for their seabird colonies (BirdLife International, 2021). Ichaboe Island regularly supports over 50,000 seabirds of at least eight species and is consequently one of the most important and densely packed seabird breeding islands in the world. The island holds 65% of the world's endangered cape cormorant (*Phalacrocorax capensis*) (Wikipedia, 2021).

Whales sighted off the island include the humpback whale (*Megaptera novaeangliae*) and southern right whale (*Eubalaena australis*). The other cetaceans include the dusky dolphin (*Lagenorhynchus obscurus),* common bottlenose dolphin (*Tursiops truncatus*) and the endemic heaviside's dolphin (*Cephalorhynchus heavisidii*).

Habitat modification may also lead to aggregations of scavenging or predatory organisms, such as sea cucumbers, sea stars, crabs, and sea-lice (isopods). These faunas tend to be displaced under highly enriched conditions and instead they often aggregate around the perimeter of the farm. However, the excess food and waste released from fish cages may be food for wild fish, especially benthic feeders (Price et al., 2013).

8.4.2 Entanglement

Physical interactions between finfish farms and marine mammals can lead to an increased risk of entanglement in structures, nets, or non-biological wastes from farm production. The risk of entanglement also increases as some marine mammals tend to be attracted to the farmed fish themselves or the associated aggregations of wild fish. Species likely to be of most concerns for their interaction with aquaculture include those that share the same area and have high conservation importance such as the penguins and fur seals. However, the net cages to be deployed will be covered on the outside with steel mesh to ensure that no entanglement with the nest can occur. The life durability of the steel mesh is up to 14 years. In addition, the proposed site C (ii) is located 19km and more from the major important bird islands. The seals are the main species located in this proposed site C(ii) area.

Dolphins and smaller whales are more agile and therefore at less risk. Marine farmers have observed that dolphins and seals are the most likely species to interact with salmon farms. There have been reported incidences of New Zealand fur seal and several dolphin species becoming entangled, or trapped in predator nets and drowning, at salmon farms.

Prevention of entanglement: Potential marine mammal entanglement will be mitigated by covering each net with a steal wire mesh which has a durability of 14 years.

8.4.3 Underwater noise

Underwater noise associated with regular, ongoing farm activities, including vessels, may either attract or exclude marine mammals. Whales and particular dolphin species tend to be sensitive to such disturbances. Seals and other dolphin species (such as common and bottlenose dolphins) may be attracted to the novel noise source.

8.4.4 Attraction to artificial ighting

The use of submerged lighting to aid in caged fish maturation may attract marine mammals to the associated aggregations of wild fish. As the footprint of submerged artificial lights is mainly confined within the cage structures and to mid-water depths, marine mammals will more likely be attracted to any increase in noise and activity of caged or wild fish in response to the lights, rather than the lights themselves. While marine mammal attraction to farms using submerged lights will be highly localised in its effect, the greater risk is potential entanglement with fishing trawler nets.

Significance of the impacts:

The adverse effects of finfish aquaculture on marine mammals are not presently considered significant issues given the small size of the New Zealand finfish industry and the actions taken by the industry to manage entanglement issues at individual farms. While there is some current overlap with marine mammal habitats, very little of this occurs in what may be described as critical habitat (such as breeding and foraging grounds for cetaceans and haul-out sites and colonies for seals). Also, the consequences of physical interaction are considered minor in most cases, as the outcomes are generally expected to affect individuals or result in only small-scale avoidance or attraction.

The scale and magnitude of the effect of aquaculture on marine mammals depend largely on the species and its population range, particularly if it is an endangered, threatened, or range-restricted species. Critical species in this regard include bottlenose dolphins, orca, southern right whales and humpback whales as outlined in the NIMP (2007).

8.4.5 Management practices and mitigations for marine birds and mammals

This section should be read in conjunction with section 5.5.3 (predator control) in Chapter 5.

8.4.5.1 Site selection

The proposed development is carefully selected to minimise the likelihood of overlap with important marine mammal migration routes and known habitats (species' home ranges, critical breeding, and foraging habitats).

8.4.5.2 Management practices

The risks associated with physical interactions can be further minimised by adopting best practice guidelines for maintenance and operation of farm structures, predator nets and the use of noise-generating equipment. Predator nets will be designed putting into consideration the configuration, mesh size, twine diameter, net tension) in a way that minimises the risk of marine mammal entanglement:

- Seals and dolphins may be attracted to the structures and wild fish aggregations that are often associated with the farms; therefore, any resulting entanglement risks can be minimised by keeping farm structures and nets well maintained, ensuring debris and waste material does not enter the water, keeping lines always secured, and ensuring anchor warps are maintained under sufficient tension. Also, efforts to reduce feed waste will minimise fish aggregation and may also reduce the amount of time some species (for example, dolphins) spend near finfish farms.
- To mitigate artificial light effects the use of non-navigational lights on-site, and, where possible, lights will be shielded from all but essential directions. If spotlights must be used, they will be positioned as high above the water as possible so that penetration is maximised, and reflection is minimised.

8.4.6.3 Monitoring programmes

Monitoring records of the presence of marine mammal species in the vicinity of the proposed farm site along with any detailed observations of their time spent around farm structures will be documented, including night-time feeding activity around illuminated cages. The Ministry of Fisheries and Marine Resources office will also be contacted in the event of marine mammal entanglement.

8.5 Wild fish interaction

Fish spatial distribution and density surveys carried out by the RV Dr Fridtjof Nansen in the 1990's indicate that the highly valued commercial fish species that occur in the vicinity of site C(ii) is the juvenile Cape hake (*Merluccius capensis*). However, swept area density surveys conducted by the RV Dr Fridtjof Nansen in the early 1990's till the turn of the century revealed that juvenile fish such as cape hake occur more offshore between the 100m to 350m isobar of the Lüderitz upwelling cell.

Potential effects of the finfish cage cluster on the marine habitat include:

8.5.1 Effects on existing fish habitats

The placement of a finfish farm directly above or adjacent to important benthic habitats to fish (such as spawning areas or rocky reefs) can impact wild fish populations through degradation of their habitat, particularly through bio deposition from fish faeces and waste feed.

8.5.2 The attraction of wild fish to arm Structures

By adding fish cages to the sea environment, finfish farm cages create artificial habitats that attract wild fish species seeking foraging habitat, food sources and refuge from predators as well as providing habitat for colonisation by biofouling pests (Callier et al., 2018). Furthermore, the use of submerged artificial lighting, which is frequently used on finfish farms to control maturation and increase productivity, can also enhance the attraction of wild fish to farm structures. The footprint of submerged artificial lights is mainly confined to within the cage structures and to mid-water depths. As such, wild fish along the bottom or further than about 10 metres from the cage structures are unlikely to be affected.

The attraction of wild fish to fish cages can also result in enhanced predation by the farmed fish and other predators such as seals and dolphins. Sharks may also be attracted to finfish farms, particularly to the presence of dead fish (Callier et al., 2018; Ministry for Primary Industries, 2013).

Moreover, wild fish attraction to the proposed development at Site C(ii) structures can potentially lead to changes in the local distribution and productivity of wild fish populations by acting either as ecological traps or possible sources for wild fish stocks. The presence of the proposed development can also result in changes to fishing patterns and pressure which in turn could affect wild fish populations differently than in the absence of the structures (Ministry for Primary Industries, 2013).

Uneaten fish pellets from finfish farms have been identified as a primary driver of wild fish aggregation around finfish cages in many countries (Ministry for Primary Industries, 2013). Waste feed pellets may provide an alternative food source for wild fish which may alter body condition and reproductive success.

Significance of the impacts:

The effects of finfish farms on wild fish populations are likely to be small in comparison to the effects on other aspects of the marine ecosystem (Milewski, n.d.; Ministry for

Primary Industries, 2013). The attraction of wild fish to waters surrounding finfish farms can have a positive effect of enhancing wild fish populations through habitat creation and increased food availability. On the contrary, the effects could potentially be negative if they result in regional fish populations becoming displaced from other habitats or possibly more vulnerable to recreational fishing pressures.

8.5.3 Management practices and mitigations for wild fish interaction impacts

The fish cage farm will be monitored for 24 hours per day and seven days per week from the service vessel which will be stationed on site **(Appendix 5).**

8.5.3.1 Site selection

The proposed finfish cage culture site is distant from spawning and nursery grounds.

8.5.3.2 Feed quality and feeding practices

To minimise feed waste feeding will be monitored by TV monitors **(Fig.26).**

8.5.3.3 Removal of dead fish

Prompt removal of dead fish will be carried out to minimise the attraction of sharks and other predators. This will be done through the automated dead fish system **(Fig. 26)** will be stalled as explained in Section 5.4.2 (Mortalities).

8.5.3.4 Lights

Non-navigational lights on site will be minimised, and, where possible, lights will be shielded from all but essential directions. If spotlights will be used, they will be positioned as high above the water as possible so that penetration is maximised, and reflection is minimised as explained in Section 5.3.2.5.

8.6 Effects on seabirds

The proposed development is located near some of the Namibian islands that are recognised as an Important Bird Area for their seabird colonies by Bird Life International. However, the distance from the proposed finfish farm at site C (ii) to the islands ranges between 19 to 22km. This section should be read in conjunction with Section 6.8 (Marine mammals and birds' interaction with the proposed project)

8.6.1 Potential effects

There is a potential risk of seabird entanglement with finfish cages, where diving birds, attracted to the fish and fish feed pellets could drown because of entanglement in underwater nets used to contain the proposed farmed fish and predator nets both above and below the cages. There have been very few reports of seabird deaths because of entanglement in finfish farming (Milewski, n.d.; Ministry for Primary Industries, 2013; Price et al., 2015; Price et al., 2013).

The potential effect to breeding and feeding seabirds also includes reduced or altered habitat for feeding and displacement from feeding grounds. The physical presence of farm structures can also reduce the habitat availability for surface-feeding seabirds, such as gulls, penguins, cormorants, gannets, terns, and albatross, while a reduction in the clarity of the water column could potentially reduce the ability of diving birds to detect their prey. However, in the vicinity of the proposed alternative site, there are no bird breeding colonies.

Other possible effects include injury or death from ingestion of foreign objects, such as marine litter, collision with farm structures, and the attraction of seabirds to artificial lighting.

In contrast, a potential beneficial effect on the possible development of seabirds includes the provision of roost sites closer to foraging areas, thus saving energy, and enabling more efficient foraging. This is most likely to benefit gulls and terns. Similarly, the attraction and aggregation of small fish to the farm cages may make them susceptible to becoming potential prey of birds, such as terns, shags, and penguins.

Significance of the impacts:

The adverse effects of existing aquaculture on seabirds are not presently considered significant. The scale and magnitude of the effect of the proposed development on seabirds depend largely on the location of the farm within the range of seabirds, the bird species, its conservation status, and the duration of the effect. The proposed project is located north of Halifax Island (19km) which is home to colonies of jackass penguins, kelp gulls, crowned cormorant, greater crested tern and Hartlaub's gull. Ichaboe Island, which is situated north (21km) from site C (ii), is one of the most important and densely packed coastal seabird breeding islands in the world.

Smaller numbers of *Larus dominicanus* and *Haematopus moquini* also breed on Ichaboe Island. There are also about 4% of the world's breeding population of *Phalacrocorax coronatus* on Ichaboe Island. The island may also harbour thousands of roosting terns, particularly *Sterna hirundo* and *Chlidonias niger* (BirdLife International, 2021).

8.6.2 Management practices and mitigations

This section should be read in conjunction with Section 5.4.3 in Chapter 5

8.6.2.1 Site selection

The proposed site was carefully selected to be at least 19 km away from the Ichaboe Island to avoid unnecessary impact of the proposed development on the threatened, endangered, or protected bird species' home ranges, critical breeding and foraging habitats and migration routes.

8.6.2.2 Good farm management practices

To reduce entanglement, the farm management will erect well maintained enclosing predator nets above and below the cages, use small mesh sizes for the nets and ensure that nets are kept taut as stipulated in Section 5.4.3 (Predator control).

8.7 Biosecurity, escapee and genetic effects

This section covers biosecurity issues in conjunction with the escapee and genetic effects as well as effects from additives because they also contain biosecurity-related issues with more emphasis on Atlantic salmon (*Salmo salar*), Yellowtail kingfish (*Seriola lalandi*) and Silver cob (*Argyrosomus inodorus*).

8.7.1 Transmission of pathogens, parasites, and diseases from farmed stocks to wild fish populations and genetic effects

Finfish are usually treated for disease and parasites. Treated fish may not show signs of pathogens but can be carriers. There is concern that fish from the proposed farm fish, that may escape, or which is released from aquaculture fish cages, may introduce disease or parasites to other species in the ocean. World-wide research suggests that escape incidents may amplify the possibility of disease and parasites from farmed stock to wild populations.

In addition, research (Hansen, 2006; Milewski, n.d.; Ministry for Primary Industries, 2013; C. S. Price et al., 2013; Thorstad et al., 2008), has disclosed that smolt is often released from the cages by heavy ocean currents and technical and operational failures of farming equipment (farm cages and net failure). Net failure can occur in many ways, including biting by predators or caged fish, abrasion, collisions with boats, and handling procedures such as lifting. Research indicates that a focus on preventing large-scale escape incidents as a result of farm structural failures will have a great effect in diminishing the consequences of escapees (Ministry for Primary Industries, 2013; Thorstad et al., 2008; UNCTAD, 2006).

The main potential effects of escapees from the proposed finfish farm are direct competition for resources with wild fish, changed genetic structure of wild fish populations such as a change in fitness, adaptability, diversity, or reduced survival by mixing farmed fish with wild populations. There is also the possibility of the transfer of pathogens between populations.

The significance and impact of potential effects of escapees will vary considerably in relation to various factors like the numbers of farmed fish that escaped, the location of the proposed farm in relation to wild populations, whether the species is native or introduced, and the ability of escapees to survive and reproduce in the wild.

8.7.2 Specie-specific impacts of fish species to be farmed at the proposed project:

8.7.2.1 Silver cob and Yellowtail kingfish (indigenous species)

According to Hansen (2006); Ministry for Primary Industries (2013) and Thorstad et al. (2008) there is a greater likelihood that the wild fish stocks e.g., silver cob and yellowtail kingfish may be a vector of disease transfer to the caged fish than the reverse. However, due to the constant force of the pulsating Benguela Current in a northerly direction sea lice infestation in the Lüderitz are would be negligible. would be negligible.

Diseases could potentially be transmitted to other animals by escaped fish through direct interaction with the cultured fish in the sea cages, or indirectly through the water column. Numerous studies have been conducted in the northern hemisphere and although there is much debate in the literature, there is insufficient evidence to conclude whether observed increases in disease in the wild stocks are due to disease transfer from the escaped cultured fish (Stephen, 2002).

However, risk transfer of diseases and pathogens to wild populations from farmed yellowtail kingfish are likely to be low if the fish are introduced into the cages without any pathogens or diseases.

8.7.2.2 Atlantic salmon (*Salmo salar)* (Species to be introduced)

Atlantic salmon (*Salmo salar*) escapees spawn in fresh water, but their reproductive success is less than that of wild salmon. The occurrence of escaped farmed salmon only raises a huge concern for the genetic alternation in areas such as the Northeast

Atlantic where wild salmon are present. Escapees may interbreed with wild salmon and may also be vectors for transferring diseases and parasites to wild salmon (Hansen, 2006). However, there is no native Atlantic salmon in Lüderitz or in the Namibian marine environment making the genetic effects **insignificant**.

Information on the survival and migratory pattern of the escaped farmed salmon is sparse. According to Hansen (2006) the survival of tagged hatchery-reared salmon (post-smolts held in saltwater) had a poor survival rate. A recent study by the University of Melbourne provides another possible explanation for why escaped farmed salmon may not thrive in a natural environment to breed or interact with other marine animals (Reimer et al., 2017). The study found that many farmed salmon are partially deaf, a possible side-effect of their accelerated growth. The study also noted that fish in the wild use their hearing to find prey and avoid predators and navigate to and from breeding grounds. Without hearing, their chances for survival are poor.

A study done in the Northeast Atlantic, (Araki et al., 2008), show results from smolt-tagging experiments and post-smolt surveys. These results strongly indicate that hatchery-reared smolts released directly into the sea tend to return to the same marine area from which they were released but because they were not released into fresh water, they enter any river in that area to spawn. Salmon that escape during early autumn, in the year before they become sexually mature, are transported with the currents to Arctic areas and, subsequently, do not survive the winter.

Consequently, there is no agreement on the magnitude of the impact of salmon escapees. However, according to Jeremy Dunn, executive director of the British Columbia Salmon Farmers Association, there has been no evidence of negative impacts or invasiveness of Atlantic salmon in their natural territory. Farmed salmon are fed food pellets, so “they’re going to have a hard time eating if the pellets aren’t readily available” once released into the wild. Farms in British Columbia are now highly engineered and able to withstand very fast currents and rough seas, reducing escapes.

In the northern hemisphere, farmed fish such as Atlantic salmon are often bred from a small gene pool for selected traits like fast growth which can result in genetic divergence from the wild populations. The main ecological concerns with the use of genetically modified organisms upon escape would include altered interactions because of changed fish characteristics, the potential for genetically modified fish having increased tolerance of physical factors allowing them to move to new regions and migratory and territorial behaviour resulting in a change to fish population dynamics. The use of genetically modified marine organisms, release and escape of aquaculture products and control of disease outbreaks in Namibian waters is controlled under the Aquaculture (Licensing) Regulations (2003)

In terms of diseases, there have been significant disease problems encountered internationally especially on salmon farming in countries like Chile, Scotland, Australia and Norway (FAO, n.d.; Hansen, 2006; Invasive Species Compendium (ISC), 2021). However, many pathogens and parasites known to cause problems for salmon farms in many countries are not known to occur in countries like New Zealand because of good farm management practices and strong pulsating currents similar to that experience at Lüderitz (Ministry for Primary Industries, 2013).

According to the (Invasive Species Compendium (ISC), 2021), disease epizootics in wild salmon are not commonly reported but the myxozoans, furunculosis, *Gyrodactylus salaris*, and sea lice (*Lepeophtheirus salmonis*) are the pathogens most likely to threaten wild and managed salmon stocks in future. Of most concern is the transmission of ectoparasites especially sea lice, from farmed fish to wild fish causing increased mortality in the latter, especially of migrating smolts. Similarly with regard to genetic effects, the impact can only be severe if there are wild salmon in the area.

Significance of the impacts:

The likelihood of escapee effects from the proposed development is **not significant**, based on the small size of the finfish farming industry in Namibia and being the only proposed finfish farm in the country. In addition, each net will be enclosed with a steel mesh which has a durability of 14 years. There is also no overlap of wild and farmed populations in terms of Atlantic salmon as it is not indigenous to Namibian waters. For yellowtail kingfish, significant genetic influences on wild stocks are unlikely. Yellowtail kingfishes are an abundant pelagic species that have a broad geographic range and are likely to be bred from wild-sourced smolt. Management measures to reduce the number of escapees and to retain the genetic diversity of cultured stock will be implemented.

To date, limited knowledge is available on the potential effect that escaped farmed yellowtail kingfish could have on the wild populations (Price et al., 2013). However, a biosecurity management plan that will include stakeholders at a national level will be put in place in case of an outbreak. The proposed project will also use well inspected, quarantined healthy smolt to ensure that they do not carry diseases to the offshore cages. The impact can be of **low significance** to the production of the proposed farm if the farm is managed according to the regulations that are in place and regular inspections conducted by NSI officials.

Furthermore, the impacts of exotic disease transfer from the cultured stock to the wild stock are **low ranked** because of the high level of inspection, monitoring and government regulation on translocations of a marine organism in Namibia.

8.7.3 Management and mitigation options for biosecurity, escapees and genetic effects

This section should be read in conjunction with section 5.4.1 (Fish health and Welfare) in Chapter 5.

8.7.3.1 Compliance to regulations

The use of genetically modified marine organisms, release and potential escape of aquaculture organisms and the control of disease outbreaks in Namibian waters is controlled under the Aquaculture (Licensing) Regulations (2003). **Part V** of the Regulations covers the control of disease outbreaks in Namibian waters, specifically disease zoning, emergency disease situations and intra-national movements of live aquatic organisms. **Part VI** deals with the protection of the aquatic environment and covers the release and escape of aquaculture products, the discharge of wastes from aquaculture facilities and the introduction and transfer of aquatic organisms.

The import and export of aquatic organisms and aquaculture products regulations (2010) cover the permitting requirements and conditions for the import and export of aquatic organisms. **Part II** of the regulations stipulates that a **risk assessment** is required as part of the import permit application. **Annexures I and J** provide lists of marine aquatic organisms approved for importation, and where importation is restricted or prohibited, respectively

In Namibia, international import pathways to the aquaculture industry are controlled by the Ministry of Fisheries and Marine Resources under the Aquaculture Act No. 18 of 2002 (Ruppel & Ruppel-Schlichting, 2016). These include guidelines, regulations, and requirements for importing marine animals and fish feeds from other countries.

8.7.4.1 Good farm practices and monitoring

The primary farm management approach to minimise escapes is to maintain nets and farm cage reliability and durability by carrying out regular maintenance of fish cages and predator exclusion nets. It will be a farm mandatory requirement to report any incident of escapees to the Ministry of Fisheries and Marine Resources. To reduce the risk of modification of the genetic makeup of wild fish populations due to escapees (indigenous finfish species), the proposed farm will use wild-sourced smolt to retain the genetic diversity in cultured stock.

Furthermore, the expected harvest size for the indigenous fish species to be harvested in the proposed farm precedes the age or size of maturation so there will be little chance of released gametes (ova or egg cell) from farmed stock. The fallowing strategy will also be employed to break the disease and parasite infestation cycle in case the outbreak occurs in the fish cages.

8.7.3.2 Surveillance

The farm manager will undertake routine (passive) surveillance at high-risk areas of biosecurity in the farm. The surveillance will be undertaken on and around the farm as well as on service vessels and quarantine facilities as the crucial first point of detection of pests and diseases. A preventative approach to disease management is part of the routine monitoring of fish health and mortalities by personnel trained in the recognition of disease symptoms.

8.7.3.3 Eradication treatment to control an outbreak

The use of eradication treatments will only be practised if the risk of re-invasion can be managed, and pests can be detected before they become widespread. The treatments will be used to control pest populations and prior cleaning of service vessels or equipment to minimise the risk of pathogen and disease dispersal. Acetic acid bath treatments will be carried out onshore and manual removal or wrapping of structures will be employed in case of a disease outbreak. Bio-security practices such as isolation, quarantine or culling of infected stocks and restricted equipment and vessel movements among infected farms will also be employed to contain the spread and the magnitude of the impacts.

8.7.3.4 Bio-security approach to contain an outbreak

The Lilongeni fish farming project will develop a bio-security approach similar to the New Zealand bio-secure approach which has proved to be effective in controlling disease outbreak in New Zealand aquaculture farming (Ministry for Primary Industries, 2013). The “bio-secure approach” was developed as an action plan in the event of a major disease outbreak depending on the pathogen and the disease outbreak. Different actions that can be employed include site fallowing, having fish of only one age class on the farm, quarantining one or a “group” of farms and using separate equipment, including service vessels and processing facilities, for each fish species.

8.7.3.5 Bio-security management plan

To implement all the management practices and prevention measure, a bio-security management plan will be formulated. The management plan will cover the implementation of regular inspection of service vessels and equipment for pathogens, pests, and diseases as well as regular inspection of offshore farm infrastructure and equipment. The management plan will also include compulsory record-keeping that will ensure that the farm manager will detect and report irregular fish mortalities and allow incursions to be traced for source and possible recipient locations. Any irregular event recording will be reported to the Ministry of Fisheries and Marine Resources.

8.8 Effects from additives

8.8.1 Accumulation of metals from the use of antifoulants and additives in fish feed

According to the Ministry for Primary Industries (2013) mariculture case studies indicate that farmers tend to make use of chemicals for the maintenance and sustainability of farming activities when required. This includes metals from antifoulants (such as copper and zinc), fish feed additives, therapeutics to treat animals for bacterial diseases or parasites (such as antibiotics and parasiticides) and anaesthetics and detergents and disinfectants to prevent the spread of diseases). These chemicals can enter the water column mainly by leaching from the use of antifouling paint, fish feed additives and other therapeutics.

Most of the copper remains on fish farm nets until they are cleaned onshore before recoating. Zinc primarily comes from fish feed (uneaten and released in faecal wastes), but also from some antifouling paints. Zinc and copper can accumulate in sediments beneath fish farms and can be toxic at high concentrations. However, these metals are also naturally present in the environment at trace level concentrations and organisms require these essential elements for physiological processes and growth. The main concern with metals is their toxicity to animals. They can be detrimental to organisms if, however, concentrations exceed (or fall below), those required for normal metabolism.

Therapeutics on the other hand, are used to treat diseases and parasites in farmed fish stocks globally. However, most therapeutics have limited environmental implications because they are usually highly water-soluble, disperse and break down readily and do not bind to sediments. Some therapeutics, however, are administered as feed additives and can be deposited onto the seabed.

In deep and high flow rate sites, as found in the proposed development site of the northern Lüderitz upwelling cell, the dilution rates are high compared to that of sites where the low flow rates are low. Furthermore, only certified fish feed will be used as certified by NSI and the MAWLR.

8.8.2 Management and mitigation for additives effects

All species farmed for human consumption from mariculture in Namibia and worldwide must meet strict food safety standards that regulate the acceptable concentrations of metals, chemicals, and additives in food products. The proposed finfish farm will also comply with the Namibia Standards Institute (NSI) code of practice and certification.

The Ministry of Fisheries and Marine Resources and fish feed supply companies implemented several measures to minimise contaminant inputs into the environment, which will likely lead to reduced contaminant loads. To be specific, fish feed companies have found ways of reducing levels of zinc in fish feed and, consequently, minimising discharges to the seabed (Milewski, n.d.; C. Price et al., 2015; Verdegem, 2013).

To minimise the effects associated with metals in antifouling paints, paints will only be used where critical, with manual befouling to be used on other structures. Furthermore, nets will be washed offsite to prevent particles from reaching the seabed. The management practices that minimise bio-deposition and benthic enrichment on the seabed may also be effective to reduce the effects of metals (refer to the section above on benthic and deposition- 8.4).

Moreover, zinc and copper concentrations in sediments beneath the finfish farm will be monitored frequently and compared with the Ministry of Fisheries and Marine Resources water quality standards to ensure that the concentration level is maintained below metal trigger levels. Further monitoring will be initiated to establish the extent and magnitude of contamination if elevated levels of metals in sediments are detected.

The use of therapeutics for marine animals is regulated by the Aquaculture (licensing) Regulations (2003). Therefore, the farm will avoid the use of therapeutics and instead promote hygienic measure in aquaculture fish farming (refer to Section 5.4 in Chapter 5). Good spacing between farm cages will be practised to prevent the spread of diseases and farming single age classes fish to maintain healthy stock and reduce the use of therapeutics.

8.9 Hydrodynamic alterations of flows

8.9.1 Potential effects

Hydrodynamics in relation to the impacts of the proposed development refers to the physical attributes of the water, including currents, stratification, and waves. The proposed finfish farm will rely on hydrodynamic conditions and influence them. Consequently, the physical existence of farm cages can alter and reduce current speeds, affecting water residence times, the footprint of the effects, and have implications for associated biological processes such as phytoplankton production. Generally, the effect is **significant** within the farmed area and decreases with distance from the farm.

On the other hand, finfish cages can also create drag which affects currents which results in causing wakes, turbulence, and flow diversion. The presence of fish inside the cage can also alter flow in addition to the flow disruption caused by the nets. In summary, the proposed finfish farm cages might alter stratification through the blocking or diversion of some water layers, generation of internal waves, and possible enhancement of vertical mixing as a result of fish-induced swirl. However, these effects are not yet well understood (Ministry for Primary Industries, 2013; Price et al., 2015; Price et al., 2013).

Another potential impact can be some degree of wave dampening due to the wave drag on finfish cages. A wave “shadow” of reduced wave energy may extend beyond the cages, potentially affecting shoreline habitat and sediment transport. The effect is **likely undetectable** for individual cages, small farms or in sheltered areas.

Significance of the impacts:

The effects of finfish farms on hydrodynamics are **negligible** in comparison with the effects on other aspects of the marine ecosystem. Small scale, local changes in currents as a result of the placement of cages are almost certain. Embayment-scale changes in circulation are highly likely in small bays or bays with several farms. However, in this case, there will only be the one proposed finfish farm in the Lüderitz water.

The ecological **significance of these changes is likely low.** The physical effects on hydrodynamic conditions will persist for the duration that the structures are in place, but recovery will be nearly immediate on the removal of all structures. Indirect ecological consequences of modified currents on the seabed and associated communities may persist for longer.

8.9.2 Management and Mitigation for hydrodynamic alterations

If changes in hydrodynamics become a concern, monitoring of hydrodynamic conditions before and, if necessary, during staged development could be used to ensure effects are in line with initial modelling. The duration of monitoring will be sufficient to capture a range of tide, wind, and stratification conditions. However, this technique is unlikely to be required if the effects from the farm on hydrodynamics are predicted to be **negligible**.

However, the impacts can be further predicted using existing data or analytical and numerical models. This information can help predict possible hydrodynamic changes and identify ways to mitigate the effects should they occur. The fish cages to be deployed will be well designed and properly laid out on the offshore farm as per specifications.

8.10 Aesthetics: landscapes

8.10.1 Possible effects

The presence of the proposed development both onshore and offshore, might modify the aesthetic value of the landscape of the Lüderitz ocean. This might have a greater impact on tourists visiting the town.

8.10.2 Mitigation measures for aesthetics impacts

To mitigate the aesthetic impacts, the proposed farm will consist of buffer zones and low-profile cages, which minimise the use of unsightly structures. An onshore existing infrastructure, the Seaflower Fish Factory, will be leased to operate the onshore activities. Offshore the cages will at most times be submersed and not visible.

8.11 Project decommission phase impacts

8.11.1 Cumulative effects associated with the proposed development

In reference to the proposed finfish farm, cumulative effects are defined as ecological effects in the marine environment that result from the incremental, accumulating and interacting effects of the aquaculture development when added to other stressors from anthropogenic activities affecting the marine environment (past, present and future activities) and foreseeable changes in ocean conditions such as a response to climate change.

The potential contribution of different types of aquaculture activities is considered together since different forms of aquaculture often co-occur within the same water bodies and therefore contribute collectively to wider-ecosystem conditions. Cumulative effects could range from bay-wide to regional scales and could occur for the duration of farm operations or extend beyond, depending on levels of change in the surrounding ecosystem.

The contribution of the effects of the proposed finfish cage culture in a marine environment toward wider cumulative environmental change, may occur from nutrient additions and will likely vary considerably depending on the combination with other nutrient inputs relative to the region’s carrying capacity. Effects could range from subtle increases in phytoplankton production to more advanced eutrophication symptoms such as bay-wide organic accumulation on the seafloor, increased decomposition, and low oxygen levels in extreme cases. Climate change may also contribute to the eutrophication process in coastal waters in cumulative ways. In addition, the nutrient enrichment cumulative effects can be at a ‘bay-wide scale’ if impacts from the proposed aquaculture development are combined with other marine farms or inputs from land in the Lüderitz area. However, there are currently no other marine fin fish farms along the coast of Namibia that may contribute to nutrient enrichment activities that could impact on the proposed cage culture site. Therefore, the impacts are treated as **significantly minor**.

The cumulative ecological effects of developed aquaculture could potentially be significant, particularly if an ecosystem such as the Lüderitz marine environment is already in a stressed state or approaching carrying capacity from other anthropogenic influences, natural changes, or a highly sensitive system. However, the Lüderitz marine ecosystem falls within an intense upwelling cell which has no recorded stress levels.

At the end of the project life span anything from 15 to 25 years, the recovery of the water column conditions from nutrient enrichment or extraction is likely to be over to the scale of days to weeks (Price et al., 2013). However, the recovery of benthic structure and function is likely to take longer approximately one to 5 years depending on the level of modification of the seabed (Ministry for Primary Industries, 2013). In this case due to only three moorings to be deployed at Site c (ii), the duration of benthic substrate recovery will be rapid.

8.11.2 Management and mitigation for cumulative effects

To minimise cumulative effects in the wider ecosystem and at the farm level, the farm will practice good farm management such as reducing feed wastage and increasing feeding efficiencies as well as reducing stocking densities. Furthermore, phytoplankton stimulated by excess finfish farm-derived nutrients can be consumed by mussels, while dissolved nutrients from fish and mussels can be assimilated by adjacent seaweeds at the farm. In addition, co-cultured species could be harvested to improve the economic performance of the farm.

In conclusion, a detailed management plan (extracts from Chapter 8), will be presented in the EMP.

9. CONCLUSION

In the past four decades, wild fish stocks began to decline globally and could no longer sustain itself. The Food and Agriculture Organization (FAO) recently stated that the "aquaculture sector" is the only industry to embark on to be able to sustain an ever-increasing demand for fish for human consumption.

It is against this background that the Proponent of Lilongeni Fish-Farming (Pty) Ltd., intends to contribute to unlock this "potential resource" referred to as the Blue Economy, to develop and manage a sustainable mega fish farm in the Atlantic Ocean, north-west of Lüderitz.

The Namibian Government is committed to promote, support and implement the Blue Economy Agenda as outlined in Namibia's NDP5 and the Harambee Prosperity Plan II. As per the HPPII – Pillar 2, the Namibian Atlantic Ocean is recognized as a potential resource available to all its citizens which when managed well can contribute to the socio-economic upliftment of our coastal towns.

The Proponent, Lilongeni Fish-Fishing (Pty) Ltd., a Namibian registered Company, hereby seeks support and consent for the approval of putting up a Mariculture farm in the Atlantic Ocean (north-west of Lüderitz) to farm with two (2) indigenous and one (1) foreign fish.

The species to be farmed offshore includes the Namibian yellowtail kingfish (*Seriola lalandi*) and the silver cob (*Argyosomus indorus*). Both species are well-known along the Namibian coast and have the potential to support a lucrative export market. The intentions are also to farm with the popular well sought-after and high-value Atlantic salmon (*Salmo salar*). The cold upwelled waters at Lüderitz make this an ideal location to farm with these above three species.

The vision of the Proponent is to develop Lüderitz into an international fish farming hub and to keep the currently existing 'low capacity' fish factories at Lüderitz utilized. In addition, such a mega fish farm will provide the necessary financial boost to a coastal town currently struggling with unemployment and the downward trend experienced in the capture fishery which has led to a low capacity of fish processing at the existing fish factories.

Initially a total of three ‘cluster cages’ are to be deployed each comprising of 6 sub-unit cages which are anchored by a buoy at 250m from each other. Each cage cluster has a total volume of 500 000m3 and with optimum management can attain a potential annual production of 12 000 tonnes per species. The proposed finfish cage culture is distant from important bird islands (19 to 25km) and neither does it infringe on any of the existing and proposed rock-lobster and line-fish sanctuaries nor the major fishing lanes.

Interactions between marine mammals and the proposed development may result from an overlap between the spatial location of the farm structures and the habitats and migration routes of the species. However, such interactions may be relatively minor given the small scale and location of the current proposed finfish farming activities 12nm north-west of Lüderitz.

Ecologically speaking, cage culture is a low impact farming practice with high returns and the least carbon emission activity. Farming of fish in an existing water body removes one of the biggest constraints of fish farming on land, namely, the need for a constant flow of clean, oxygenated water. Due to the localized position and mode of farming operation proposed/envisaged the potential impacts of this cage culture farm on the environment will be negligible.

This proposed project to farm with finfish in cages offshore north-west of Lüderitz will be the first in Namibia which will tap into a resource that can be optimized sustainably.

In conclusion, Namibia with its extensive coastline is ideally positioned to tap into this “Blue Economy” which has its support and commitment from the government through the recently made Public HPPII and when compared to other industries e.g. mining, the carbon footprint of this fish farm which occupies a fraction of see space, will be negligible.

10. APPENDICES

Appendix 1: Appointment letter of the EAP by the Proponent Lilongeni Fish- Farming (Pty) Ltd on 6th October 2020.

Co. Reg. No. 2015/0190

Lilongeni Fish-Farming (Pty) Ltd.

FINFISH FARMING IN THE ATLANTIC OCEAN OF NAMIBIA APPOINTMENT OF THE ENVIRONMENTAL ASSESPMENT PRACTITIONER

Dear EC Dr T Mufeti,

This is to inform you that we intend to farm with Finfish in the Atlantic ocean off Walvis Bay with a further expansion to Lüderitz.

Project Name: Mariculture of silver and dusky cob, yellowtail and Atlantic salmon in the Atlantic Ocean of Namibia.

Nature of Activity: Production of quality Finfish in a Marine environment for the export market.

For this Project to become a reality we are aware that Lilongeni Aqua Fishing (Ltd) need to conduct an Environmental Impact Assessment (EIA) as per the Environmental Management Act No. 7 of 2007, the Environmental Management Act - Regulation of 2012 and the Aquaculture Act of 2002.

We hereby wish to inform you that Lilongeni Aqua Fishing (Ltd) has appointed Dr Ekkehard Klingelhoeffer of Atlantic Consulting Services as the Environmental Assessment Practitioner (EAP), to conduct this EIA process.

Your blessing in this regard will be highly appreciated.

Yours sincerely,

Thomas Mausberg (Director) **Date: 6th October 2020**

Appendix 2: *Concept note: Farming offshore at Lüderitz with finfish in cages.*

Atlantic
Aquatic & Terrestrial
CONSULTING SERVICES
CC/2021/03824

Animal and Ecosystem Health Consultant
Dr. Ekkehard KLINGELHOEFFER
081 719 3939
ekkehardwk@gmail.com
P.O.Box 549 Swakopmund

CONCEPT NOTE – PROPOSED MARICULTURE PROJECT

TAPPING INTO NAMIBIA'S BLUE ECONOMY

FARMING OFFSHORE at LÜDERITZ with FINFISH in CAGES

// KARAS REGION, NAMIBIA

at 26° 27' 00'' Latitude South and 15° 00' 00'' Longitude East between the 60-70m ISOBATH

Date: 14th April 2021

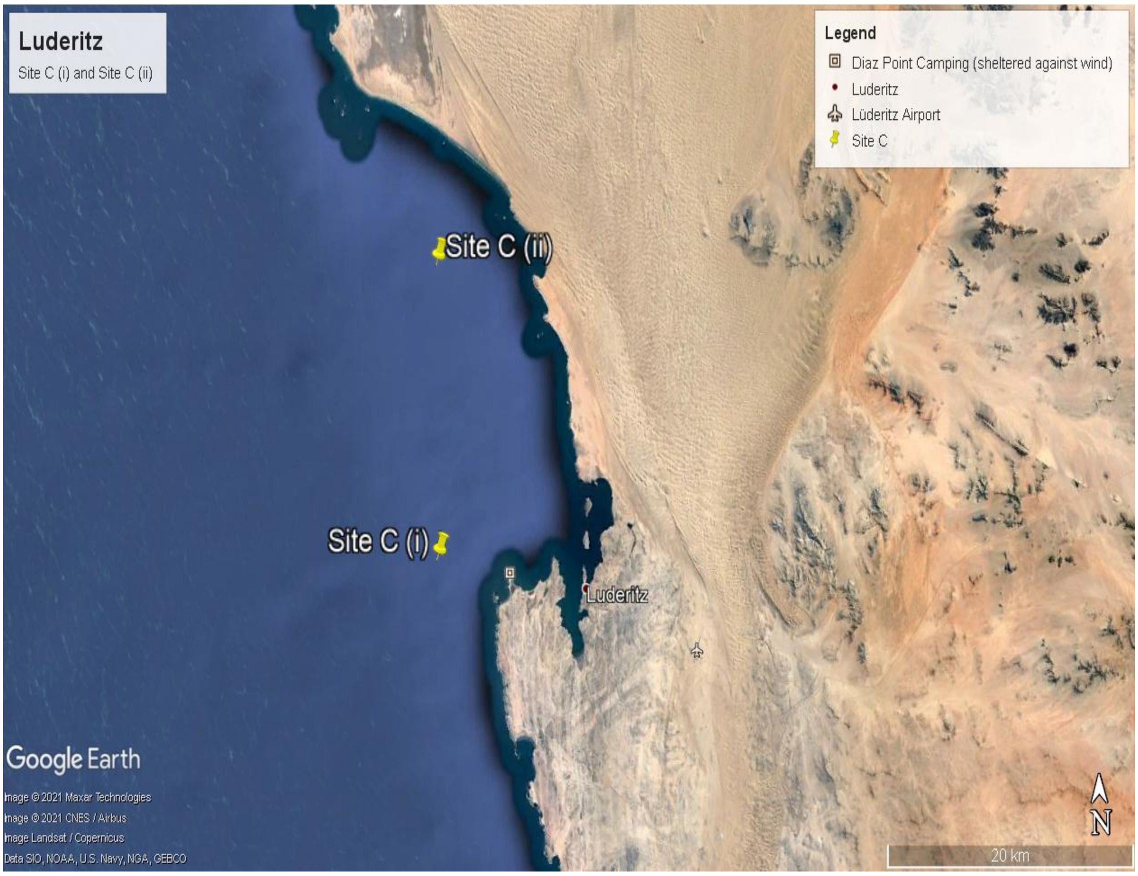
PURPOSE OF THE DOCUMENT

The purpose of this Background Information Document (BID) is to provide a brief description of a proposed Finfish farm to be established in the Atlantic Ocean north-west of Lüderitz at site C (ii) **(Fig. 1)**, for which an Environmental Clearance Certificate is being requested.

This Background Information Document serves to provide the Ministry of Fisheries and Marine Resources (the Competent Authority) and other Interested and Affected Parties (I&APs) with information on the proposed project, relating to:

- Constructing a Mariculture farm in the Atlantic Ocean north-west of Lüderitz to farm with two (2) indigenous fin-fish species and one (1) foreign fin-fish species
- The socio-economic importance that this Mariculture project can hold for Namibia in the light of job creation and related industries

- Recognizing the call made by HE President Geingob in the HPP II and NDP5 which both refer to the Blue Economy, a natural resource which needs to be optimized
- The development of the Mariculture sector in the vast expanse of the Atlantic Ocean of Namibia can contribute to the socio-economic upliftment of Namibia's coastal towns
- A project of this magnitude, with a financial investment of 65 million U$ dollar, will contribute in stimulating growth and confidence in the coastal town of Lüderitz
- The Blue Economy Agenda and NDP5 can further contribute and assure that certain aims and objectives of VISION 2030 can be achieved
- Mariculture in Namibia can be the pathway to unlock the potential that the Namibian coastline can provide for a sustainable ocean economy



<u>Figure 1:</u> Proposed site for finfish cage culture at site C (ii) north-west of Lüderitz.

Note: Site C (i) was the original site proposed by the Proponent (in proximity of Halifax island).

FATE OF THE WORLD'S FISHERY RESOURCES

During the 17th and 18th Century the sea was perceived to be a place that offered an endless supply of fish and that fishing was a "free for all". Even until recently fishermen had the notion and belief that the oceans' fish was a renewable resource that could not be depleted.

However, in the past four decades the perception in this regard changed as wild fish stocks began to dwindle and no longer could sustain itself and the question rose "is there enough fish for everybody to have enough?" **(Fig. 2).**

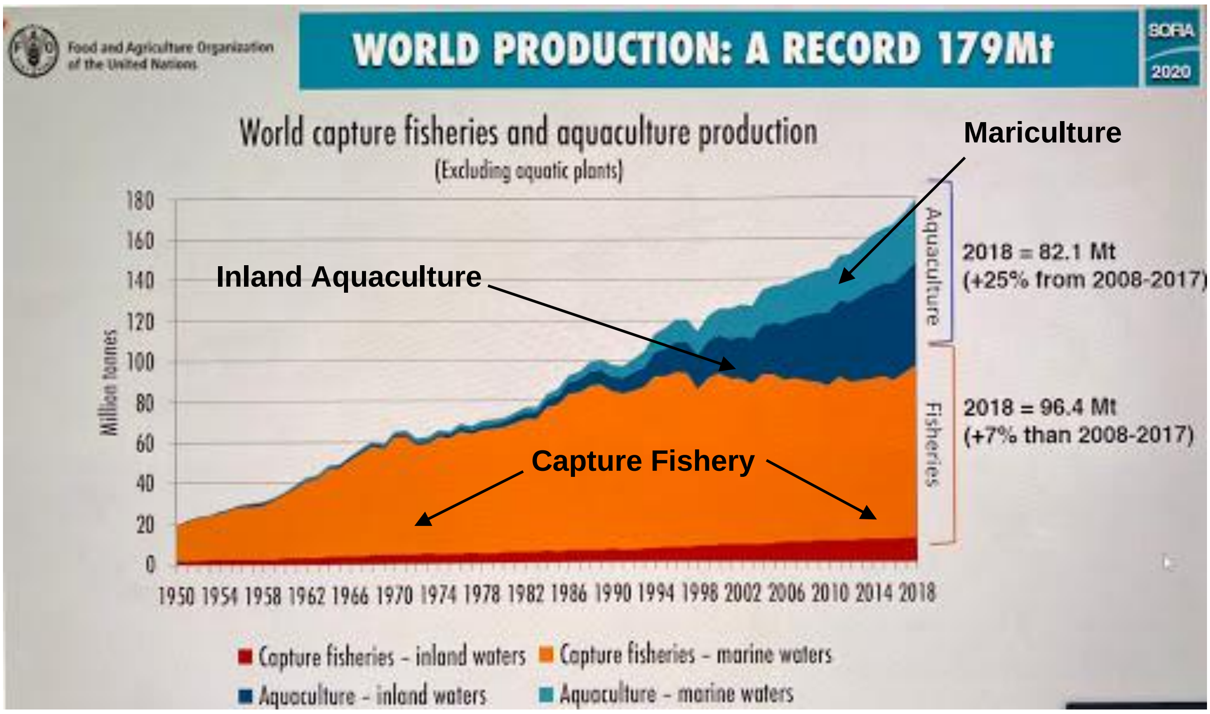


Figure 2: Annual world capture fishery compared to aquaculture production since 1950 to 2018 (FAO, 2018).

It has been widely accepted by the Food and Agriculture Organization (FAO) that the **"aquaculture sector"** is the only path to embark on to sustain an ever-increasing demand for fish for human consumption. The Namibian Government is committed to promote, support and implement the Blue Economy Agenda as outlined in Namibia's NDP5 and the Harambee Prosperity Plan II.

The HPP II addresses and supports this notion i.e. how can Namibia's vast expanse of Atlantic Ocean be sustainably utilised for Mariculture purposes which can stimulate economic growth, improve livelihoods and jobs at coastal towns, while preserving the health of the Namibian ocean ecosystem.

EIA – CLEARANCE CERTIFICATE

Atlantic Consulting Services, Dr Ekkehard Klingelhoeffer, was appointed by Lilongeni Fish-Farming (Pty) Ltd., as the Environmental Assessment Practitioner (EAP) to conduct the EIA and EMP for the proposed finfish cage culture in the Atlantic Ocean, north-west of Lüderitz.

The EIA is currently being conducted which complies to the Policies, Acts and Regulations that Government has put in place that are required to be followed and adhered to when applying for an Environmental Clearance Certificate (ECC) and an Aquaculture License.

PROPONENT AND EIA PREPARERS

The Proponent

The proponent, Lilongeni Fish-Farming (Pty) Ltd., which is a Namibian registered company (Co. Reg. No. 2015/0190), hereby seeks approval for the activity of putting up a mariculture farm in the Atlantic Ocean north west of Lüderitz to farm with three (3) indigenous and one (1) foreign marine fish.

This EIA was prepared on behalf of Lilongeni Fish-Farming (Pty) Ltd. P. O. Box 655, Omaruru, Namibia. Lilongeni Fish-Farming which is a joint venture company established by four individuals of which two of the founding members are Namibian based.

Vision: To become a major Namibian sea fish ranching company serving the economy of Namibia by developing the first mariculture cage farm in the Atlantic Ocean of Namibia.

Mission: To develop Lüderitz into an international fish farming hub to compensate for the shrinking global capture fishery and to keep the existing underutilized fish industries in Lüderitz utilized.

The company is committed to follow and adhere to all the Namibian Policies, Acts and Regulations that will impact on this mariculture project.

Lilongeni Fish-Farming (Pty) Ltd

Co. Reg. No. 2015/0190

The Environmental Assessment Practitioner (EAP)

- The proponent has appointed Atlantic Aquatic and Terrestrial Consulting Services, with Dr Ekkehard Klingelhoeffer as the lead consultant, as the Environmental Assessment Practitioner (EAP).
- Document contributors include, Ms. Maria Shimhanda, Ms. Ndamona Kauluma, Dr Andrea Klingelhoeffer and Ms. Alusha Hitula.
- The EAP hereby brings it to the attention of the Ministry of Environment, Forestry and Tourism (MEFT) in accordance with the Environmental Management Act (7 of 2007) and the Ministry of Fisheries and Marine Resources (MFMR) Aquaculture Act of 2002, the intentions of the proponent to farm with indigenous and foreign finfish in the Atlantic Ocean.
- The appointed EAP (Appendix 1), conducted intensive one to one stakeholder meetings with the industry, local authorities, NAMPORT and government officials at Swakopmund (MFMR) and Lüderitz (MFMR) including three public meetings held at Swakopmund, Walvis Bay and Lüderitz. Outcomes of these meetings assisted the team to develop and compile the Environmental Impact Assessment (EIA) and the Environmental Management Plan (EMP) which was to find mitigating solutions to the possible environmental consequences that could be associated with the envisaged mariculture operation.
- Dr Ekkehard Klingelhoeffer, the appointed EAP, has been in the position of a marine biologist since Namibian independence and was eventually tasked to develop and lead the newly established Directorate Aquaculture for MFMR on 1st October 2003. During his tenure he was, amongst other, responsible for introducing the “one stop shop” for the application of aquaculture license.

PUBLIC MEETINGS HELD AT COASTAL TOWNS

This EIA followed a process which included meeting stakeholders on a one-on-one basis including three public meetings held at Swakopmund, Walvis Bay and Lüderitz during January and February 2021. At the public meetings the following four (4) alternative sites, based on the Feasibility Study conducted by the Proponent, were presented **(Fig. 3):**

- **Site A – north of Walvis Bay** (22° 50' 8'' Latitude south and 14° 24' 13'' Longitude east) – detailed presentation
- **Site B – south of Walvis Bay** (23° 00' 20'' Latitude south and 14° 20' 56'' Longitude east) – detailed presentation
- **Site C – west of Lüderitz** (26°37'40'' Latitude south and 15°01'53'' Longitude east)- referred to
- **Site D – inshore true west of Oranjemund** (28°41'27'' Latitude south and 16°17'25'' Longitude east) – referred to but not an option

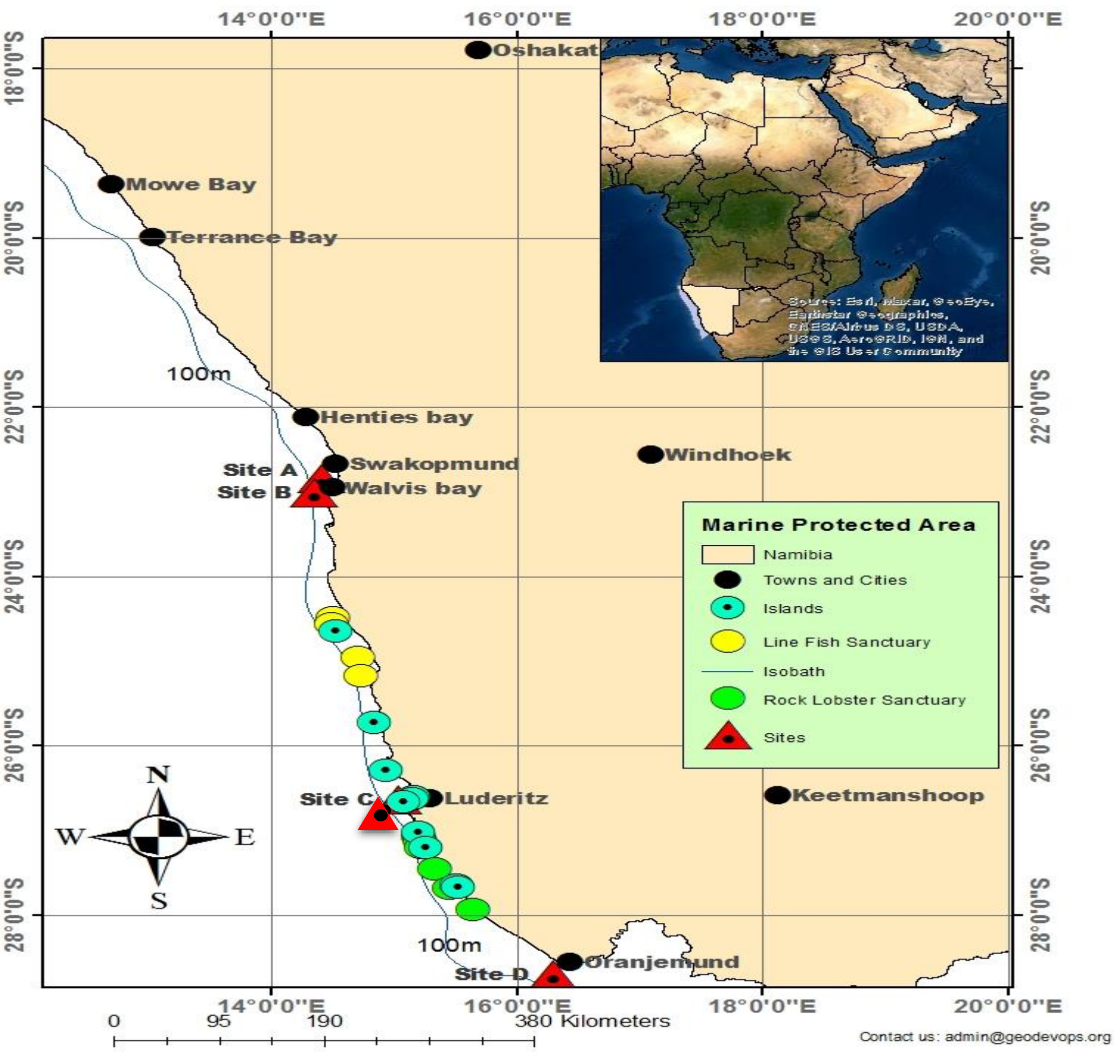


Figure 3: The four alternative sites A, B, C & D, proposed by the Proponent for possible finfish cage culture, in the Feasibility Study (InnovaSea, 2020).

Possible environmental impacts raised by Interested & Affected Parties (I & AP) were noted and measures to be implemented to mitigate theses negative impacts were addressed.

In summary the following sites were discarded based on Environmental research data and public inputs:

Site A: No mitigation possible due to periodic excessive sulphur eruptions and toxic algal blooms. No finfish can survive in these periodic anoxic conditions.

Site B (i): Inshore region no mitigation possible - similar conditions prevail as at site A. It was proposed to move the **site B (ii)** further offshore to a depth of 200m sea depth to escape this prevailing anoxic region **(Fig. 4).** However, the bottom depth to secure the cages was exessive and in addition the long term environmental monitoring line of NatMIRC proved to be an impediment. Grounded on inputs received from the public at Swakopmund on the 13th January 2021 including environmental data of the environment in this region, the appointed EAP advised the Proponent to relocate its operation to Lüderitz.

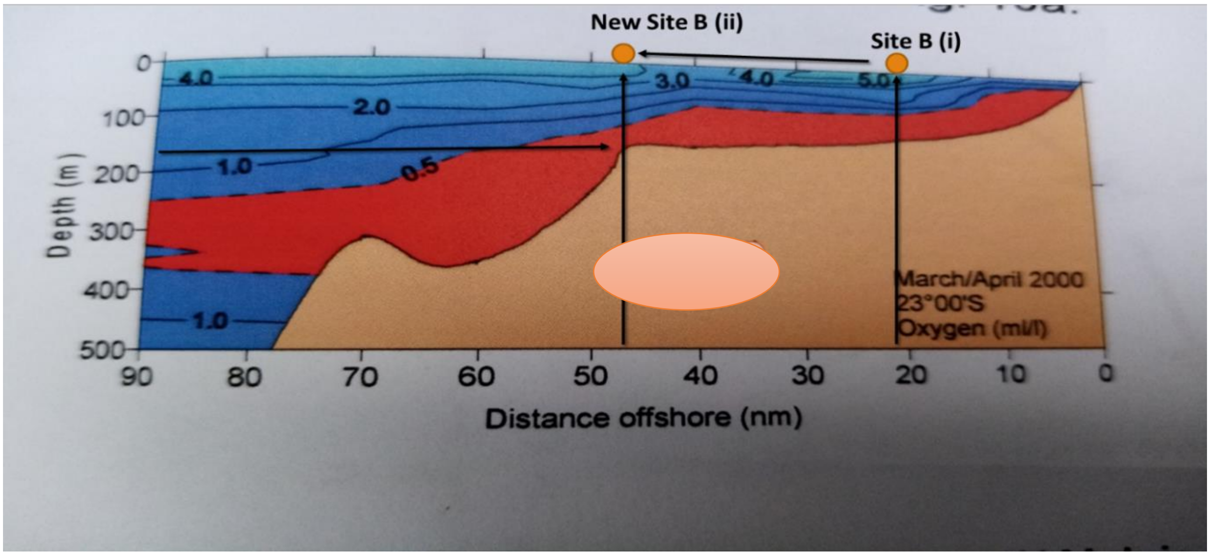


Figure 4: Vertical section off Walvis Bay (23° latitude south) on the 90nm transect, displaying dissolved oxygen concentrations (ml/l) for March/April (Red zones = Anoxic water) (In: Klingelhoeffer, 2005).

Site C (i): During the consultation with Ministry of Fisheries and Marine Resources (MFMR) and public meeting held at Lüderitz, it was raised that the proposed site is in the proximity of Halifax Island and the foraging grounds of the endangered penguin (*Spheniscus demersus*). The proposed cage culture of finfish is also positioned on the long-term environmental oceanographic monitoring line of MFMR Lüderitz research center. Therefore, it was recommended for the proponent to choose another site. The alternative site C (ii) north-west of Lüderitz was chosen after consultations **(Fig. 5).**

This **site C (ii),** is at a sea depth ca. 70m and at least 10nm from the two major bird islands namely Halifax and Ichaboe and north of the MFMR Lüderitz environmental monitoring **(Fig. 5)**. In addition, s**ite C (ii):**

- falls outside the current rock lobster sanctuary as well as <u>the proposed</u> line fish and rock lobster sanctuaries north and south of Lüderitz
- situated east of the current main shipping lanes but still in proximity to the harbour which makes the day to day operations to this site cost effective and reachable in less than two hours in case of an emergency

Site D: This site west of Oranjemund was excluded due to its remoteness, lack of harbour infrastructure and no availability of existing fish factories.

Should an Environmental Clearance Certificate be issued this will be the first Mariculture finfish project to materialize in the Atlantic waters of Namibia which will not only stimulate the ailing economy of Lüderitz but possibly also attract more investors to tap into the Blue Economy, an untapped niche which has potential to prosper.

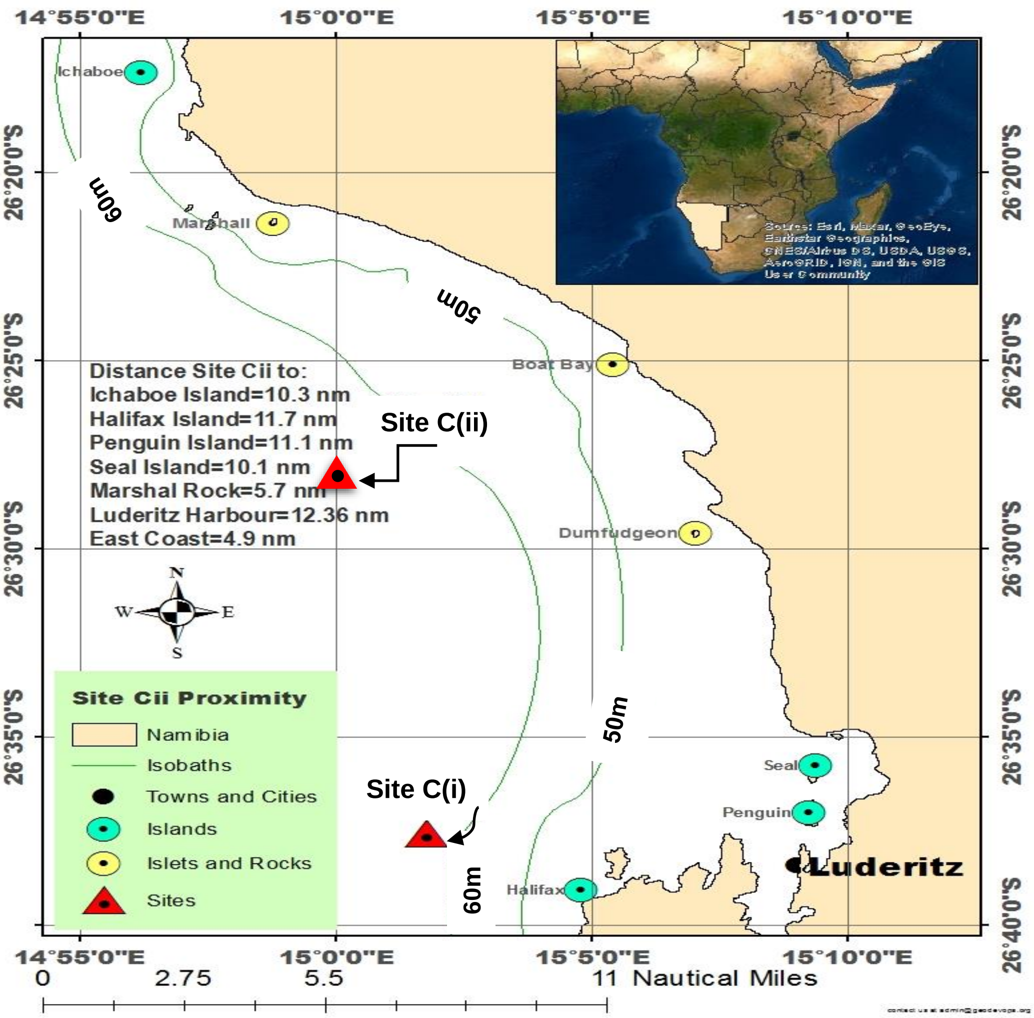


Figure 5: The alternative site C (ii) chosen after extensive one -on-one discussions and public meetings held at the three coastal towns.

CURRENT STATUS OF THE AQUACULTURE SECTOR IN NAMIBIA

The Aquaculture Directorate was officially established by the Ministry of Fisheries and Marine Resources (MFMR) on 1st October 2003 with its main goal to assist in developing the Aquaculture sector in Namibia. However, to date the Mariculture sector, especially for finfish ranching, has not yet taken off as expected. It is against this background that Lilongeni Fish-farming (Pty) Ltd. has embarked to take advantage to optimize on Namibia's untapped ocean to develop a sustainable mariculture farm to farm with finfish 12nm northwest of Lüderitz at a sea depth of 60m.

Government, through the HPPII and NDP5, is committed in harnessing Namibia's water resources sustainably for future socio-economic development in line with the Blue Economy National Policy which is currently being finalised. In essence, the Blue Economy approach is an attempt to create a holistic socio-economic development framework that seeks to meet the interest of environmental protection, economic development and social upliftment.

FISH SPECIES TO BE FARMED

Based on the Feasibility Study conducted by the Proponent the following four (4) species to be farmed with include:

- ***Argyrosomus coronus*** **(Dusky cob) – onshore** (future operation)
- ***Argyrosomus inodorus*** **(Silver cob) - offshore**
- ***Seriola lalandi*** **(Yellowtail kingklip) - offshore**
- ***Salmo salar*** **(Atlantic salmon)- offshore**

The Namibian yellowtail kingklip (***Seriola lalandi***) and the silver cob (***Argyrosomus inodorus***) and the dusky cob (***Argyrosomus coronus*** **(Fig. 6a and b)** are species well known along the Namibian coast and have the potential to support a lucrative export market. The proposed fish cage farming will contribute to the demand for quality fish in a sustainable manner and ensure that the ever demand for oceanic fish is maintained through this Mariculture operation. Annual production for the yellowtail kingklip is set for ca. 12 000 tonnes per annum.

Both cob species are popular angling fish along the central Namibian coastline and at times silver cob are being caught by purse seine fishing boats in large numbers south of Walvis Bay. Due to preference to warmer sea temperatures, the dusky cob will be farmed onshore with an ultimate 1000 tonnes per annum (future expansion) and the silver cob offshore in cages with an annual target of ca. 12 000 tonnes..

Figure 6a: Farmed yellowtail kingklip (*Seriola lalandi*) targeted for the sushi market.

Figure 6b: The Namibian silver cob (*Argyrosomus inodorus*) and dusky cob (*Argyrosomus coronus*).

It is to be noted that the yellowtail kingfish are being farmed successfully for the past few decades in both Japan and Australia and the breeding trials and the raising of fry for Cob at SANUMARC – UNAM are ongoing.

The intentions of Lilongeni Fish-Farming (Pty). Ltd. are also to farm with the popular well sort after Atlantic salmon ***(Salmo salar)*** ***(*****Fig. 6c).** The cold upwelled waters at Lüderitz make this an ideal location to farm with salmon and the projected annual production of salmon is set at 12 000 tonnes.

__Figure 6c:__ The Atlantic salmon ***(Salmo salar)*** a fish that caters for a niche product.

FARMING OPERATION
Onshore and Offshore operation:

- *Fish processing factory* – Lüderitz currently has fish processing facilities which are underutilized due to the decline of the fishing sector over the past decades; in addition there are also warehouses standing empty which could be re-designed to house a hatchery and quarantine facility
- *Annual Production (at sea)* of 36 000 metric tonnes mainly for the export market to Europe (Germany) Asia (Japan) and the USA – to be processed onshore
- *Quarantine facility and a hatchery for future expansion for brood stock and fingerling production*

Initially fingerlings (cob) will be sourced from SANUMARC - UNAM (Henties Bay). However, through the MFMR, permission will be requested to catch brood stock. The brood stock will be kept onshore Lüderitz where a hatchery will be established to sustain the annual production of ca 12 000 tonnes for the silver cob

- *Employment*
  - The magnitude of this project will be of direct benefit to the people in the coastal town of Lüderitz.

- *<u>Onshore:</u>* Administration (5x); Stores manager – equipment (1x) and labourers (4x); Quarantine facility (6x); Hatchery (8x); Fish processing (25x); plumber and electrician (2x); Feedstore manager (1x) and labourers (6x); Lab technicians (2x), workhand (2x) *TOTAL: 62*
- *<u>Offshore:</u>* Service Vessel: Captain (1x), 2nd Officer (1x), 1st and 2nd Engineer (2x), IT specialist – monitoring (2x), deckhands (4x), Lab technicians (2x), workhand (2x) *TOTAL: 14*
- Total persons to be initially employed: 76 staff and to be increased as production increases to a maximum of 36 000 metric tonnes annually (Phase 1 and 2).

This operation will provide needy opportunities for highly skilled people in a wide range of expertise from the Lüderitz community.

Offshore - The cage cluster system of submersible cages will be deployed (design by BW FishFarm, 2021). The outlay and holding capacity will be as follows:
<u>Cage cluster:</u>
Six 'cluster cages' to be deployed in Phases in a 'cluster' **(Fig. 7)** for each species and separated by 200m from each other. Each cage cluster having the following capacity and output potential:

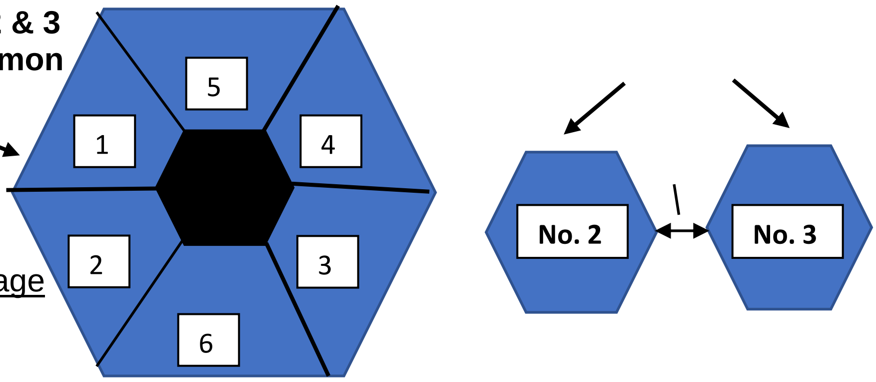
- Each sub-unit in a cage cluster has a water volume of 85 000m^3
- 1 x cage cluster (each with 6 sub-cages): total water volume of 500 000m^3
- Stocking density of 16 fish/m^3 (ca. 1.5kg/fish) i.e. 24kg/m^3.
- Total output for each cage sub-unit = ca. 1 900 tonnes
- Total output per cage cluster = ca. 12 000 tonnes

<u>Deployment of cage clusters:</u>

- <u>Phase 1</u>: 1x cage cluster (comprising of four sub-units: 1 to 4), with a cage cluster having a holding capacity of ca. 7 500 tonnes for silver cob **(Fig.7)**.
- <u>Phase 1</u>: 2x cage clusters (each comprising of four sub-units: 1 to 4), with each cage cluster having a holding capacity of ca. 7 500 tonnes for yellowtail kingklip and Atlantic salmon respectively **(Fig.7)**.
- <u>Phase 2:</u> To add cages 5 and 6 to each cage cluster for yellowtail kingfish and Atlantic Salmon – each cage cluster with a holding capacity of ca. 12 000 tonnes for each species respectively
- <u>Phase 3:</u> Future expansion: 2x cage clusters (each comprising of six sub-units: 1 to 6), with each cage cluster having a holding capacity of ca. 12 000 tonnes for yellowtail kingfish and Atlantic salmon respectively **(Fig.7)**.

- Initially a water surface area of 250ha is being required and with future expansions to be increased to a maximum of 500ha.

<u>Phase 1</u>: Cage clusters 2 & 3 for silver cob and Atl salmon
Cage cluster No.1
e.g. yellowtail k.



<u>Phase 1:</u> Includes <u>3x Cage clusters</u> with each cluster comprised of six separate management cage units

<u>Figure 7:</u> Schematic example of a "cage cluster" with a total water capacity of ca 500 000m^3 producing approximately 12 000 tonnes fish per 24 month cycle (pending on species) conservatively stocked at 16 fish/m^3 (ca 1 to 1.5kg/fish). Based on BW FishFarm - Nordic Matrix, 2020 and 2021.

Below **(Fig. 8),** is an example of a cage cluster deployed in the sea, which consists of six units. The cage clusters, via a hydraulic system, can be submersed during times of rough seas.

Figure 8: An example of a cage cluster, also referred to 'pens', to be deployed at the proposed site C (ii) (BW FishFarm, 2021).

THE HARAMBEE PROSPERITY PLAN II AND NDP5

The commitment of the Namibian Government aims to guarantee a more secure future for all its citizens through developing resilient processes, systems and institutions. Government is continuing to mold a society which has a chance to pursue their dreams through equitable access to opportunities. As per the HPPII – Pillar 2, the Namibian Atlantic Ocean is recognized as a potential resource available to its citizens which when managed sustainably can contribute to the socio-economic upliftment of our coastal towns.

The HPPII - Economic Advancement Pillar No. 2 (EAP) makes provision for a collaborative approach to harnessing the economic potential of the country. The EAP comprises of 3 Goals and 16 Activities that aim to strengthen the stewardship of our natural resources, enhance the productivity of key sectors and develop complementary engines of growth and ultimately, new employment opportunities and macroeconomic sustainability.
The impressive portfolio of Namibia's natural resources, has already attracted investments into a competitive and dynamic mining sector; however, the mariculture sector in Namibia can be a major contributor to the future engine of growth.

The HPPII, Pillar No. 2, provides guidelines and directives which strive to achieve Economic Advancement. The main objectives of Goal 3 (Pillar 2), includes: "Developing Complementary Engines of Growth". Activity 1 and Activity 3 makes reference to Namibia's Blue Economy which has the potential to tap into this 'ocean resource' for a sustainable future.

In summary the two activities within Goal 3 make mention of the following:
Activity 1: *Develop an implementation plan to attract private sector investment into the Green and Blue Economy.*
Given its world class renewable resources and proximity to the ocean, Namibia is well placed to become a sub-Saharan powerhouse with dynamic green and blue economies.
Namibia having recently joined the 14-member High Level Panel on Ocean Sustainability in 2018, government is well positioned to design and champion a sustainable "blue economy" which will play a central role in alleviating the multiple

demands on the Namibian land resources and contribute to social upliftment especially at the coastal towns.

Activity 3: *Design and offer competitive investment incentives to facilitate local and foreign direct investment attraction and retention.*
The focus is to develop appropriate incentives that can attract an array of investment capital which supports a robust and diverse growth trajectory, which is a critical component of a private sector-led economic growth programme. Furthermore, it is the government's wish to provide incentives to attract investors with skills, discretionary capital and ambitions to set up businesses and residency in Namibia.

CONCLUDING REMARKS

The Feasibility Study commissioned by the Proponent recommended four (4) alternative sites located between Swakopmund to Oranjemund. During the EIA process i.e. screening, scoping and public participations process a site north west of Lüderitz referred to as site C (ii) was finally chosen based on the best environmental data on hand, public inputs received during Stakeholder engagements and the positive socio-economic impacts that such a project could have for the coastal town of Lüderitz.

The proposed finfish cage farming at **site C (ii)** lies within the dynamic Lüderitz upwelling cell on the 70m isobar and is situated approximately 10 to 12nm distant from the two (2) important bird islands namely Halifax and Ichaboe. As per the Islands' Marine Protected Area Policy and Regulation (2007 and 2012), no operation nor activity of any kind is permitted within 120m radius of an island.

The Namibian economy is currently in a downward spiral due to various factors which can be ascribed to drought, COVID19 related stagnation of medium and small scale businesses, global recession, decline in fish resources, collapse of the tourism industry, to name a few.

The social and economic impacts of this proposed finfish farm, north-west of Lüderitz, has the potential to revive the current economic slump experienced in the fishing industry and its related businesses at this coastal town. For example, two million people are estimated to be engaged in the mariculture industry in Japan, with women and older workers involved in all stages of the yellowtail kingfish culture (*Seriola lalandi*). A similar scenario could also apply to the Lüderitz coastal town.

According to FAO (2020), the Aquaculture sector will need to supply two-thirds of the world's seafood requirements by 2030. Without aquaculture, the world will face a seafood shortage of 50-80 million tonnes per annum by 2030.

Countries with coastlines, such as Namibia, are endowed with a range of environmental, economic and aesthetic benefits which are unavailable to landlocked countries. However, Namibia's coastal towns that had relied heavily on the fishing and tourism sectors are currently hardest affected by the economic recession and are open to investors who wish to optimize Namibia's resources in a sustainable manner.

In accordance to the HPPII and NDP5, tapping into the Blue Economy of Namibia **(Fig. 9),** advocates for a sustainable ocean economy in which potential investors and its associated industries can prosper.

Figure 9: The Blue Economy – an untapped potential resource of Namibia.

The vision of the Proponent is to develop Lüderitz into an international fish farming hub and to keep the currently existing 'low capacity' fish factories at Lüderitz utilized. In addition, such a mega fish farm will provide the necessary financial boost to a coastal town currently struggling with unemployment and the downward trend experienced in the capture fishery which has led to a low capacity of fish processing at the existing fish factories.

In conclusion, Namibia with its extensive “pollution free” coastline, is ideally positioned to tap into this “Blue Economy”, which has its support and commitment from the Namibian government through the recently made Public HPPII, by HE Dr. H. Geingob. It is against this background that the Proponent Lilongeni Fish-Farming (Pty) Ltd., intends to contribute to unlock this “potential resource” to develop and manage a sustainable mega fish farm in the Atlantic Ocean, north-west of Lüderitz.

Appendix 3a: Request for a letter of support / consent from the competent authority Ministry of Fisheries and Marine Resources (MFMR), for the cage culture of finfish offshore west of Walvis Bay, on 23rd November 2020. (Prior Public meetings)

Dr. Ekkehard Klingelhoeffer
Atlantic Consulting Service
PO Box 594
Swakopmund
23rd November 2020

The Executive Director
Mrs. A. Haipheeni
Ministry of Fisheries and
Marine Resources
Windhoek **t/a**

Dear Mrs. A. Haipheni,

SUBJECT:
REQUEST for a CONSENT LETTER for the SUPPORT of a PROPOSED MARICULTURE PROJECT on FINFISH, in the ATLANTIC OCEAN WEST of WALVIS BAY

Atlantic Consulting Services has been appointed to conduct an EIA for the proposed Mariculture project (finfish), by Lilongeni Aqua Farming Ltd. Dr. E. Klingelhoeffer, of the Atlantic Consulting Services, has been appointed as the Environmental assessment Practitioner (EAP) to conduct this EIA with a team of experts.

Lilongeni Aqua Farming Ltd. intends to develop a Mariculture hub and to farm with indigenous finfish in the Atlantic Ocean, west of Walvis Bay, with focus on the production of quality finfish in a marine ecosystem for the export market. This oceanic farm will cater mainly for the export market with some offset to the hotels, restaurants and lodges in Namibia.

The two fish species to be farmed off Walvis Bay are the:

- Namibian Yellow Tail **(*Seriola lalandi*)** and
- Namibian Silver Kob (***Argyosomus indorus***) a popular coastal line fish

Both species are well known along the Namibian coast and have the potential to support a lucrative export market and ensure that the demand for oceanic fish is maintained through a Mariculture operation.

The proposed site for this Mariculture operation has the following co-ordinates:

- At 23.0054295 degree Latitude South (23° 00’ 20’’) and 14.33222659 degree Longitude East (14° 20’ 56’’) which falls within the jurisdiction of the Erongo Region.
- The site is situated east of an oil and gas concession area; this site is also an ideal spot which experience minimal sulphur eruptions and algal blooms

The magnitude of this project will require offshore and onshore the following area: (Capital input for the development of this project is estimated at U$ 65 million).

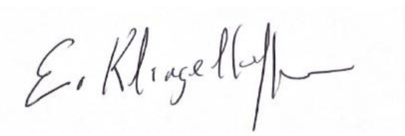
- **Offshore:** a 25 km^2 ocean area
- **Onshore:** a warehouse in Walvis Bay Industrial area

Once the Walvis Bay operation has taken off and become profitable, the intention of Lilongeni Aqua Fishing Ltd. is to *replicate the Walvis Bay farm in Lüderitz* with the main focus of a third species which will include the Norwegian salmon (***Salmon solar***). The 26° Latitude is well known for its intense upwelling and rich nutrient waters with surface oxygen levels above 3mg/L. Salmon farming is currently being successfully farmed on a large scale in southern Chile and Norway.

As part of the EIA procedure, the Department of Environmental Affairs at MEFT requested Atlantic Consulting Services to inform and acquire a consent letter from your kind office regarding the proposed development. A Background Information Document (BID) is hereby attached for more detail.

Your consideration to the above request will be highly appreciated.

Yours sincerely,



Dr. Ekkehard Klingelhoeffer (EAP)

Appendix 3b: Request for a letter of support / consent from the competent authority Ministry of Fisheries and Marine Resources (MFMR), for the cage culture of finfish offshore north west of Lüderitz, on 12th April 2021. (After Public Meetings)

Atlantic Aquatic & Terrestrial CONSULTING SERVICES CC/2021/03824

Animal and Ecosystem Health Consultant
Dr. Ekkehard KLINGELHOEFFER
081 719 3939
ekkehardwk@gmail.com
P.O.Box 549 Swakopmund

The Executive Director
Mrs. A. Haipheni
Ministry of Fisheries and
Marine Resources
Windhoek

Dr. Ekkehard Klingelhoeffer
Atlantic Consulting Service
PO Box 594
Swakopmund
12th April 2021

Dear Mrs. A. Haipheni,

SUBJECT:
REQUEST for a CONSENT LETTER for the SUPPORT of a PROPOSED MARICULTURE PROJECT on FINFISH, in the ATLANTIC OCEAN NORTH-WEST of LÜDERITZ

Atlantic Consulting Services has been appointed to conduct an EIA for the proposed Mariculture project (finfish), by Lilongeni Fish-Farming (Pty). Ltd.

Dr. E. Klingelhoeffer, of the Atlantic Consulting Services, has been appointed as the Environmental Assessment Practitioner (EAP) to conduct this EIA with a team of experts.

Lilongeni Fish-Farming (Pty). Ltd. intends to develop a Mariculture hub and to farm with 3x indigenous and 1x foreign finfish in the Atlantic Ocean, north-west of Lüderitz, with focus on the production of quality finfish in a marine ecosystem for the export market. This oceanic farm will cater mainly for the export market with some offset to the hotels, restaurants and lodges in Namibia.

The four fish species to be farmed at Lüderitz include:

- Namibian Yellowtail kingfish **(*Seriola lalandi*)**
- Namibian Silver cob (***Argyosomus indorus***) a popular coastal line fish
- Namibian Dusky cob (***Argyosomus coronus***) a popular coastal line fish
- Atlantic Salmon ***(Salmo salar)***

The former three species are well known along the Namibian coast and have the potential to support a lucrative export market and ensure that the demand for oceanic fish is maintained through a Mariculture operation.

The proposed site for this Mariculture operation has the following co-ordinates:

- At 26° 27' 00''Latitude South and 15° 02' 00'' East which falls within the jurisdiction of the Karas Region.
- Site C (ii) is situated approximately 10nm south and north of the two important bird islands namely Halifax and Ichaboe.
- The 26° Latitude south, is well known for its intense upwelling and rich nutrient waters with surface oxygen levels above 3mg/L.
- In addition this site is also an ideal spot which has not experienced Sulphur eruptions and algal blooms.

The magnitude of this project will require offshore and onshore the following area:

- **Offshore:** a 1 to 2 km^2 ocean area
- **Onshore:** a warehouse in Lüderitz Industrial area to accommodate a hatchery, stores, admin block, grow out ponds for dusky cob, fish processing and freezer facility.

The Capital input for the development of this project calculated at U$ 65 million.

As part of the EIA procedure, the Department of Environmental Affairs at MEFT requested Atlantic Consulting Services to inform and acquire a consent letter from your kind office regarding the proposed development. A Concept Note is hereby attached for additional information on this proposed Mariculture project.

Your consideration to the above request will be highly appreciated.

Yours sincerely,

E. Klingelhoeffer

Dr. Ekkehard Klingelhoeffer (EAP)

Appendix 4: ***Letter from the EC (MEFT) to the Proponent and EAP on deliverables. NOTE: 0n 11th June 2021 a New APP no. had to be requested, due to change to alternative Site C (ii) off Lüderitz.***

NEW APP = 002735

:

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INSTRUCTION RECEIVED FROM THE EC OFFICE OF MEFT ON THE EXTENT AND DELIVERABLES REQUIRED

Dear Ekkehard Klingelhoeffer,

This email serves to inform you that your application **APP-002092** has been verified as submitted on 11th November 2020.

Taking the following into considerations:

- Location of the project
- Pollution potential
- Sensitivity of the area
- Scale of operation of the project

Please upload the following documents:

- EIA – Stage 3
- EMP – Stage 3
- Consent letter or support doc from relevant Authority – Stage 2
- Proof of Consultation (Minutes, Newspaper adverts, etc) – Stage 2
- Project Site Area (map) with clear coordinates, e.g. -22.664250° 14.551275° - Stage 2
- Curriculum Vitae of designated EAP to manage the assessment process as per Regulation 3 & 4 – Stage 2

Thank you

Phillip Troskie Building, Kaunda Street, Windhoek
P/Bag 13306, Windhoek | Tel: +264 61 284 2111 | DEA: +264 61 284 2701
Date: 16th November 2020

Appendix 5: BW FishFarm offshore farm design and operation option proposed.

BW Fish Farm - Mission Statement Goals and Objectives

Your technology partner to farm fish at sea, we provide state of the art facility and operational expertise to fish farmers, enabling them to farm the highest quality of fish at sea.

UN Sustainable development goals

- **Nr 2 – Zero hunger**
  - Industrialized production of high-quality food in open sea
  - Global industry with local production
- **Nr 9 – Industry, innovation and infrastructure**
  - Industrial partnership with Fish Farmers
  - Innovative approach
  - Offshore location
- **Nr 14 – Life below water**
  - Waste and dead-fish collection and processing
  - Passive system with low power consumption

Objectives

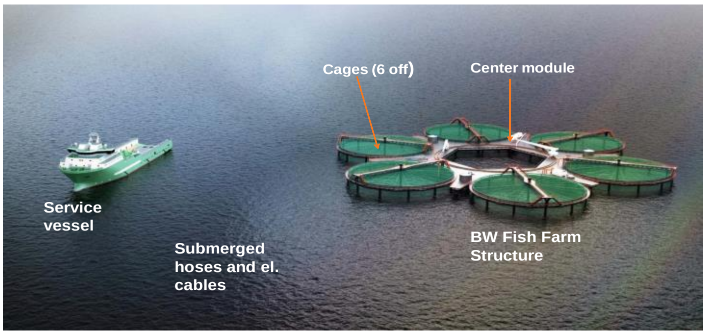
- **Commercial**
- **Ideal growth conditions**
- **HSE**
- **Green footprint**

Ⓒ Nordic Matrix 2021

BW OFFSHORE (BWO) – Global Footprint

- **Producing 600.000 barrels of oil per day**
- **Delivered 40 projects since 1983**
- **Operating 13 FPSOs (Lease & Operate)**
- **Integrated project management, engineering, operation and maintenance organization**

BW Fish Farm Solution – Surface Mode (max 5m Hs)



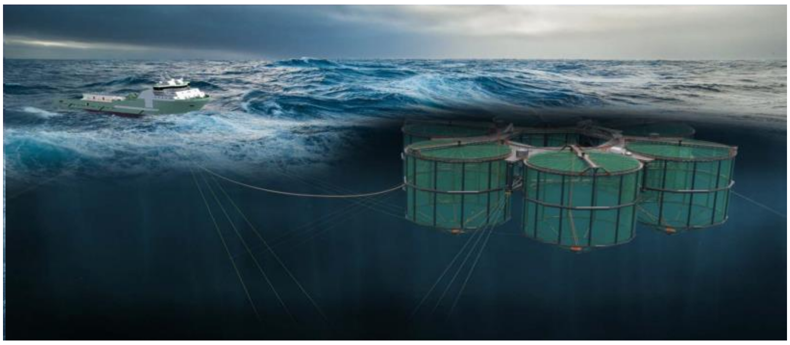
BW Fish Farm Solution locations
- Designed for offshore operation

Production volume
- Production volume 12,500-ton biomass
- Total cage volume – 500,000m3

BW Fish Farm
- Two modes of operation - Surface and Submerged
- Six cages – each 83.300m3

Service Vessel
- Provide control and monitoring
- Feed and dead-fish management
- Living quarter
- Passive weather vanning
- Green power
- Disconnectabel

BW Fish Farm – Submerged Mode (20m below surface)



Water particle velocities at minus 20m in 11m HS is equal to surface velocities at 5m Hs

© Nordic Matrix 2021

Bw Fish Farm – Service Vessel Disconnected

© Nordic Matrix 2021

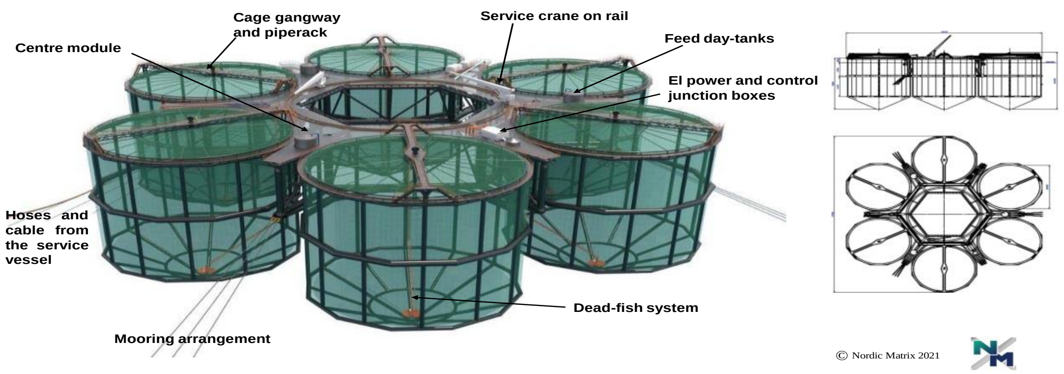
BW Fish Farm Key Features

- Offshore fish farm solution designed for harsh environment – 10 to12m Hs
- Farming volume with 6 cages approx. 500.000 m3
- Max biomass capacity with 25 kg/m3 is 12.500 tonnes (2.500.000 fish a'5kg)
- Provides optimum farming a fish welfare conditions
- Robust design with double barriers to prevent escape of biomass and protection against predators
- Modularized design provides farming volume flexibility (1-6 cages)
- Modularized design – local fabrication
- Standard qualified offshore marine operations (installation, operations, loading…..)
- All farming and maintenance operation performed at the facility

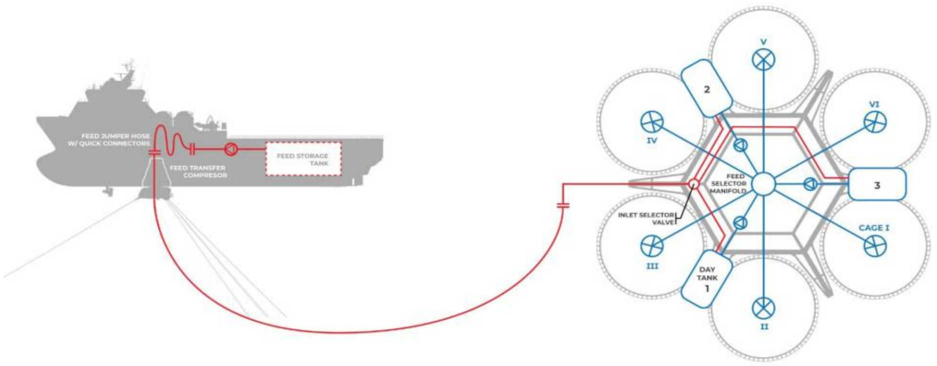
BW Fish Farm Structure

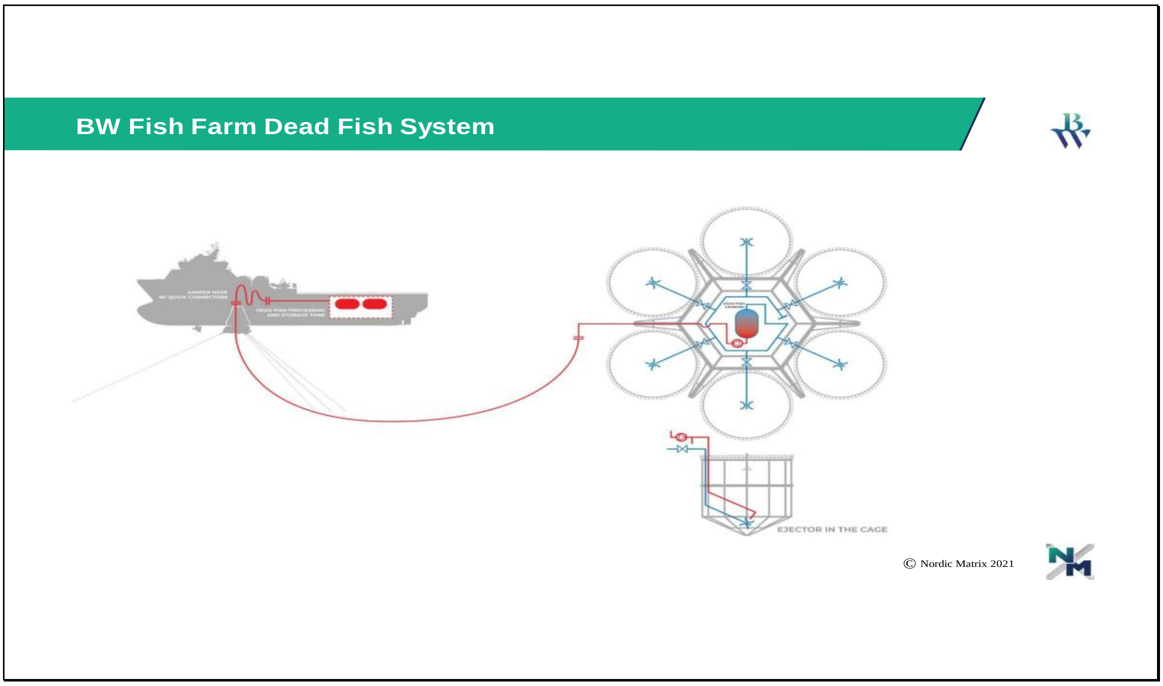
- Rules for classification of offshore fish farms and installation DNVGL-RP-OU-0503
- Double barrier "escape-proof" with inner net in Dynema and outer barrier is "typical BlueSea Mesh"
- Remote operated and fully integrated feed and dead-fish system
- Each cage is equipped with a movable cover with net to sort out the fish for harvesting
- Service crane for operation and maintenance
- Clean power from service vessel

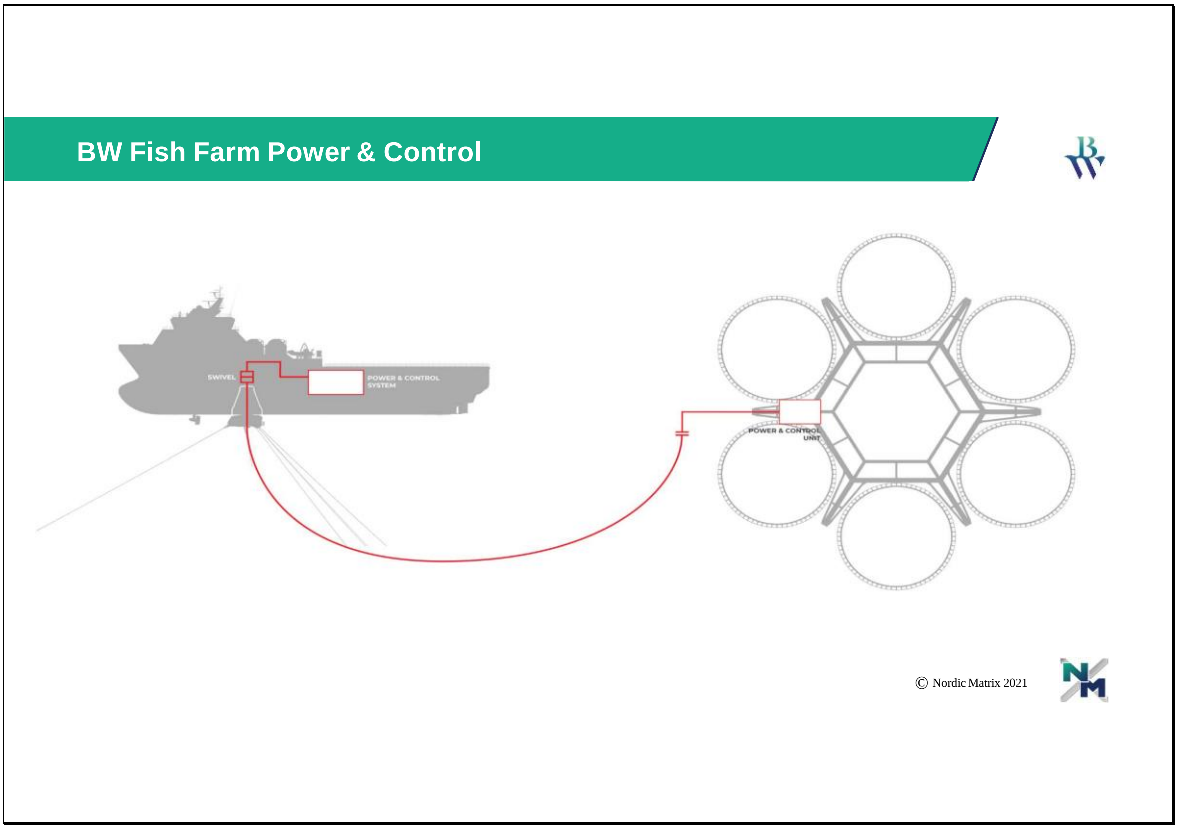
BW Fish Farm Structure



BW Fish Farm Feeding System



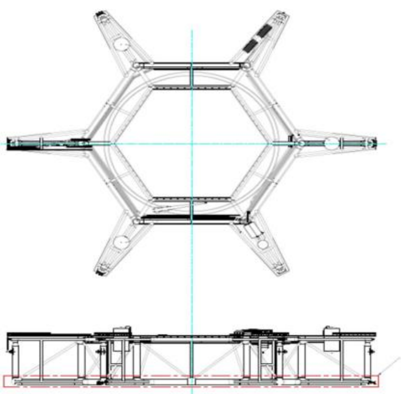

BW Fish Farm Dead Fish System
JUMPER HOSE W/ QUICK CONNECTORS
DEAD FISH PROCESSING AND STORAGE TANK
EJECTOR IN THE CAGE
© Nordic Matrix 2021

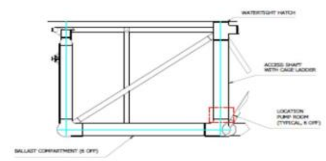

BW Fish Farm Power & Control
SWIVEL
POWER & CONTROL SYSTEM
POWER & CONTROL UNIT
© Nordic Matrix 2021

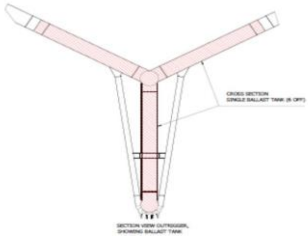
BW Fish Farm Ballast System integration

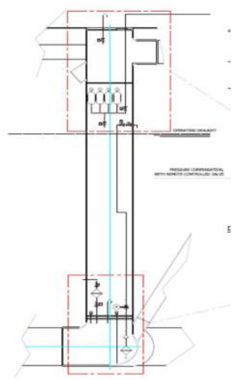
- 6 off ballast tanks
- Total available ballast volume is equal to 1500 T
- Preliminary data requires 150 T from submerged to surface plus freeboard equal to Hs 3m
- Ballast pumps located in a pump-room together with valves in the vertical columns
- Pump capacity typical 2-6 hours from submerged to floating position

BW Fish Farm - Ballast System Integration





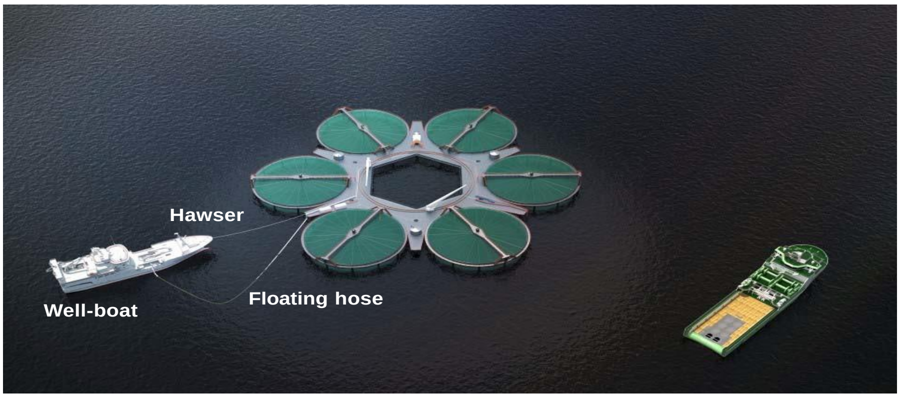




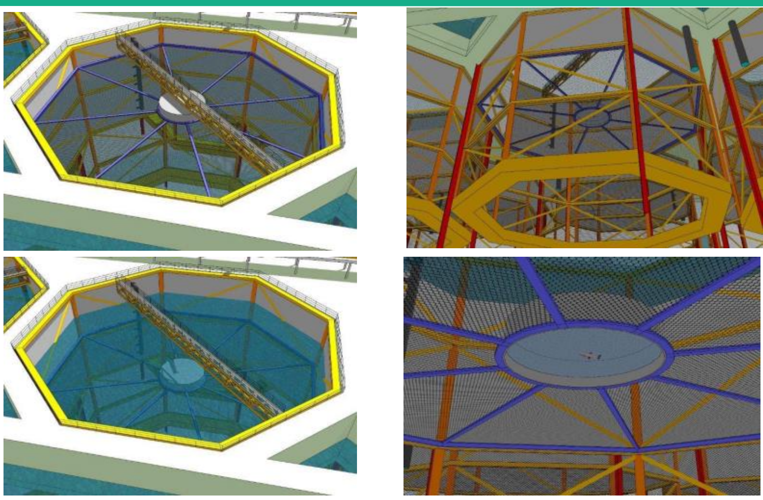
BW Fish Farm Modularity

BW Fish Farm Assembling

Loading and Offloading

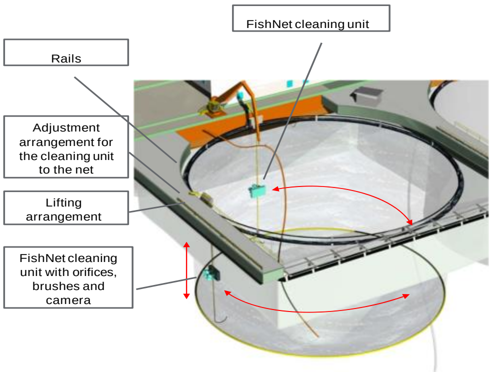


BW Fish Farm Movable Cover For Harvesting



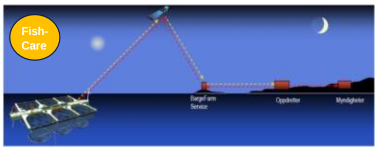
- Under certain special conditions the fish may be forced to deeper water
- A cover with grating will be lowered to optimal depth.
- The cover may be lowered and lifted frequently in a controlled way

Cage cleaning and inspection

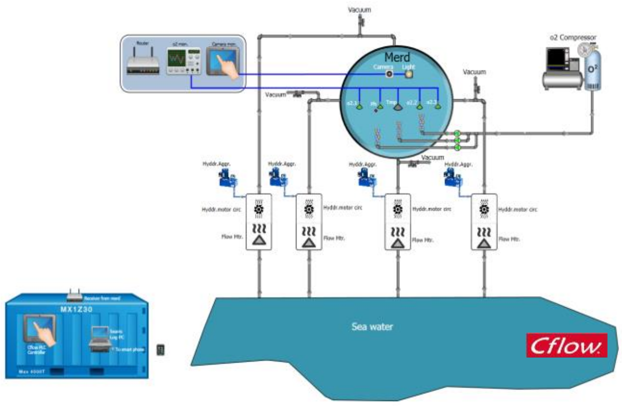


- Including orifices and brushes for net cleaning
- Camera for documentation
- Automatic and manual FishNet cleaning unit lifting arrangement
- Rails for positioning of the FishNet cleaning unit

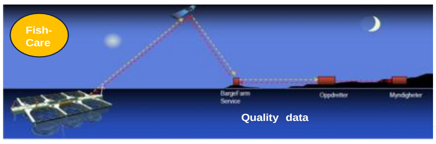
Fish Stock Monitoring

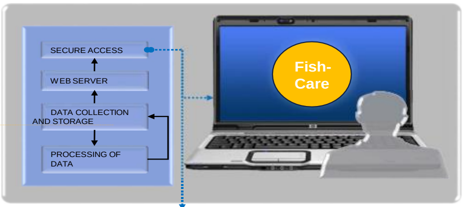


- Local and remote operation
- Instrumentation in the cages – temperature, oxygen, PH, salinity, CO2, environmental parameters.
- Clean water from the deep may be pumped into the cages
- Oxygen and freshwater production at the facility (options)



«FishCare» Monitoring and Logging

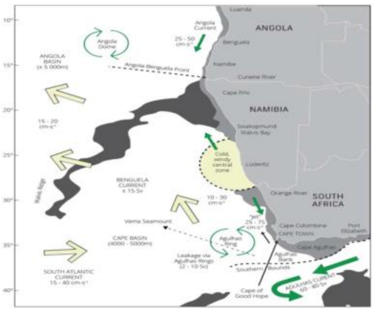




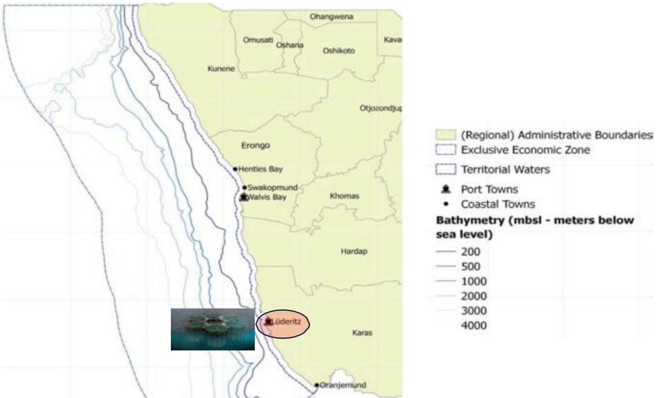
Access to data

- 24/7 Support – Help Desk
- Alarms
- Reports and documentation
- Fish well-care monitoring
- Status on equipment and maintenance
- Lessons learned (pictures, film, data, reports….)
- Discussion platform and expert support

Namibia – Oceanographic Data

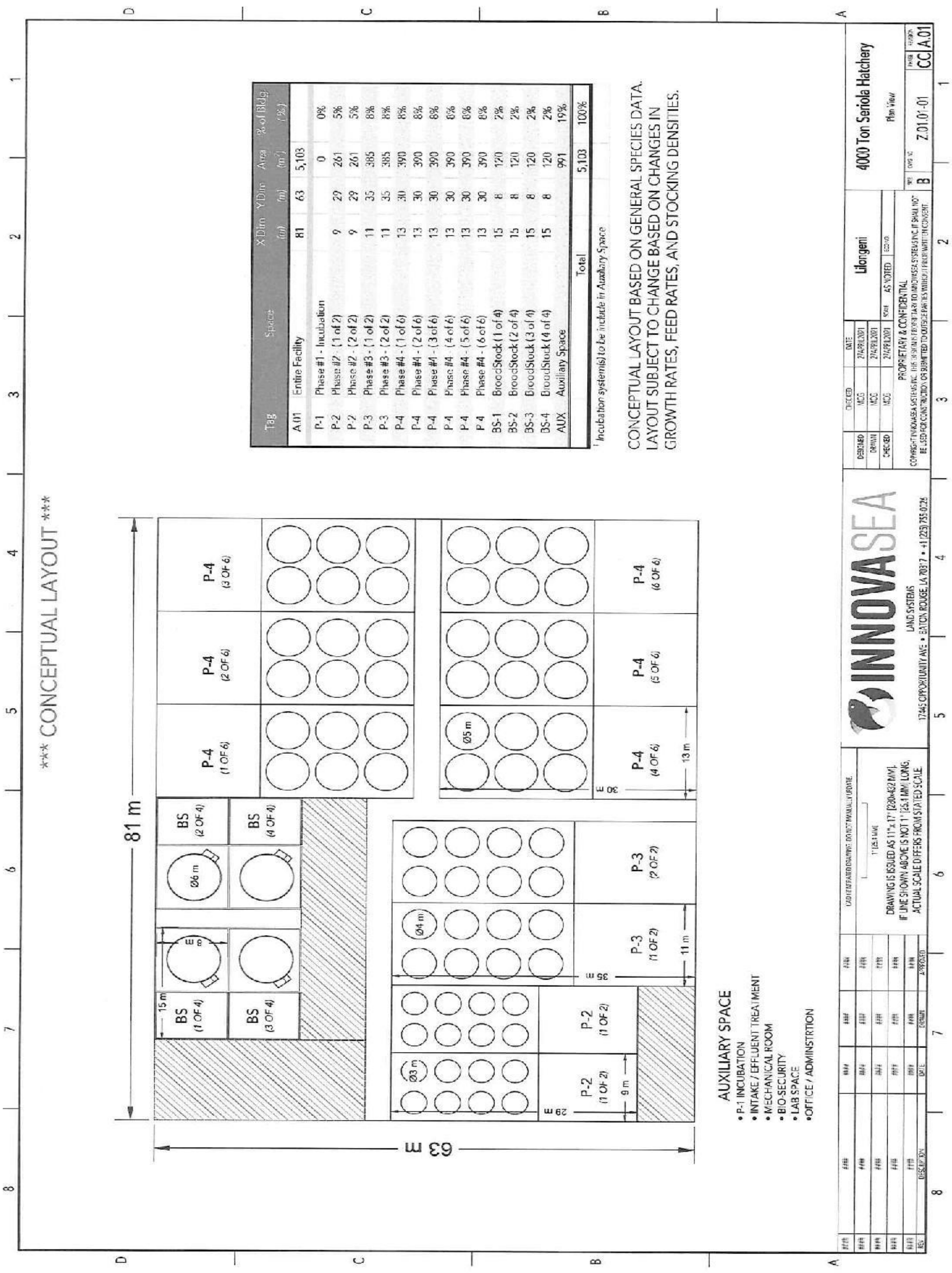


The Namibian sea is part of the BCLME, which is characterized by wind-driven upwelling leading to high productivity. The BCLME extends along the south-western margin of Africa, from Cape Agulhas (34°S) in the south through Namibia up to the Angola-Benguela front at around 15°S in the north (map 3). It is unique as it is bordered by warm water currents in the north and in the south. The Angola-Benguela front moves seasonally, being further south in austral summer and further north in winter.10

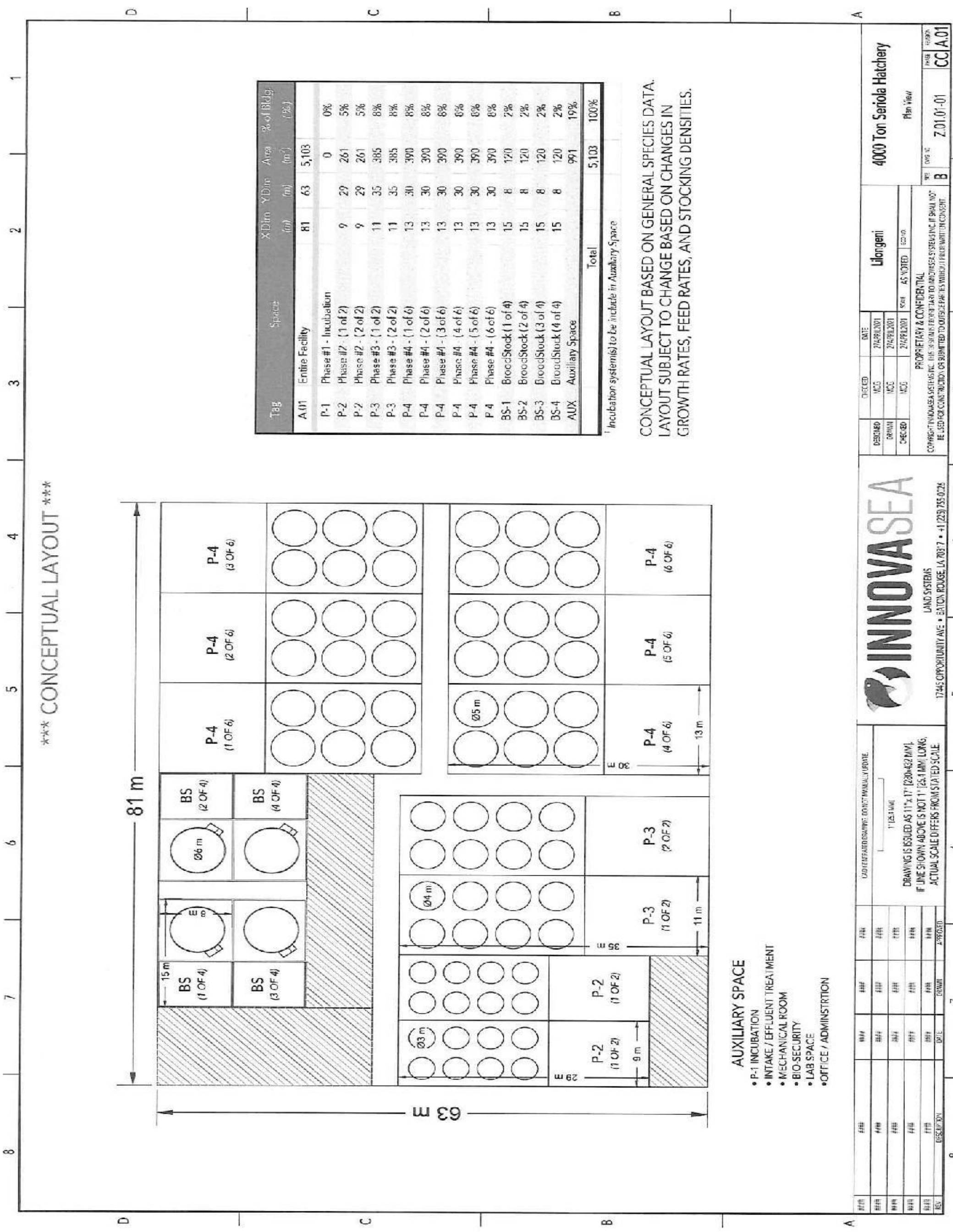


- The Benguela current is dominating outside Namibia and creates an upwelling close to shore that is cold and nutrious. This is the main reason for ideal fishing conditions for wild fisheries.
- In Namibia the average temp close to the shore is 13-14 deg.C, which is very good temperature
- The temperature will increase to 17-19 deg. further out

Appendix 6a: Onshore layout option proposed InnovaSea (2001).



Appendix 6b: Onshore layout option proposed InnovSea (2001).



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Appendix 7a: ***The Namibian dated 18th December 2020, to announce the public meeting scheduled for Walvis Bay and Swakopmund on the 12th and 13th January 2021.***

28 Friday 18 December 2020 | 18-12-20 THE NAMIBIAN

Notices • Public •

Register as an I&AP!

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED MARICULTURE FINFISH CAGE FARM OPERATION AT 23°05'00" LATITUDE and 14°20'56" LONGITUDE, WEST OF WALVIS BAY

Under the Environmental Management Act No.7 of 2007 and its 2012 EIA Regulations, the public is hereby notified that an application for Environmental Clearance Certificate (ECC) for the proposed Mariculture Finfish Farm will be submitted to the Environmental Commissioner of Ministry of Environment, Forestry and Tourism.

Proponent: Likegeni Aqua Fishing (Proprietary) Ltd
Environmental consultant (EAP):
Atlantic Consulting Services t/a Dr. E Klingelhoeffer

Type of activity: Construction and operation of a mariculture finfish farm offshore in cages and onshore a hatchery in the Walvis Bay industrial area. Indigenous species to be farmed include silver Kob and Yellowtail (Phase 1) and Salmon (Phase 2).

Offshore footprint: Cages secured to buoys covering an area of 20km² and an annual Production of 30 000 metric tons.

Onshore footprint: Fish processing facility and a hatchery for fingerling production

Site coordinates: 23° 05' 00" Latitude South and 14° 20' 56" Longitude East.
Public participation is important in the EIA process. Therefore, members of the public are further invited to register as an interested and affected party (I&AP) in order to comment/raise concerns or receive further information on the EIA process. Registrations are to be done with Atlantic Consulting Services via the contact details below.

Public meeting will be held on:
• Wednesday the 13th January 2021;
Time: 09h00 – 12h00;
Venue: Protea Hotel - Lagoon, Walvis Bay
• Thursday the 14th January 2021;
Time: 09h00 – 12h00;
Venue: NatMIRC (MFMR), Swakopmund

Registration and comments should reach Atlantic Consulting Services before end of business hours on the 8th January 2021 at 16h00.

Contact persons: Dr. Ekkehard Klingelhoeffer (ekkehardwk@gmail.com)
Ms. Maria Shimhanda (merrycasey64@gmail.com)
Call no. +264817193838

Appendix 7b: ***The Namib Times dated 18th December 2020, to announce the public meeting scheduled for Walvis Bay and Swakopmund on the 12th and 13th January 2021.***

12 NAMIB TIMES

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED MARICULTURE FINFISH CAGE FARM OPERATION AT 23°05'00" LATITUDE and 14°20'56 " LONGITUDE, WEST OF WALVIS BAY

Under the Environmental Management Act No.7 of 2007 and its 2012 EIA Regulations, the public is hereby notified that an application for Environmental Clearance Certificate (EEC) for the proposed Mariculture Finfish Farm will be submitted to the Environmental Commissioner of Ministry of Environment, Forestry and Tourism.

Proponent: Lilongeni Aqua Fishing (Proprietary) Ltd

Environmental consultant (EAP): Atlantic Consulting Services t/a Dr. E Klingel-hoeffer

Type of activity: Construction and operation of a mariculture finfish farm offshore in cages and onshore a hatchery in the Walvis Bay industrial area. Indigenous species to be farmed include Silver Kob and Yellowtail (Phase 1) and Salmon (Phase 2 off Lüderitz).

Offshore footprint: Cages secured to buoys covering an area of $20km^2$ and an annual Production of 30 000 metric tons.

Onshore footprint: Fish processing facility and a hatchery for fingerling production

Site coordinates: 23° 05' 00'' Latitude South and 14° 20' 56'' Longitude East (Phase 1).

Public participation is important in the EIA process. Therefore, members of the public are further invited to register as an interested and affected party (I&AP) in order to comment/raise concerns or receive further information on the EIA process. Registrations are to be done with Atlantic Consulting Services via the contact details below.

Public meeting will be held on:

- **Wednesday the 13th January 2021; Time: 09h00 – 12h00; Venue: Protea Hotel - Lagoon, Walvis Bay**
- **Thursday the 14th January 2021; Time: 09h00 – 12h00; Venue: NatMIRC (MFMR), Swakopmund**

Registration and comments should reach Atlantic Consulting Services before end of business hours on the 8th January 2021 at 16h00.

Contact persons: Dr. Ekkehard Klingelhoeffer (ekkehardwk@gmail.com)
Ms. Maria Shimhanda (merrycasey94@gmail.com)
Cell no. +264817193939

18 DECEMBER 2020

LITURGICAL SERVICES

Roman Catholic Parishes, Walvis Bay (Year B)

20 December 2020 – 3 January 2021

"Year of Poverty Eradication 2020/2021"

20 December SUNDAY 4th SUNDAY OF ADVENT "B" (P)

08h00	Mass (Fr Rufus / Dc Damaseb)	Stella Maris
09h30	Mass (Fr Rufus / Dc Hango)	St Peter's
09h30	Mass (Fr Heller / Dc Damaseb)	Good Shepherd

24 December THURSDAY CHRISTMAS EVE (W)

17h30	Vigil Mass (Fr Rufus / Dc Hango)	Good Shepherd
21h30	Vigil Mass (Fr Rufus / Dc Damaseb)	St Peter's
00h00	Vigil Mass (Fr Rufus / Dc Damaseb)	Stella Maris

[illegible]mber FRIDAY CHRISTMAS DAY (The Nativity of the Lord) W)

08h00	Mass (Fr Rufus / Dc Hango)	Stella Maris
09h30	Mass (Fr Heller / Dc Hango)	St Peter's
09h30	Mass (Fr Rufus / Dc Damaseb)	Good Shepherd

26 December SATURDAY ST STEPHEN (First Martyr) (R)

18h00	Mass (Fr Rufus / Dc Damaseb)	Stella Maris

27 December SUNDAY HOLY FAMILY (W)

08h00	Mass (Fr Rufus / Dc Damaseb)	Stella Maris
09h30	Mass (Fr Rufus / Dc Damaseb)	St Peter's
09h30	Mass (Fr Heller / Dc Hango)	Good Shepherd

1 J[illegible] FRIDAY HAPPY NEW YEAR – 2020 (Mary Mother of God)

08h00	Mass (Fr Rufus / Dc Hango)	Stella Maris
09h30	Mass (Fr Heller / Dc Hango)	St Peter's
09h30	Mass (Fr Rufus / Dc Damaseb)	Good Shepherd

2 January SATURDAY

18h00	Mass (Fr Heller / Dc Hango)	Stella Maris

3 January SUNDAY EPIPHANY SUNDAY (Solemnity)

08h00	Mass (Fr Heller / Dc Damaseb)	Stella Maris
09h30	Mass (Fr Rufus / Dc Hango)	St Peter's
09h30	Service (Dc Damaseb / Lay Ministers)	Good Shepherd

Appendix 7c: *The Namibian dated 3rd February 2021, to announce the public meeting scheduled for Lüderitz on 23rd February 2021.*

22 WEDNESDAY 3 FEBRUARY 2021 THE NAMIBIAN

Goods • Auction •

Auction

Housing & Property • For Sale •

Obituaries • In Memoriam •

IN LOVING MEMORY OF OUR BELOVED SON, BROTHER, FATHER AND HUSBAND

Late Silas Nande Nghifinwa

A year has passed since that sad day. You are gone but never forgotten.

Psalm 23 verse 4

May your soul continue resting in Eternal Peace

Housing & Property • For Rent •

Notices • Legal •

IN THE HIGH COURT OF NAMIBIA

Obituaries • Death & Funeral Notice •

In loving memory of our beloved son, brother and uncle.

Ndatelouwa Dawids

MEMORIAL SERVICE

BURIAL SERVICE

CONTACT PERSONS:

Obituaries • In Memoriam •

memory of

Housing & Property • For Sale •

Notices • Public •

Register as an I&AP

APPLICATION FOR AN ENVIRONMENTAL CLEARANCE CERTIFICATE FINFISH CAGE FARMING WEST OF Lüderitz (PROJECT ALTERNATIVE SITE) IN THE ATLANTIC OCEAN

Under the Environmental Management Act No.7 of 2007 and its 2012 EIA Regulations, the Public is hereby notified that an application for Environmental Clearance Certificate (EEC) for the proposed Finfish Farm will be submitted to the Environmental Commissioner of Ministry of Environment, Forestry and Tourism.

Proponent: Lilongeni Aqua Fishing (Proprietary) Ltd

Environmental consultant (EAP):
Atlantic Consulting Services t/a
Dr. E Klingelhoeffer

Type of activity: Construction and operation of a finfish farm offshore in cages, onshore a fish processing facility and hatchery in Lüderitz industrial area. Fish species to be farmed include Silver and Dusky Kob, Yellowtail and Atlantic Salmon.

Offshore footprint: Cages secured to buoys covering an area of 20km² to be developed in phases and a maximum Production of 35 000 metric tons.

Onshore footprint: Fish processing facility, storage, office complex and a hatchery for fingerling production at a later stage.

Site coordinates: 26°37'40" Latitude South and 15°01'53" Longitude East. Public participation is important in the EIA process. Therefore, members of the public are further invited to register as an interested and affected party (I&AP) in order to comment/raise concerns or receive further information on the EIA process. Registrations are to be done with Atlantic Consulting Services via the contact details below.

BID: The Background Information Document is available on request to I & APs upon registration.

Public participation meeting will be held on:
Tuesday the 23rd February 2021;
Time: 09h00 – 12h00;
Venue: The Nest Hotel – Lüderitz As per Government directives the COVID 19 regulations shall apply.

Registration and comments should reach Atlantic Consulting Services before end of business hours on the **19th February 2021 at 16h00.**
Contact persons: (ekkehardwk@gmail.com)

Lilongeni Aqua Fishing Ltd

Appendix 7d: *The Republikein, SUN and Allgemeine Zeitung, dated 29th January 2021, announce public meeting scheduled for Lüderitz on 23rd February 2021.*

8 Republikein Sun AZ Allgemeine Zeitung — Market Watch — FRIDAY 29 JANUARY 2021

035 Regskennisgewings Legal Notices

IN THE Magistrate's Court for the District of Gobabis. Held at Gobabis. Case No: 236/2020.
In the matter between:
GOBABIS GYMNASIUM - Plaintiff and DANIE OPPERMAN - Defendant NOTICE SALE IN EXECUTION
In pursuance of a judgment in the Magistrate's Court of Gobabis and Writ of Execution dated the 13th November 2020, the following goods will be sold in Execution on the 12th February 2021. at 09:00 o'clock at 48 Rugby Street - Office of the Messenger of Court, Gobabis to the highest bidder, Viz.:
Grey Toyota Land Cruiser.
Dated at Gobabis on this 25 January 2021.
BN VENTER LEGAL PRACTITIONER
23 Cuito Cuanavale Street
PO Box 1265
Gobabis
Tel (062) 56 5226/7
Fax (062) 56 5228.
DM0202100376428

LIQUIDATION AND DISTRIBUTION ACCOUNTS IN DECEASED ESTATES LYING FOR INSPECTION: In terms of Section 35(5) of Act 66 of 1965, notice is hereby given that the copies of the Liquidation and Distribution Accounts (First and Final, unless otherwise stated in the estate specified below will lie open for inspection for all persons interested therein for a period of 21 days (or shorter or longer if specifically stated) from the date specified or the date of publication hereof, whichever may be the later, and at the offices of the Master of the High Court at Windhoek and the Magistrate's as stated.
Should no objections thereto be lodged with the Master concerned during the specified period, the Executors will proceed to make payments in accordance with the accounts.
Registered Number of Estate: E1191/2020.
Surname: De Jager.
Christian Names: Jacobus Frederik Botha.
Identity Number: 37070200161.

035 Regskennisgewings Legal Notices

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROSED FINFISH CAGE FARM WEST OF Lüderitz (PROJECT ALTERNATIVE SITE) IN THE ATLANTIC OCEAN: Under the environmental management Act No.7 of 2007 and its 2012 EIA regulations, the public is hereby notified that an application for environmental clearance certificate (EEC) for the proposed finfish farm will be submitted to the environmental commissioner of Ministry of Environment, Forestry and Tourism.
Proponent: Lilongeni Aqua Fishing (Proprietary) Ltd
Environmental consultant(EAP): Atlantic consulting services t/a Dr. E Klingelhoeffer
Type of activity: Construction and operation of a finfish farm offshore in cages, onshore a fish processing facility and hatchery in Lüderitz industrial area. Fish species to be farmed include Silver and Dusky Kob, Yellowtail and Atlantic Salmon.
Offshore footprint: Cages secured to buoys covering an area of 20k m² to be developed in phases and a maximum production of 35 000 metric tons.
Onshore footprint: Fish processing facility and a hatchery for fingerling production in later stage.
Site coordinates: 26°37'40" Latitude South and 15°1'53" Longitude East.
Public participation is important in the EIA process. Therefore, members of the public are further invited to register as an interested and affected party (I&AP) in order to comment/raise concerns or receive further information on the EIA process.
Registrations are to be done with Atlantic consulting services via the contact details below.
Public participation meeting will be held on: Tuesday 23 February 2021; Time: 09h00 - 12h00. Venue: The Nest Hotel - Lüderitz
Registration and comments should reach Atlantic consul-

APPLICATION FOR ENVIRONMENTAL CLEARANCE CERTIFICATE - Exploration for natural stone to produce dimension stone & industrial minerals on EPL 6069, Erongo Region

Under the Environmental Management Act, 2007, (Act No. 7 of 2007) & the EIA Regulations 30 of 2012, prospecting of good quality natural stone for production of dimension stone and industrial minerals is a listed activity which cannot be conducted without an Environmental Clearance Certificate (ECC) from the Department of Environmental & Forestry Affairs (DEFA). OMAVI Geotechnical & Geo-environmental Consultants cc has been appointed to undertake the Environmental Scoping Assessment & prepare an Environmental Management Plan to support the application for ECC.

Proponent: Dwyka Investment cc

Site Locality: The EPL is located about 27 km to the north east of Arandis, & overlies Farms Trekkopje 120, Haskeen 89 & Sukses 90.

Interested & Affected Parties (I&Aps) are hereby invited to register & submit written comments/ concerns by close of business on 26 February 2021 to the contact details below. A Background Information Document is available for circulation to I&APs upon registration.

A public consultation & engagement meeting is tentatively scheduled for **6th February 2021**. Meeting details to be communicated with registered I&Aps only. All covid-19 regulations shall apply.

OMAVI Tel: +264 81 478 6303 (SMSes preferred) Email: info@omavi.com.na

Multiple Sclerosis NAMIBIA

WHAT IS

gef — Benguela Current Convention — UNDP

Invitation to Tender

The Benguela Current Convention (BCC) is a multi-sectoral Inter-Governmental Organisation by Angola, Namibia and South Africa (Parties) to spearhead regional collaboration for integrated management, sustainable development and protection of the environment using an ecosystem approach to ocean governance in the Benguela Current Large Marine Ecosystem (BCLME).

The Benguela Current Convention invites proposals from competent consultancy firms/ individuals to undertake the following consultancies:

1. Design, Development, Implementation and Hosting of the Benguela Current Large Marine Ecosystem Regional Integrated Information Management System (BCLME RIIMS).
2. Update the 2014 State of the Marine Environment Report of the Benguela Current Large Marine Ecosystem (BCLME).

Detailed Terms of Reference are available on BCC website (www.benguleac.org) or from Mr. Jackson Kaoti, (jackson@benguelacc.org, Tel: + 264 64 406 901).

The deadlines for the submission of proposals/bids for all the tenders is **22 February 2021.**

Kindly note that these are two separate consultancies.

NAGN

The Ministry of Education, Arts and Culture

PUBLIC INVITATION

Appendix 8a: *Participant list of the public that attended the coastal public meeting at Walvis Bay on the 12th January 2021.*

Total 12

Lilongeni Aqua Fishing (Proprietary) Ltd

Environmental Impact Assessment Public Meeting

Attendance Register

Date: 13th January 2021 Time: 09h00-12h00 Venue: Protea Hotel-Logoon, Walvis Bay

No.	Name & Surname	Company/Organization	Position	Contact No.	Email address:	Signature
1	Fritz Botes	Esthers Trading Enterprises	Owner/Manager	0813260027	fubotes@gmail.com	[signature]
2	Volker Vankmeier	BrandboxGmbH	MD	0811240300	volker-brandbox@iway.com.na.	[signature]
3	Tokeninawa-Bonghe	NSI	QA Officer	0811232904	hakatulete@nsi.com.na	[signature]
4	Hamutale Hakali / Rama Hakali	Lilongeni Aqua Fishing	Director	0811271753	rama@[illegible].com.na	[signature]
5	Ivy Mutanima	NSI	QAO	0815559727	mutanima[illegible]@nsi.com.na	[signature]
6	Ekkehard Klingelhoeffer	EAP	EAP	0817193939	ekkehard.ak@gmail.com	E.K.L.
7	Henry [illegible]	Atl. Cons. Serv. / Zeist Invest	Eienaar	0811275275	hanningdup@gmail.com / koos.blaauw@[illegible].com	[signature]
8	Koos Blaauw / IVORY UIRAB	Mariculture Officer MFMR	Chairman CFL.	0811689777 / 081252/008	ivox4520006@gmail.com	[signature]
9	Ndapewoma Kaulama	Atlantic Cons. Services	Secretary	081 377 9111		M. Ekz
10	Marja Shinhard	Atlantic Cons. Services	Expert	081 429 6089		M. Ekz
11	Thomas Mausberg	Lilongeni Aqua. Fishing	Director	081 308 7465		M. Ekz
12	Hanning du Plessis	ZEIST Invest.	Owner	0811275275		
13						

Note: Refer to Minutes of meeting, as proof of 12x participants.

[signature] EAP

Appendix 8b: ***Participant list of the public that attended the coastal public meeting at Swakopmund on the 13th January 2021.***

TOTAL 32 + 2

Lilongeni Aqua Fishing (Proprietary) Ltd

Environmental Impact Assessment Public Meeting

Attendance Register

Date: 14th January 2021 Time: 09h00-12h00 Venue: NatMIRC (MFMR), Swakopmund

No.	Name & Surname	Company/Organization	Position	Contact No.	Email address:	Signature
1	Mansfay	Lilongeni	Dreul.	0813032445		
2	Fritho Botes	Fitlos	Owner/Manager	0812240022	fwbotes@gmail.com	
3	MANUEL Romero	Beira Aquaculture	Director	0811497376	beiraaquaculture@gmail.com	
4	Mike Scott	African Conservation Services	Member	0812845130	ecoserve@iway.na	
5	Ann Scott		Member	"		A Scott
6	S. Gariseb	NAMPORT	SHEQ Manager	0811672175	s.gariseb@namport.com	
7	Stephanus Hamutenya	MFMR	Fisheries Biologist	0812203946	hamutenya5stephanus@gmail.com	
8	SASKIA KISTNER	MFMR	FCT	0816619152	Saskia.Kisting@mfmr.gov.na	
9	Ruan COWAN	MFMR : AQUACULTURE	FISHERIES BIOLOGIST	0812878885	ruan.cowan@mfmr.gov.na	
10	GEORGIE	FERMAR	Aqua. Expert	0812840501	georgiemoros@hotmail.es	
11	Victor Libuku	MFMR	Biologist	0811463142	victor.libuku@mfmr.gov.na	
12	Ramah Haikali	Lilongeni Aqua Fish	Promoter	0811271753	ramah@afol.com.na	
13	Charmaine Jagger	MFMR	Biologist.	0818010960	Charmaine.Jagger@mfmr.gov.na	Jagger
14	Anja v.d. Plas	MFMR	Senior Scientist	0812421891	anja.vanderplas@mfmr.gov.na	
15	Richard Horaeb	MFMR	Senior Biologist	0817669525	Richard.Horaeb@mfmr.gov.na	

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E. Klingelhoeffer EAP

Attendance Register

Date: 14th January 2021 **Time: 09h00-12h00** **Venue: NatMIRC (MFMR), Swakopmund**

16	Secilia Shilongo	MFMR	Fisheries Research Technician	0814072050	secilia@gmail.com	[illegible]
17	F. Hamukwaya	MFMR	Fisheries Tech	0812444495	Ferdinand.Hamukwaya@mfmr.gov.na	[illegible]
18	A. Kern	"	CFB	0812896870	—	[illegible]
19	J. Edward	"	FB	0817530993	[illegible]	[illegible]
20	Perttecilia	MFMR	CFRT	0813216198	Perttecilia.[illegible]	[illegible]
21	J. Reitham	MFMR	SFB	0812374441	Jolia.Reitham	[illegible]
22	P. Kainge	MFMR	CFB	0811490433	Paulus.Kainge	[illegible]
23	L. Shi.	MFMR	SFB	0812082[illegible]	Lateya. Shint	[illegible]
24	T. NGHWADA	MFMR	FB	0813480932	Tobias.Nghwada	[illegible]
25	J GEI-KHAUB	MFMR	STA	0814458196	Jan. Geikhaub	[illegible]
26	H-Skrypzeck	"	CFB	064-410900		[illegible]
27	BSM Tjizoo	"	CFB	0812687[illegible]	bsm.tjizoo mfmr.gov.na	[illegible]
28	Tony Rowan	Benguela Ski Boat Assoc	Member		bski.fish@gmail.com	[illegible]
29						
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E. Klingelhoeffer EAP

Lilongeni Aqua Fishing (Proprietary) Ltd

Environmental Impact Assessment Public Meeting

Attendance Register

Date: 14th January 2021 **Time: 09h00-12h00** **Venue: NatMIRC (MFMR), Swakopmund**

No.	Name & Surname	Company/Organization	Position	Contact No.	Email address:	Signature
1	Bronwen Currie	retired MFMR	-	0816352093	currie32@gmail.com	[signature]
2	[illegible]	[illegible]		0819989492	[illegible]@africaonline.com.na	[signature]
3	Ivory Uirab	MFMR		0812521448	ivory452000@gmail.com	[signature]
4	Tobias Endjambi	MFMR	Biologist	0814633427	Tobias.Endjambi@mfmr.gov.na	[signature]
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E. Kl[illegible] EAP

Appendix 8c*: Participant list of the public that attended the coastal public meeting at Lüderitz on the 23rd February 2021.*

Lilongeni Aqua Fishfarming (Proprietary) Ltd

Environmental Impact Assessment Public Meeting

Attendance Register

Date: 23rd February 2021 **Time: 09h00-12h00** **Venue: The Nest Hotel,, Luderitz**

No.	Name & Surname	Company/Organization	Position	Contact No.	Email address:	Signature
1	Kozi Kaving	Metcalfe Beukes Att.	Legal Repres.	0816309175	lawyer@metcalfe whk.com	[signature]
2	Aune Nantinda	Hangana Abalone	General Manager	081241462	aune.nantinda@ol.na	[signature]
3	Kaken Ndiwa	Marco Fishing	Sales Manager	081128739	export@marcofishing.com.na	[signature]
4	[illegible]	5 Roses Aqua	Member	0811292819	[illegible]@iway.na	[signature]
5	Austin Kruger	SY Zephyr	Chef	082 756 0846	austinkruger[illegible]@gmail.com	[signature]
6	Toma Nangombe	[illegible] Aqua	Management	0814346904	[illegible]	[signature]
7	Elizabeth Petrus	MFMR	SFRT	0817326695	e.g.petrus@gmail	[signature]
8	Foibe B Nghoongulute	MFMR	SFB	0813811318	foibe.nghoongulute@mfmr.gov.na	[signature]
9	Jessica Kemper	private	–	0813231110	jkemper04@gmail.com	[signature]
10	Ranga Haikali	Lilongeni Aqua	Director	0811271753	ranga@afol.com	[signature]
11	Dina Mwaale	Fisheries	F. Biologist	0813179678	[illegible]	[signature]
12	Hileni Malumbu	Fisheries	F. Technician	0812580825	[illegible]	[signature]
13	Paulus Ngalangi	Fischor	GM finance	0811492553		[signature]
14	SS Shumuamoh	AHCA	HR Advisor	0813323458	ctemopi@gmail.com	[signature]
15	Erikkie Andreas	Onganga Coastal Tou.	Member	0812696945	erikkieandreas@gmail.	[signature]
16	[illegible]	Fisheries	C.F.I.	0812593515	jbester@mfmr.gov.na	[signature]
17	K. GRUBER	Fisheries	Fisheries Biologist	0813202415	kolettegr@gmail.com	[signature]
18	Moira Elia	Coastways Tours	Director	0812478455	moiraelia66@gmail.com	[signature]
19	Marion Klingelhoeffer	EAP	EAP	0812792259	Lewiscwt@iway.na	
20	Aina Petrus	Nandjamba Aquaculture	Admin	0812820622	AinaPetrus1@gmail.com	[signature]
21	Rassie Erasmus	Benguela Wealth	Owner	0811273377	seagulls@africaonline.com.na	

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EAP E.Klingelhoeffer [signature]

Lilongeni Aqua Fishfarming (Proprietary) Ltd

Environmental Impact Assessment Public Meeting

Attendance Register

Date: 23rd February 2021 Time: 09h00-12h00 Venue: The Nest Hotel,, Luderitz

22	AMADHILA A.N	MFMR	RESERCH TECH	0816774655	[illegible]@gmail.com	
23	Kapa Saima	MFMR	Research Tech	0813479768	Kapasaima73@gmail.com	
24	Brigitte Fredericks	LTC	Lüderitz Town [illegible]	0811284126		
	NI					
25	MAAN AMENDSI	MFMR	MCS - LÜDERITZ	0812616300	[illegible]007.1@gmail.com	
26	Winfred Handa	Ngungu [illegible]	Civil Eng	-812314623	wnihengk@gmail.com	
27	ASSER MUKAPULI	AHCA	Coordinator	0818471664	mukapuliasser@gmail.com	
28	Ekkehard	EAP	EAP	0817193939	ekkehardwk	
	Klingelhoeffer	Consultant			@gmail.com	
29	T. Mausberg	Lilongeni		0813087445		tj.mausberg@gmail.com
30						
31						

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EAP E.K[illegible]

Appendix 9: Application form for a new aquaculture license form.

REPUBLIC OF NAMIBIA

Ministry of Fisheries and Marine Resources

ANNEXURE A (REGULATION 2)
APPLICATION FORM FOR NEW AQUACULTURE LICENCE

INSTRUCTIONS

1. *Submit a copy of a company registration from Ministry of Trade/BIPA*
2. *Submit a copy of Environmental Impact Assessment report*
3. *Submit a copy of Environmental Management Plan*
4. *Submit a copy of your Business Plan*
5. *Submit a copy of land/site approval or written consent from owner*
6. *Submit a copy of approval for water use*
7. *Submit a copy of public notice published in local newspaper*
8. *Complete this application form in full*

WARNING: Incomplete application will not be processed

1.	Name of person (representative)			
	Designation/position			
	Name of the company			
	Business physical address			
	Phone and facsimile numbers			
	Postal address			
	E-mail address			
2.	Type of aquaculture *(tick appropriate box)*	(a) Freshwater		
		(b) Marine	(i) Shore Based	
			(ii) Non-Shore based	
			iii) Sea ranching	
		(c) Shellfish		
		(d) Finfish		
3.	Aquatic species to be cultivated			

4.	Location of proposed aquaculture site		
	Size of the proposed aquaculture site		
	Description of proposed aquaculture site		
5.	Sources of stock of aquatic organisms for cultivation		
6.	Maximum annual production intended, in quantity or weight per year		
	Number of jobs intended at full production		
7.	Brief description of the type of aquaculture facilities to be used		
	Size of the proposed aquaculture facility		
8.	*Water*	*Sources*	*Flow rate/ hour or day*
	Freshwater supply to aqua-facility		
	Saltwater supply to aqua-facility		
9.	Brief whether effluent is to be discharged in Namibia waters		
	Annual quantity of effluent		
	Composition of effluent		
10.	Other relevant information		

11. Declaration by Applicant:

I …………………………………………..declare that the above and any accompanying information are true, complete and correct. I understand I am required to report immediately to the Minister any changes to the information given on this form and further understand that failure to do so may render me liable to prosecution.

	/ /2021
Applicant's Representative Signature	**Date**

This application is to be forwarded to the Minister at the address shown below:

The Executive Director
Ministry of Fisheries and Marine Resources
Private Bag 13355
WINDHOEK

Aqua. Act Sections	Aquaculture Act Requirements	Motivate your answer
12 (2) EIA	Did you compile and submit your BID/EIA Scoping Report to MFMR?	
12 (3)(a) Business plan and cash flow	Did you demonstrate the technical ability to execute the project in your Business Plan?	
	Did you demonstrate the financial ability to execute the project in your Business Plan?	
12 (3)(b)	Is the species you applied for viable?	
	Is the species you applied for an alien?	
	Is the species you applied for a disease carrier?	
	Is the farming method appropriate?	
12 (4)	Did you publish the public notice in the local newspaper in connection with your application for aquaculture licence for 30 days?	
12 (6)	Do you know whether there more than one application for the same site?	
13 (1) (b) and (d)	Did you submit a written consent/approval from the owner of land/site authorising the project on that land to MFMR?	
	Did you submit the written approval for water use for your project?	
13 (1) (c)	Did you submit a copy of Environmental Compliance Certificate (ECC) to MFMR?	
	Did you submit a copy of Environmental Management Plan (EMP) to MFMR?	
13 (2)(b)	Will granting of a licence create a significant risk of pollution or otherwise adversely affect the environment?	
43 (2) (d) and (i)	Will you import live aquatic species into Namibia?	

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Policy and Legal Framework (Namibia):

➢ **Direct impact:**

- Environmental Management Act of 2007
- EIA Regulation of 2012
- Aquaculture Act no. 18 of 2003
- The Aquaculture (Licensing) Regulation of 2003
- Import and Export of aquatic organisms and aquaculture products regulation of 2010
- Marine Resources Act No. 27 of 2000
- NIMPA. (2008 & 2012). Namibia Island's Marine Protected Area (NIMPA) (Marine 003/2008) and (No. 316 of 2012)

- **Indirect impact:**
  - Marine Traffic Act (No. 2 of 1981) (as amended by the Marine Traffic Amendment Act (No. 15 of 1991)
  - Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990
  - Dumping at Sea Control Act (No. 73 of 1980)
  - Water Act, 1956 (No. 54 of 1956), as amended
  - Water Resource Management Act 11of 2013
  - Public Health Act 36 of 1919 (as amended)
  - Labour Act, 2007 (No. 11 of 2007)
  - Namibian Ports Authority Act (No. 2 of 1994) and Port Regulations
  - Nature Conservation Amendment Act No.5 of 1996
  - Pollution Control and Waste Management Bill (draft 2003)
  - National Solid Waste Management Strategy
  - Seabird and Seals Protection Act 46 of 1969

Additional: Legislation and Policy

- A review of the Aquaculture Policy and Institutional Capacity in the BCLME Region, with recommended regional policy options. BCLME Project LMR/MC/03/0 (1st July 2006).
- Fisheries and Aquaculture industry in Namibia Series Report No 2 on the Fisheries and Aquaculture review in the 22 ATLAFCO member countries (October 2012).
- The Aquaculture Strategic Plan for the Directorate of an Aquaculture (2004).
- Aquaculture Master Plan for Namibia 2013 to 2023. (2012).
- Marine Spatial Plan in Namibia (Draft Report) – Current status report knowledge baseline for Namibia’s Central Marine Plan (2016).

Government of the Republic of Namibia:

- Namibia Constitution (1990).
- National Development Plans (NDP5) (2017).
- Harambee Prosperity Plan II (HPP II) Economy (2021).
- Vision 2030 (1990).

International Laws and Conventions

The following listed international treaties and obligations have been signed by Namibia and may have possible impacts on the proposed Finfish Farm project.

- Convention on Biological Diversity, 1992
- The Benguela Current Convention, 2013
- United Nation Law of Sea Convention, 1982
- Base Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989
- International Convention for the Prevention of Pollution from Ships, 1973
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973
- Stockholm Convention on Persistent Organic Pollutants, 2001
- SADC Protocol on Shared Watercourse Systems in the Southern African Region, 1995

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