MEFT REFERENCE NO.: APP-003890

Proposed Construction and Operation a Finfish Cage Farm in Lüderitz, //Karas region, Namibia

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

This EIA Report is prepared to Support an Application for Environmental Clearance Certificate (ECC: APP-003890) to construct and operate a Finfish Cage Farm in Lüderitz, //Karas region, Namibia

Prepared for

Benguela Blue Aqua Farming (PTY) LTD

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SEPTEMBER 2022

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Swakopmund

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ACRONYM

BCC Benguela Current Convention

BCLME Benguela Current Large Marine Ecosystem

BOD Biological Oxygen Demand

CO_2 Carbon Dioxide

DCs Decompression sickness

DO Dissolved Oxygen

EAP Environmental Assessment Practitioner

EIA Environmental Impact Assessment

EMP Environmental Management Plan

ECC Environmental Clearance Certificate

IAS Invasive Alien Species

IOD Injury On Duty

MEFT Ministry of Environment, Forestry and Tourism

MFMR Ministry of Fisheries and Marine Resources

NAMPORT Namibia Ports Authority

NCRST National Commission on Research, Science and Technology

NGOs Non-governmental organizations

NUST Namibia University of Science and Technology

P/A index polycheate to amphipod index

SOPs standard operations procedures

SSTs seas surface temperatures

TDS total dissolved solids

TORs terms of references

TSS total suspended solids

UN United Nations

UNCLOS United Nation Convention on Law of the Sea

PROFILE OF CONSULTING COMPANY

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Since establishment in 2013, ECUTS had completed more than 20 projects across various economic sectors including the following:

1. **Waste management/maritime transport** (EIA/scoping to perform in-water cleaning for Ufudu Marine Namibia cc, September-November 2022).
2. **Maritime pollution** (Development of a national oil dispersant use policy for Namibia on behalf of the Ministry of Works. Transport, May-December 2022).
3. **Tourism/aviation transport** (EIA/scoping to construct and operate a private airstrip for Brandberg White Lady Lodge, September-November 2022).
4. **Mariculture** (Full EIA/Baseline Environment specialist study to construct and operate a cage finfish farm for Benguela Blue Aqua Farm, Lüderitz, 2022).
5. **Waste management/maritime transport** (EIA/scoping to perform under-water cleaning for Walvis Bay Diving & Salvage cc, Walvis Bay, 2021).
6. **Mineral exploration** (EIA/scoping for Exploration Activities on EPLs 7795, 7796, 7797, 7798, 7799 and 7800 for Mangroove PTY LTD, Omaheke and Hardap regions, 2021).
7. **Tourism** (EIA/scoping for upgrading of Rhino campsite for Brandberg White Lady Lodge, Erongo region, 2019).
8. **Agriculture** (Climate resilience readiness country study in Namibia on behalf of the Technical Centre for Agricultural and Rural Co-operation, Windhoek, 2016).
9. **Training** (Strategic coastal management training for NACOMA/Ministry of Environment and Tourism, Erongo region, 2015).
10. **Off-shore mining** (Benthic baseline study for Deb-marine, Windhoek, 2014).
11. **Waste management/tourism** (EIA/scoping for the Mudumu National Park/Ministry of Environment and Tourism, Kongola, Zambezi region, 2013).

PROJECT DETAILS

PROJECT TITLE

Proposed Construction and Operation a Finfish Cage Farm in Lüderitz, //Karas region, Namibia

ENTITIES REPRESETNTING GOVERNMENT REPUBLIC OF NAMIBIA (GRN)

Ministry of Environment, Forestry and Tourism (Permitting Authority).

Ministry of Fisheries and Marine Resources (Competent Authority).

KEY LEGAL INSTRUMENTS

Environmental Management Act (No. 7 of 2007) and EIA regulations of 2012.

Aquaculture Act (Act 18 of 2002)

Marine Resources Act (Act no. 27 of 200)

NIMPA Regulations (No. 316 of 2012)

TARGET ECONOMIC SECTOR & ACTIVITY

Mariculture

PROPONENT

Benguela Blue Aqua Farming (PTY) LTD

EIA PROCESS AND TIMELINES

SCOPING STUDY (phase I):

- *Adverts in the newspapers: 18 December 2020.*
- *Adverts in the newspapers: 03 February 2021.*
- *Public meeting in Lüderitz, Walvis bay and Swakopmund.*
- *Release of recommendation letter by MFMR.*

FULL EIA (phase II):

- *Baseline environmental specialist studies: April 2022.*
- *Release of environmental reports: May 2022.*
- *Request for consent letter from MFMR: June 2022.*
- *Launch application for ECC and release of screening report: June 2022.*
- *Release of recommendation letter by MFMR: September 2022.*
- *Submit outstanding documents and finalize application for ECC.*

EXECUTIVE SUMMARY

Introduction

The Proponent for this project is Benguela Blue Aqua Farming PTY LTD (formerly Lilongeni Fish Farming PTY LTD). The Proponent intends to construct and operate a finfish cage aquaculture farm at a site near Boat Bay in Lüderitz (//Karas region). The proposed farmed species are:

- *Yellowtail kingfish (Seriolli lalandi),*
- *Silver Cob (Argyrosomus inordurus,) and*
- *Atlantic Salmon (Salmo salar).*

Overview of the Namibian mariculture sector

- *Many fishery resources in Namibia were over-exploited at independence and there are still some resources that under moratorium.*
- *Over-exploitation of capture fisheries could have negative impacts on employment creation and generation of state revenues.*
- *There is an opportunity to change this by producing fish from farms where production and harvesting could be easily controlled.*
- *Despite the potential for mariculture development in Namibia, the sector is less diversified (more concentrated only on shellfish species) which makes it more prone to various risks.*
- *The Government of the Republic of Namibia (GRN) recognizes the mariculture sector and has put in place regulations to ensure sustainable development of this sector.*
- *The Proponent for this project would like to diversify the mariculture sector by farming with finfish.*

The receiving environment and environmental impacts

The proposed site is part of the southern BCLME (Benguela Current Large Marine Ecosystem). The BCLME is one of the most productive LME (Large Marine Ecosystems) in the world; due to consistent upwelling cells. The most intensive upwelling cell is located near Lüderitz and is characterized by strong winds and higher biological productivity which will benefit the proposed farm.

Activities from the proposed farm will have negative impacts on the environment. Some negative impacts will be significant and will need mitigations:

- *Ecological impact of the detritus in the form fish feed waste and fish excreta on sediment quality will be mitigated through environmental monitoring and if such impacts is found to be significant and is directly related to the farm operations, farming activities would be temporarily suspended until investigations conclude that it is safe again to start operations;*
- *Impacts of the proposed activities on water quality will be mitigated in order to determine if levels of pollution are over the recommended threshold limits;*
- *Impacts on benthic fauna and plankton communities will be mitigated in order to determine if there are significant changes in species composition and distribution;*
- *In case of an escape of the introduced Atlantic salmon (Salmo salar) into Namibian waters, the proponent intends to only import triploid eggs of Atlantic salmon. Fish reproduced using triploid eggs will be unfertile and cannot reproduce or establish wild populations;*
- *The medium in which the eggs are transported will be checked for diseases, viruses and pathogens, and*
- *Potential conflicts with other users in the same area will be avoided by:*
    - *Selecting an ideal site,*
    - *Follow existing regulations, policies and plans put in place by GRN to ensure all users of the ocean space work together to ensure various sectors of the economy contribute to socio-economic development and national development goals.*

EIA process and stakeholder participation

This EIA is divided into 2 phases:

Phase 1: *EIA/Scoping study (December 2020 to August 2021):*

During the EIA/Scoping phase, various issues raised were summarized and incorporated into the EIA/Scoping Report. Unfortunately, due to lack of specialized studies, the EIA/Scoping Report was unable to address a number of issues. These issues were communicated to the Proponent in a letter by MFMR dated, 19 August 2022; specifically addressing 7 (seven) issues. In summary, the letter recommended that the Proponent should undertake a full EIA which should be supported by specialist studies.

Phase 2: *Full EIA (March 2022 to September 2022).*

Based on issues and concerns raised by the MFMR in a letter addressed to the Proponent, the appointed Consultants identified 4 (four) components which the specialist studies needed to address, namely:

- *Seawater quality;*
- *Sediment quality;*
- *Introduced aquatic species, and*
- *Avifauna.*

Reports from these studies were prepared and compiled to support application for ECC. These reports were submitted to MFMR for review and also to seek support from MFMR to issue a consent letter. The consent was issued on 27 September 2022 with the recommendation that the ECC may be issued pending various conditions.

Conclusions and recommendations

The receiving environment of negative impacts emanating from the proposed finfish cage farm activities will mainly be water and sediment quality as well as benthic species and plankton communities. There is also the bio-risk of the introduced Atlantic Salmon. However, all the negative impacts will be mitigated as provided in the EMP. The EMP will also be further supported by preparing a biosecurity protocol and management plan as recommended by MFMR.

Therefore, it is recommended that, the ECC should be granted provided that the Proponent:

- *Undertakes a regular biosecurity and water quality monitoring;*
- *Focuses on monitoring abundance of benthic species and epifauna invertebrates;*
- *Provide an environmental monitoring plan indicating the type of parametres to be monitored and the frequency (e.g. per month or per year or as recommended by MFMR);*
- *Monitors changes in physical water quality by measuring pH, conductivity, salinity, turbidity and other physical parameters that may be affected by the proposed activity quarterly or as recommended by MFMR;*
- *Measures concentration of nutrients (e.g. ammonia, nitrites, nitrates, phosphates, etc) that may be affected by fish feed input into the seawater quarterly or as recommended by MFMR;*
- *Submit 2 (two) environmental monitoring reports to MFMR or other GRN authorities, and*

CHAPTER 1

1. INTRODUCTION AND BACKGROUND

1.1 Introduction

The Proponent for this project is Benguela Blue Aqua Farming PTY LTD (formerly Lilongeni Fish Farming PTY LTD). The Proponent intends to construct and operate a finfish cage aquaculture farm at an identified area in Lüderitz (Karas region).

GRN (Government Republic of Namibia) has made comprehensive efforts in formulating environmental policies and legislations that regulate the Namibian mariculture sector. The Proponent understands this activity cannot be undertaken without permission from relevant entities representing GRN especially, the Ministry of Fisheries and Marine Resources (MFMR) which is the Competent Authority as well as the Ministry of Environment, Tourism and Forestry (MEFT) which is responsible for issuance of ECC as well as management of the MPA (Marine Protected Area) where the proposed site is located.

1.2 Overview of the Namibian mariculture sector

Globally, there are indications that marine capture fisheries are overharvested, and this has a negative impact on the global seafood supply value chain. In addition to population growth and higher demand for seafood, seafood shortage is exaggerated by climate change and variability. Additionally, historical consumption of heavy fuel diesels by fishing fleets and emission of GHG (greenhouse gas) has a large footprint on the environment. Mariculture production has a relatively small footprint due to low GHG emission and is considered a climate friendly production and harvesting system.

Additionally, mariculture could be considered a Climate Resilient Solution (CRS) to climate change and variability. The Government of the Republic of Namibia (GRN) recognizes the mariculture sector and has put in place regulations to ensure sustainable development of this sector.

In Namibia the baseline year for commercial mariculture is 1980. Initially, the activity was a secondary activity taking place mainly in areas used for salt mining in Walvis Bay and Swakopmund. Walvis Bay Salt Company (PTY) LTD had successfully operated an oyster farm until 2008 when it was closed due to low DO (dissolved oxygen) and sulphur eruption events.

Table 1: licenced aquaculture sites.

Area (ha)	Species	Method	Active
38.5			
32.4	Abalone		✓
2.1			
1	Abalone	Flow-through Circulation	✓
10			
10			
10			
14.2	Oysters	Raft System	✓
45.06	Oysters	Long-line & Raft System	✓
10			
10			
10			
10			
23.5			
10			
10	Oysters	Long-line & Raft System	✓
1.91			
130.58			

1.2.1. Tetelestai Oyster farm

After closure of operations at the Walvis Bay Salt Company, Tetelestai began oyster farming in the same area. Fresh seawater is pumped using a generator from the Ocean into a series of ponds. The jetty facility and infrastructure through which seawater water is pumped and transported belongs to the Walvis Bay Salt Company. The water is pumped for sun drying for the purpose of salt mining and refining. However, before reaching the refinery areas, seawater still contain a lot of nutrients suitable for farming shellfish. Tetelestai takes advantage of this opportunity by farming oysters using the ‘rack and bag’ method.

1.2.2 Rich water Oyster hatchery

Rich water Oyster hatchery is the only oyster hatchery in Namibia. It hatches and supply spats to local farmers. Rich water Oyster hatchery is located within the Swakopmund salt work facilities.

1.3. Mariculture policies and legislations

The GRN has developed several policy documents that are aimed at regulating the aquaculture sector such as the Aquaculture Act (Act 18 of 2002) and the Aquaculture Master Plan. The Aquaculture Master Plan is the blue print for accelerating development of mariculture in Namibia.

Other legislations that are aimed at promoting mariculture while protecting the environment and marine resources from harmful mariculture practices are:

- Marine Resource Act (no. 27 of 2000), and
- NIMPA Regulations (no. 316 of 2012)

There is a potential conflict in the interpretation of the legislative framework regulating the mariculture sector. While some regulations are aimed at development of mariculture sector; others are aimed at protection of the marine and coastal environments from mariculture activities.

The common challenge experienced is when all these regulations are administered by one GRN entity, which acts as both the regulator and the promoter of the mariculture activities. For example, MFMR is the GRN entity responsible for issuance of Aquaculture licences and is also, at the same time, responsible for enforcing the Marine Resource Act (no. 27 of 2000) and NIMPA Regulations (no. 316 of 2012). However, the responsibilities are allocated to different Directorates namely; the Directorate of Aquaculture and the Directorate of Resources Management.

The above scenario is not new in Namibia, and it is not the purpose of this EIA Report to shift blame. Rather, this report argues that there is a need to create a dialogue and provoke a debate on environmental policies and legislations that do not complement each other. It is the purpose of this EIA Report to bring together regulators, practitioners, and stakeholders to debate this issue. Specifically, Chapter 3 in this EIA Report will describe in detail which Namibian environmental policies and legislations qualify as constituting environmental law merely based on relevance or potential relevance to environmental management.

1.3 The receiving environment

The proposed site is part of the southern BCLME (Benguela Current Large Marine Ecosystem). The BCLME is one of the most productive LME (Large Marine Ecosystems) in the world; due to consistent upwelling cells as described by several authors (e.g. Man & Lazier; Shannon & O'Toole 1999). LMEs only make up a small proportion of global oceans; however, they account for about 95% of global fisheries production (Bakun 1995). Although climate and weather in LMEs is influenced by large-scale processes, there are also small-scale processes which create niches for feeding and breeding for marine fauna. This small-scale variation in micro-site and micro-climate determine biological productivity, diversity as well as resilience to negative environmental impacts. Heterogeneous ecosystems provide variable micro-climate sites that favour different species (Raven & Johnson 1999). Subsequently, heterogeneous ecosystems are likely to be less susceptible to negative environmental impacts.

In order to map environmental impacts of the proposed mariculture activities, the focus will be on valued ecosystem components (VECs). VECs are fundamental components within the ecosystem that are essential for marine ecosystem health and the ecosystem services they provide. The following VECs had been identified and will be the focus during environmental impact assessment and mitigation:

- Physical and chemical component of the ocean including weather and climate;
- Ecosystem diversity including ecologically sensitive areas;
- Biological productivity and diversity including marine fauna, and
- Human environment.

1.4 Project motivation

Currently, the Namibian population is dominated by members of generation Y and Z. Members of the Y generation were born between 1981 and 1996; while members of generation Z were born after independence between 1997 and 2012. In the next 10 years, the seafood market will be dominated by members of generation Y and Z both as consumers as well purchasers. For this reason, sea producers will be targeting consumers in these generations. These consumers are conscious about where and how seafood products are produced and harvested as well as environmental impacts that occur along the seafood value chain from production, harvesting and distribution.

As a result, seafood producers will eventually start to invest in environmentally friendly practices and technologies to satisfy consumer demand. As more members of the Y and Z generation become decision-makers in governments, many seafood producers will soon be compelled to implement sustainable seafood systems.

Given that the current capture fishery practices have more environmental impacts compared to mariculture practices, it is expected that members of the Y and X generations will prefer to consume seafood produced from mariculture production systems.

Benguela Blue Aqua Farm (PTY) LTD or the Proponent would like to take advantage of this opportunity by investing in a sustainable farming in Lüderitz using the following species:

- Yellowtail kingfish (*Seriolli lalandi*),
- Silver cob (*Argyrosomus inordunus*), and
- Atlantic Salmon (*Salmo salar*).

1.5 Problem statement

There are prospective and constraints associated with each emerging economic sector. While the proposed mariculture activities are expected to contribute to employment creation and revenue generations, the proposed activities will have negative environmental impacts.

The problem associated with increased mariculture activities such as:

- Potential introduction of aquatic species and pathogens;
- Seawater pollution due to detritus in the form of fish feed and fish excreta;
- Colonization of bio-fouling organisms on mariculture facilities;
- Effects of lighting;
- Entanglement of marine mammals in fish cages, and
- Vessel collisions and faunal strikes.

Attempts will be made to mitigate these impacts by considering various alternatives and compilation of an EMP (Environmental Management Plan) as well as a biosecurity protocol and management plan.

1.6 Project location alternatives

In 2020 and 2021, the Proponent committed to undertake the EIA/Scoping exercise, including the public participation which was successfully completed in July 2021. The Proponent has considered various alternatives during the EIA/scoping exercise in order to minimize negative environmental impacts without compromising on positive impacts of the proposed project.

Various alternatives were considered as explained below.

1.6.1 Walvis Bay 'alternative'

The proponent initially selected a site near Afrodite Beach in Walvis Bay but was advised against this due to higher environmental risks of Sulphur eruptions and low DO (dissolved oxygen) waters in this area.

1.6.2 Alternative site C(i)

The Proponent considered site C(i) located south of Lüderitz near the Port but it was opposed during public meetings due to proximity to bird Islands.

1.6.3 Alternative site C(ii)

Alternative site C(ii) was more suitable due to location away from bird island. This site is also of particular interest due to similar activities taking place such as the proposed kelp farming activities. This means fish farm effluent or organic waste generated from the farm will help the kelp grow faster. However, the site is located within ML (mining licence) area which belongs to Diamond Field Resources (PTY) LTD and discussions are at an advanced stage with the owner to allocate the most ideal location without compromising contribution of these economic activities to employment creation and generation of state revenues.

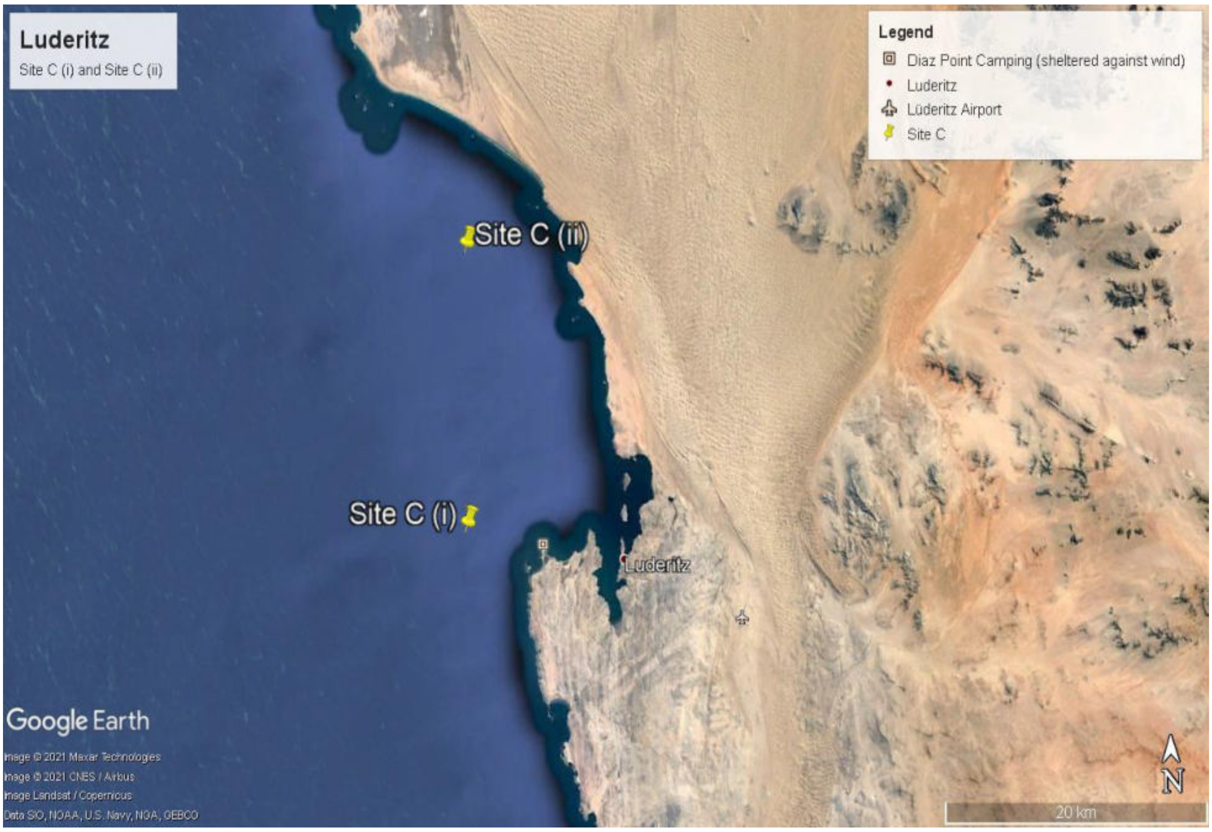

Figure 1: site C(i) was the suitable site (source: Benguela Blue Aqua (PTY) LTD).

1.6.4 'No development' alternative

The alternative to not develop ('no development') had also been considered. The 'no development' alternative will limit the potential for mariculture development in Namibia as set out in the Master Plan for marine aquaculture in Namibia as well as MFMR's strategic objectives.

1.6.4 Other alternative blue economy activities

The proposed site is located in the Lüderitz upwelling cell and this provide favorable conditions for finfish growth. Furthermore, the site overlaps with diamond mining areas. Also, recently Kelp Blue (PTY) LTD was awarded an Aquaculture licence to operate a kelp farm within the same vicinity.

1.6.5 Potential user conflict

The Proponent also considered other users. The MSP (marine spatial planning) framework guides how maritime development activities across three planning areas (central, southern and northern MSP Areas) should take place while minimizing potential conflicts. When fully implemented, the MSP for Namibia will play a key role in maritime development planning.

1.8 Profile of Benguela Blue Aqua Farming (PTY) LTD

Benguela Blue Aqua Farming (PTY) LTD is a Namibian registered company (cc/2015/0190) which operates according to Namibian company laws. Benguela Blue Aqua Farming (PTY) LTD intends to invest in the Namibian mariculture sector. Although, investing in the mariculture sector is a higher risk investment, after many years of planning, Benguela Blue Aqua Farming (PTY) LTD, had raised the capital needed. Benguela Blue Aqua Farming (PTY) LTD recognizes importance of the mariculture sector as well as the potential growth of this sector due to enabling legislative framework that encourages development of the mariculture industry and also given favorable conditions in the BCLME.

The proposed project will create economic opportunities along the mariculture value chain. The mariculture value chain consists of: upstream, mid-stream and downstream.

- *Mid-stream* involves hatchery facilities and transportation of fingerlings while *down-stream* entails fish farming operations, harvesting, storage and distribution of fish products.
- *Upstream* value chain forms a basis of the mariculture sector. Main activities undertaken in the upstream value chain include feasibility and baseline studies, environmental compliance procedures and acquisition of environmental permits and certificates as well as construction of mariculture facilities.
- The Proponent has demonstrated commitment, for example through appointment of local Consultants, to invest in the upstream value chain.
- All inputs, materials and resources needed during the procurement will be sourced from Namibia and majority employees will be Namibians. This will create temporary and permanent employment opportunities.

The upstream value, being comprised of environmental compliance and baseline studies, contribute to generation of baseline information and understanding of the local environment and mariculture production systems.

- The Proponent has already started investing in the upstream value chain;

- During 2021, the Proponent undertook an EIA/scoping study as part of the application for ECC;
- Upon recommendations by MFMR there was a need to undertake a full EIA study, and
- The Proponent committed additional resources to undertake a full EIA study.

1.9 Terms of references

In March 2022, the Proponent appointed a consultant to undertake a full EIA and specialist studies. Terms of references were:

- Undertake a full EIA study including detailed specialist studies, specifically regarding the activity's ecological and physiochemical impacts on the environment;
- Demonstrate that the introduced Atlantic Salmon (*Salmo salar*) will not establish a viable wild population in case of an escape;
- Provide a contingency and mitigation plan in case of an escape of *Salmo salar* into nature. This plan should be designed in conjunction with the Aquaculture Act of 2002, Part VI, regarding protection of the aquatic environment;
- Provide site specific information on prevailing environmental conditions and oceanography (as much of the information provided from literature, satellite or regional scale surveys);
- Undertake benthic specialist study to investigate impacts of the proposed activities on benthic fauna and plankton;
- Prepare literature review about the IAS (Introduced Aquatic Species) and pathogens specialist study to investigate impacts of introduced fish species on marine fauna.
- Compile and prepare a detailed EMP (Environmental Management Plan) to:
    - Map sensitive habitats, protected areas and potential user conflicts (fisheries, mining, shipping, etc) structured in tables and include assessment before and after mitigation measures to be incorporated in a comprehensive EMP;
    - Demonstrate what measures will be put in place to prevent release of the introduced *Salmo salar* into nature, and
    - Provide a contingency and mitigation plan in conjunction with the Aquaculture Act of 2002 in case of an escape of *Salmo salar* into nature;
- Reference the environmental impact of the proposed project against experience gained from other similar aquaculture projects undertaken in the region or elsewhere;
- Complete and submit draft EIA and EMP reports for comments/review;

- Obtain consent letter from Competent Authority (or MFMR);
- Submit final EIA and EMP reports to the Ministry of Environment and Tourism (MEFT);
- Launch application for ECC (environmental clearance certificate) at MEFT, and
- Deliver ECC to Client.

1.10 Discussions, conclusions, and recommendations

Climate change and variability is negatively affecting marine capture fisheries and mariculture is expected to play a significant role as climate resilient solution in mitigating impacts of climate change and variability. However, climate change and variability is not the only factor negatively affecting capture fisheries as there are also other factors such as over-fishing and the environmental impacts of fishing gears on ecosystem habitats and marine fauna as well as release of GHGS into the atmosphere from use of heavy fuel diesels. Marine capture fisheries in Namibia commenced in the early 1950s and went on illegal, unreported and unregulated such that many fisheries were overexploited in 1990. Catches of Rock lobster, a common fishery resource off Lüderitz has drastically declined over the years (Shuuluka, 2019) mainly due to overfishing.

Unconsumed fish feed and organic waste from mariculture activities and their release into seawater will have negative environmental impacts on the environment. However, the mariculture sector is a small-scale sector compared to the capture fishery sector and the environmental footprint is expected to be localized.

In the MFMR 's mariculture master plan (MFMR, 2012) it is stated that *"…availability of investment and development funding are preventing…"* growth of the mariculture sector. Therefore, investments into the mariculture sector need to be supported and strengthened. Furthermore, development of this sector is expected to complement marine capture fisheries which is under various natural and anthropogenic threats.

Often solutions to climate change and other social challenges exist; but they are rarely utilized to make real impacts. Real solutions are practical, flexible and adaptable to different situations and contexts. The real world and the human mindsets are triggered by practical solutions.

Usually, investors are prepared to invest in the mariculture sector; but are their efforts generally recognized and supported?

All stakeholders (GRN entities, port authorities, local authorities, NGOs, financial services providers, etc) need to recognize and support efforts by investors to invest in the emerging mariculture sector in Namibia. There is a need to do away with the bureaucratic administration processes; promote actions that transform behaviors, and invest into these resilient pathways for socio-economic and sustainable development.

CHAPTER 2

2. APPROACH AND METHODOLOGY

2.1. Introduction

This chapter provides the approach and methodology used to undertake the EIA. It also provides steps in the EIA procedures as guided by Environmental Impact Assessment Regulation of 2012 and the Environmental Management Act (no. 7 of 2007).

2.2. Desk studies and literature review

Desk studies and literature reviews were undertaken to gather facts, relevant background documents and information from literature and previous works about the site; gather information about similar services provided by other service providers; identify IAPs (affected and interested parties); document current and past use of the underwater hull cleaning technologies. All documents considered and the body of literature reviewed are provided in the bibliography.

2.3. Field surveys

Surveys were undertaken on 19-22 April 2022 by collecting water and sediment samples as well as planktons samples. Stations were selected using the stratified random sampling method. During the random sampling method stations were grouped mainly based on depths strata but also putting into consideration wind and current direction. The basis for this reasoning is because the impacts of the finfish cage mariculture activities will be influenced by depth, wind and current direction. A total of 17 stations were randomly selected and were broadly classified into category A (at >40 m depth) and B (at >40 m).

A detailed description of the field survey methods is provided in Schedule I.

2.4. Screening

Background Information Document (BID) was submitted to the ED (Executive Director) of MFMR to notify the ED that the Proponent is undertaking a full EIA as was recommended by MFMR. The application for Environmental Clearance Certificate was verified by the Environmental Commissioner and allocated an application number APP-003890. A notice was given to MEFT that the old APP-002735 should be cancelled and replaced with a new APP-003890.

2.5. Public consultation process

2.5.1. Public notices at public places

It was required by law (EIA regulations) for public notices to be placed at various places in Lüderitz and this was done during the EIA/Scoping exercise.

2.5.2. Written notices to key I & APs

In addition to public notices, key I & APs were identified and notified of the intention by the proponent to apply for the ECC.

2.5.3. Advert in newspapers

Notices were placed in 2 (two) local newspapers, according to the EIA regulations during the EIA/scoping.

2.5.4. Public meetings

Three (3) public meetings were held in Lüderitz, Walvis Bay and Swakopmund.

2.5.5 Release of draft reports

The draft EIA and Specialist reports were sent by email to key stakeholders. Hard copies were submitted to the Office of the ED (Executive Director) of the Ministry of Fisheries and Marine Resources in Windhoek on 21 June 2022.

2.6 Environmental impact assessment methods

2.6.1 Leopold matrix method

The Leopold matrix assessment was used in the evaluation of impacts. This is a qualitative environmental impact assessment method and it involves a series of stages including impacts prediction, description, and assessment as described below.

2.6.2. Valued ecosystem components

Project activities to be undertaken will have impacts on the essential physical, biological, and human components of the environment. These environmental components are well known as VECs (valued ecosystem components). The first requirement in the Leopold matrix was the identification of VECs as illustrated in the table below.

Table 1: valued ecosystem components (VECs).

Valued ecosystem component	Environmental resource	Potential impacts on the valued ecosystem component
Air and climate	Air quality	• Heavy diesel emission. • Health implications for all users. • Effects on ambient air and the atmosphere. • Main Sustainability issue: *is air pollution a critical concern locally?*
	Climate	• Greenhouse emission. • Contribution to global warming. • Main Sustainability issue: *is climate change a concern locally?*
Land, seabed and seascapes	Landscape Sediment Seascapes, canyon and seamounts	• Land sensitivity and conservation status. • Increase in turbidity and widespread sediment transportation. • Change in sedimentology and benthic ecology. • Solid waste disposal. • Oil and chemical spills. • Use of non-renewable energy. • Effects of waste disposal methods. • Risks of ships grounding or sinking. • Sustainability issues: *-Since the area is declared an EBSA, is the conservation and*

		ecological status of the area critically endangered and which human activities caused this? *-Which species are endangered or extinct and how many are introduced through mariculture activities?*
Ocean	Seawater quality	• Detritus in the form of fish feed waste and fish excreta. • Increased seawater turbidity. • Oil and chemical spills. • Pollution implications for ecosystem and marina fauna. • Sustainability issues: *-Is seawater pollution a critical concern locally?*
Ecology and aquatic biodiversity	Terrestrial ecology and aquatic biodiversity	• Effect of introduced species on NIMPA. • Introduction of bio-fouling organisms that accumulate on artificial structures and the probability of them being alien species. • Releases of ballast water containing invasive aquatic species and harmful pathogens. • Ship strike on marine megafauna. • Incidental entanglements of seals, cetaceans and birds in cages. • Importance for ecosystem well-being and proper functioning.
Human Environment	Socio-economic & biodiversity	• Impacts of maritime activities on other blue economic activities (e.g. fisheries and mariculture). • Employment opportunities. • Community welfare.
	Public health and safety	• Harmful algae blooms.

		• Introduction of toxic shellfish species. • Reduction on gas flaring.
	Noise pollution	• Underwater noise. • Influence on aquatic biodiversity. • Nuisance to local community and ecosystem.
	Light pollution	• Nuisance to local community and ecosystem. • Marine traffic accidents, theft and property damage.

2.6.3. 2.6.4. Impacts evaluation

During this stage in the Leopold matrix, impacts were evaluated in terms of importance to determine their significance on the receiving environment. Each impact was rated in terms of their level, duration, intensity, probability and significance as illustrated below.

2.7. Environmental impact assessment

Impacts were evaluated using the Leopodt Matrix by looking at environmental resource sensitivity and the scope and coverage of impact as well as their magnitude, probability and significance.

2.7.1. Sensitivity of environmental resources

SENSITVITY RATING		CRITERIA
1	Negligible	The environmental resource is resistant to impacts or has less environmental value.
2	Low	The environmental resource could either absorb impacts or is able to rebound its original state after the impacts, is of low environmental or social value or is of local importance.
3	Medium	The environmental resource is either unable to absorb impacts or after impacts is unable to rebound to original state, is of high environmental or social value, or is of national importance.
4	High	The environmental resource has moderate capacity to absorb impacts, has some environmental or social value, or is of regional importance.
5	**Very high**	The environmental resource has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental or social value, or is of international importance.

2.7.2. Magnitude of impacts

0	No observable impact
1	Low impact
2	Tolerable impact
3	Medium high impact
4	High impact
5	Very high impact

2.7.3. Duration of impacts

T	Temporary
P	Permanent

2.7.4. Geographic coverage

L	Localized impacts or limited to location
O	Impact of importance to municipality
R	Regional impacts
N	National impact
I	International

2.7.5. Probability

LP	**Low** probability (possibility of impact occurring is low, below 25%).
P	**Probable** (there is a distinct possibility that it will occur, approximately 50%).
HP	**Highly probable** (the impact is most likely to occur, 75%).
D	**Definite** (the impact will occur, 100%).

2.7.6. Significance

	ENVIRONMENTAL RESOURCE CHARACTERISTICS				
IMPACT SEVERITY **[Magnitude, duration, extent, probability]**	**Very high 5**	**High 4**	**Medium 3**	**Low 2**	**Negligible**
Very high 5	**Major [5/5]**	**Major [4/5]**	Moderate [3/5]	Moderate [2/5]	Minor [1/5]
High 4	**Major [4/5]**	**Major [4/4]**	Moderate [3/4]	Moderate [2/4]	Minor [1/4]
Medium 3	**Major [3/5]**	Moderate [3/4]	Moderate [3/3]	Minor [2/5]	None [1/3]
Low 2	Moderate [2/5]	Moderate [2/4]	Minor [2/5]	None [322]	None [1/2]
Negligible 1	Minor [2/5]	Minor [2/5]	None [3/1]	None [2/1]	None [1/1]

2.7.6.1. Mapping of significant impacts

The last stage was to provide a detailed evaluation of impacts as well as their summary evaluation, combining magnitude and importance. This summary evaluation highlighted significant impacts that should receive higher priority during impacts mitigation and was the basis for developing a sound EMP.

This was a critical stage during which Consultants were to probe issues in details, for example by asking the following questions:

- What are the project impacts and which VECs are more vulnerable?
- Which impact is most significant?
- Which impact should be prioritized during mitigation?
- Which impacts should be monitored and how?

2.8. Discussions, conclusions and recommendations

The above questions were very important in the designing of an effective EMP and implementation of the baseline environmental monitoring plan. As often argued in literature, EIA as an instrument for environmental management and sustainable development is not sufficient in evaluating development projects because it has weaknesses (Cashmore, 2004). These weaknesses include the fact that the scope of EIAs is limited when measured on a temporary scale. It merely provides a snapshot overview of baseline conditions of a development project and fails to consider indirect environmental impacts or cumulative impacts that may occur as a result of a development project during operation.

Therefore, to make up for this it is recommended that an EMP and baseline environmental monitoring plan should be prepared and submitted along with the EIA/scoping report.

CHAPTER 3

3. ENVIRONMENTAL POLICIES AND LEGISLATIONS

3.1. Introduction

MFMR is the Competent GRN authority both for regulating and promoting development of mariculture in Namibia and has since 2001 created an enabling environment for sustainable development of this sector. Mariculture has a potential to significantly contribute to economic development in Namibia, as reflected in key strategic documents including Vision 2030.

Mariculture development is guided by the National Aquaculture Policy (2001), the mariculture Act (2000) and the Namibian Aquaculture Strategic Plan (2004) – all of which promote and regulate the aquaculture industry to ensure the sustainable utilization of coastal and marine resources as well as the protection and conservation of ecosystems and resources.

MFMR has developed the Aquaculture Master Plan (2013-2023) to direct mariculture development in Namibia. Key actions identified are:

- The implementation of the National Shellfish Sanitation Programme;
- Promotion of environmental sustainability and the creation of an enabling legislative, regulatory and policy environment which emphasizes the national need for the improvement;
- Enhancement of the current Water Quality Monitoring Programme;
- Establishment of a National Aquatic Animal Health and Biosecurity Plan, and
- Establishment of Radiation Management Plans (RMPs) in research laboratories.

Other measures to protect the marine environment includes:

- Environmental monitoring;
- Environmental impact assessments;
- Research and standards setting;

- Responsible mariculture and the development of standards for aquaculture practices and animal health, and
- Certification systems for the health and safety of mariculture products and the quality of fingerlings, spats and feeds.

While this report acknowledges that local policies and legislations are the most relevant in this project, it is also important to note that mariculture strictly adhere to international standards that are guided by international laws and Conventions.

Furthermore, this report argues that not all environmental policies and legislations are regarded as constituting environmental law. An important question is whether specific environmental policies and legislations would qualify as constituting environmental law merely based on relevance or potential relevance to environmental management. In this regard, environmental policies and legislations could be classified into broad categories as described in below.

Table 4: classification of environmental policies and legislations.

Category	**Example**
a) *Exclusive environmental policies and legislations* aim exclusively at environmental management and contain specific environmental principles.	**Soil Conservation Act 76 of 1969**. The environmental principle specific to this Act is *conservation of natural resources.* **Pollution Control and Waste Management Bill**. The environmental principle specific to this Bill is *pollution control.* **Environmental Management Act no. 7 of 2007**, etc. This Act covers a broad range environmental principle including *conservation, pollution, environmental protection and monitoring,* among others.
b) Environmental policies and legislations that *predominantly* contain environmentally specific principles are formulated to promote an environmental object and predominantly contain environmental specific norms, but they also have other provisions.	For example, the **Animal Health Act 1 of 2011** predominantly deals with *prevention, monitoring* and *contro*l of animal diseases in order to protect public health but it also has other provisions (such as trade) that are not relevant to the environment.

c)	Environmental policies and legislations that *incidentally contain* environmental specific principles. These policies and legislations are not necessarily directed at environmental management but include provisions that may be contribute thereat.	The **Water Act no. 12 of 1997** incidentally cites terms such as *"more efficient use and control water resources"* because the Act itself mainly deals with establishment of the Namibian Water Co-operation Limited.
d)	Environmental policies and legislations with *indirect environmental relevance*. Often, these policies and legislations are not aimed at environmental management, but they include provisions that are indirectly of environmental significance.	E.g. the **Urban and Regional Planning Act no.** 5 of 2018 indirectly relates to marine spatial planning which will be critical in coastal land use planning during development of the Namibia blue economy.
e)	Environmental policies and legislations with *potential environmental relevance.* These policies and legislations are not aimed at environmental management, but includes provisions that are potentially of environmental significance.	E.g. **Appropriation Act no. 1 of 2017.** **Income Tax Act no. 24 of 1981.** **Land Tenure Act no. 32 of 1966.**
f)	Environmental policies and legislations which regulate *environmental exploitation* are aimed at promoting development of natural resources such as minerals, fisheries, tourism, etc.	E.g. **Marine Resources Amendment Act no. 9 of 2015**. **Mineral (Prospecting and Mining) Act 33 of 1992**.
g)	Environmental policies and legislations with *no environmental relevance.*	**Labor Act 11 of 2007.**

3.2. Degree of relevance

It is appropriate to examine which of the above environmental policies and legislations would qualify as environmental laws. Environmental policies and legislations of categories *a)* and *b)* explicitly constitute environmental law while the last category *(g)* fall outside environmental law. Category *(c)* retains some characteristics of environmental law, although it also constitutes some provisions which seeks to further some other causes. Purely exploitive (category (f)) does not constitute environmental law, but if such policies and legislations are found to constitute environmental principles which promote environmental management, they could be qualified as environmental law.

The interesting question is whether category *(d)* and *(e)* should be recognized as environmental laws. The environmental significance of these legislations and policies only become relevant when they are interpreted to serve the cause of environmental protection. This means they are neutral; and are often silent when it comes to environmental protection. Therefore, when misinterpreted in courts, they could be used to harm the environment.

3.3. Local environmental policies and legislations

Below are some of the relevant local environmental policies and legislations:

- Aquaculture Act (no. 18 of 2002);
- Regulations under the Marine Resources Act relating to the Namibian Islands' Marine Protected Area (NIMPA) (No. 316 of 2012);
- Regulations no. 17 relating to the import and export of Aquatic organisms and Aquaculture Products (made under section 43 of the Aquaculture Act, 18 of 2002).
- Environmental Assessment Regulations GN. 30 of 2012;
- Conservation of Biotic Diversity and Habitat Protection Policy of 1994;
- Environmental Management At (no. 7 of 2007);
- Public Health Act 36 of 1919 (as Amended by South-West Afric), prior to 1990;
- Constitution of the Republic of Namibia (and First Amended Act 34 if 1998, Second, and Amended Act 7 of 2010 and Third Amended Act 8 of 2014), and

Some of the environmental policies and legislations are summarized below.

3.3.1. Regulations under the Marine Resources Act relating to the Namibian Islands' 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 this 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,
- 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 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 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.
- Mariculture operations may be conducted provided they do not obstruct the passage of the Heaviside's dolphins and African penguins in Guano Bay.

3.3.2. Environmental Impact Assessment Regulations GN. 30 of 2012

The below is a summary of some of the regulations.

3.3.2.1. Duties of the proponent

According to *regulation 3*, it is the duty of the proponent to appoint independent Consultants who will guide in the EIA process. The regulations further require the proponent to provide information needed to complete the EIA and also ensure that the EIA procedures are followed

3.3.2.2. Appointed Consultants

Appointed Consultants should (*regulation 4*) have sufficient knowledge and experience in conducting EIAs as well as knowledge of the Act and relevant activities involved in the proposed project.

3.3.2.3. Public consultation process

According to *regulation 21*: *"The person conducting a public consultation process must give notice to all potential interested and affected parties of the application which is subjected to public consultation by:*

> *(a) fixing a notice board at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is or is to be undertaken;*

(b) giving written notice to: (i) the owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site;

(ii) the local authority council, regional council and traditional authority, as the case may be, in which the site or alternative site is situated;

(iii) any other organ of state having jurisdiction in respect of any aspect of the activity.

(c) advertising the application once a week for two consecutive weeks in at least two newspapers circulated widely in Namibia.

3.3.2.4. Regulations on affected and interested parties

According to *regulation 22*, ECUTS must open and maintain a register which contains the names and addresses of:

(a) all persons who, as a consequence of the public consultation process conducted in respect of that application, have submitted written comments or attended meetings with the applicant;

(b) all persons who, after completion of the public consultation process referred to in paragraph (a), have requested the applicant responsible for the application, in writing, for their names to be placed on the register; and

(c) all organs of state which have jurisdiction in respect of the activity to which the application relates. An applicant responsible for an application must give access to the register to any person who submits a request for access to the register in writing.

3.3.3. Namibia's Environmental Assessment Policy

Amongst others, this policy:

- Promotes sustainable development;
- Underscores the need to undertake EIAs for all development projects in Namibia;
- Encourages developers to practice 'reduction at source' in pollution control and waste management;
- Lists and describes all activities that require EIA;
- Describe the EIA process, and
- Stresses on the need to incorporate international accepted environmental norms.

3.3.3. Namibia Climate Change Policy

The National Climate Change Policy (NCCP) guides on how climate should be mitigated in Namibia. The NCCP shows 16 key climate change issues including:

- Sustainable energy and low carbon development;
- Technology development and transfer;
- Biodiversity and ecosystem services;
- Prioritize climate risk and integrate them into sectoral policies, and
- Sustainable development and ensuring environmental sustainability.

3.3.4. Other local environmental policies and legislations

The list of local environmental policies and legislations which are summarized below are not in any order of importance.

Table 5: list of local environmental policies and legislations.

Legislation	**Summary**	**Environmental principles**
Soil Conservation Act 76 of 1969	This act consolidates and amend the law relating to the combating and *prevention of soil erosion, the conservation, improvement and manner of* using the soil and vegetation and *the protection of water sources* and provide for matters incidental thereto.	Environmental principles specific to this Act are *conservation of soil.*
Pollution Control and Waste Management Bill	This Act promote sustainable development; to provide for the establishment of a body corporate to be known as the Pollution Control and Waste Management Agency; to prevent and regulate the discharge of pollutants to the air, water and land; to make provision for the establishment of an appropriate framework for integrated pollution prevention and control; to regulate noise, dust and odor pollution; to establish a 'system of waste planning and management; and to enable Namibia to	The environmental principle specific to this Bill is *pollution control.*

	comply with its obligations under international law in this regard.	
Environmental Assessment Policy (1995)	This policy aims to promote sustainable development and economic growth while protecting the environment in the long term. Therefore, Sector Ministries, the Private Sector, NGOs, and prospective investors and donors are urged to comply with this policy for all future development projects, programs and policies.	To use natural resources in a sustainable way for future purposes.
Land Use Planning Towards Sustainable Development Policy (1994)	This policy facilitates appropriate land-use planning and subsequent land use, support the process of consultation with appropriate institutions to ensure that local communities are involved in all decision-making process and ensure that they get maximum sustainable benefit from the land and natural resources with which they are associated and upon which they depend.	Environmental principles of this policy include sustainable and integrated planning of land use in all environments throughout Namibia.
Territorial sea and exclusive economic zone of Namibia Act 3 of 1990	This Act determines and defines the territorial sea, internal waters, contiguous zone, exclusive economic zone and continental shelf of Namibia and to provide matters incidental thereto.	Minimize the exploitation of fisheries and marine resources.

Namibia Ports Authority Act 2 of 1994	To provide for the establishment of the Namibia Ports Authority to undertake the management control of ports and lighthouse in Namibia and the provision of facilities and services related thereto.	To manage and exercise control over the operation of ports and lighthouse and other navigational aids in Namibia and its territorial waters.
Aquaculture Act 18 of 2002	This Act regulate and control aquaculture activities; to provide for the sustainable development of aquaculture resources; and to provide for related matters.	Environmental principles of this act are to promote sustainable aquaculture; management, protection and conservation of marine and inland aquatic ecosystems.
Environmental Management Act no. 9 of 2007	This Act covers a broad range environmental principle including *conservation, pollution, environmental protection and monitoring,* among others.	*Prevent or minimize negative environmental impacts, pollution, function of the ecological systems.* *Reduce, reuse and recycle.*
Animal Health Act 1 of 2011	This Act predominantly deals with *prevention, monitoring* and *contro*l of animal diseases in order to protect public health but it also has other provisions (such as trade) that not relevant to the environment.	To *prevent* and *control animal diseases* in public and environment
Water Act no. 12 of 1997.	This Act incidentally cites terms such as *"more efficient use and control water resources"* however the Act itself mainly deals with establishment of the Namibian Water Co-operation Limited.	To *use* water in a *sufficient* or *sustainable* way
Marine Resources Amendment Act no. 9 of 2015.	This act provides for the sovereign exercise of ownership by the State over marine resources; to amend the provisions relating to the total allowable catch and allocation of quotas	Principles of this act is to manage, *protect, harvest* and *utilize marine resources* in Namibia.
Minerals (Prospecting and Mining) Act 33 of 1992	To provide for the reconnaissance, prospecting and mining for, and disposal of, and the exercise of control over,	To protect minerals by ensuring that all mining activities in Namibia are

	minerals in Namibia; and to provide for matters incidental thereto.	licensed. No specific environmental principles but it is important to environmental management.
Atmospheric Pollution Prevention Ordinance 11 of 1976	To provide for the prevention of the pollution of the atmosphere	To prevent atmospheric pollution and *minimize environmental impacts* associated with it.
Water Resources Management Act 11 of 2013	To provide for the management, protection, development, use and conservation of water resources; to provide for the regulation and monitoring of water services and to provide for incidental matters.	Manage *water resources, prevent water pollution* and *control water storage* and provision.
Public and Environmental Health Act 1 of 2015	To provide a framework for a structured uniform public and environmental health system in Namibia.	Principles of this act includes protecting individuals and communities from public *health risks*, encourage community participation in order to create a *healthy environment*; and provide for early detection of diseases and public *health risks*.
National Climate Change Policy	This policy identifies technology development and transfer to be a key issue for which strategies and action plans should be developed.	Promote and encourage new and clean technologies to be developed in order to reduce greenhouse gas emissions.
Namibian Constitution (1990)	The constitution is the Supreme Law of Namibia, according to which all other laws are only valid if they are consistent with the rights contained within the Constitution	Specifically, Article 95 promotes welfare of the people and the environment.

3.4. International environmental policies and legislations

3.4.1. UN Stockholm Conference (1972)

The UN Stockholm Conference (1972) was the first world conference on the environment. It contains 26 principles which could be broadly classified into 3 categories: (a) global environmental assessment; (b) environmental management activities and (c) international measures to support assessment and management activities.

3.4.2. United Nations Convention on Law of the Sea

UNCLOS of 1982 was formulated to provide a legal framework for marine and maritime activities. Namibia and other 167 countries are party to the convention. UNCLOS guides on how each coastal state should delineate maritime boundaries, guard and control marine resources.

3.4.3. UN Conference on Environment and Development

The Rio Conference of 1992 sets goals aimed at addressing environmental problems. It was at the Rio Conference where the plan of action well known as *Agenda 21* was adopted. *Agenda 21* was reviewed continually through annual meetings of the Commission on Sustainable Development, including the 1997 UN General Assembly Special Session (otherwise known as the ***Rio+5***) and the World Summit on Sustainable Development (also known as the ***Rio+10***).

Table 6*:* list of international environmental policies and legislations.

Legislation	**Summary**	**Environmental principles**
2011 Guidelines for the Control and Management of Ship's Biofouling to minimize the Transfer of invasive Aquatic Species.	These guidelines are intended to provide a globally consistent approach to the management of biofouling, which is the accumulation of various aquatic organisms on ships' hulls	Prevent the transfer of invasive and coordinating a timely and effective response to invasions which requires cooperation and collaboration among governments.
Stockholm Convention on Persistent Organic Pollution (2001)	This a global treaty to protect human health and the environment from chemicals that remain intact in the environment for longer periods.	To protect human health and the environment from persistent organic pollutants.

Vienna Convention for the protection of ozone layer (1985)	This Convention is aimed to promote cooperation among nations by exchanging information on the effects of human activities on the ozone layer.	To take control actions to protect the ozone layer.
Montreal protocol (1997)	Is a global agreement to protect the earth's ozone layer by phasing out the chemicals that deplete it.	Control substances and chemicals production that are depleting the ozone layer.
UN Framework on climate change (1992)	This framework was introduced to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system.	Countries should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.
Kyoto protocol (1997)	It is also designed to assist countries in adapting to the adverse of climate change. It facilitates the development and deployment of technologies that can help increase resilience to the impacts of climate change.	Reduce GHG emission at least by 18%.
Basel Convention (1992)	To protect human health and the environment against the adverse effects of hazardous wastes.	Reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes.
Convention on International Trade in Endangered Species of Wild Faunal and Flora (1963)	It is an international agreement between governments which is aimed to ensure that international trade in specimens of wild animals and plants does not	Control and regulate the trade of wild animals and plants between countries and protect them from over-exploitation.

	threaten the survival of the species.	
Cartagena Protocol on Biosafety (2000)	International agreement which aims to ensure the safe handling, transport and use of modified living organisms resulting from modern biotechnology that may have an adverse effect on biological diversity, taking also into account risks to human health.	It seeks to protect biodiversity from the potential risks of living modified organisms (LMOs) resulting from modern biotechnology.
Conventions on Wetland of International Importance (1971)	Conserving wetlands (swamps, marshes, lakes, mudflats, peat bogs and other bodies of water whether natural or artificial, permanent or temporary).	This convention establishes a management framework aimed at conserving the wetland and ensuring its wise use.
Paris Agreement (2015)	Is a legally binding international treaty on climate change.	To limit global warming to preferably 1.5 degrees Celsius, compared to pre-industrial levels.
United Nations Convention on Law of the Sea of 1982 (UNCLOS).	It's a legal framework for marine and maritime activities. It lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources.	It provides that coastal States have sovereign rights in a 200-nautical mile exclusive economic zone (EEZ) with respect to natural resources and certain economic activities, and exercise jurisdiction over marine science research and environmental protection.
International Convention for the Control of and Management of Ships' Ballast Water and Sediments of 2004.	This Convention seeks to prevent the spread of harmful aquatic organisms from one region to another, by the establishment of standards and procedures for the management and control of	Environmental principles of this convention protection of the oceans from invasive aquatic species

	ships' ballast water and sediments.	
International Convention for the Prevention of Pollution from Ships (MARPOL) and the protocol of 1978.	This convention is aimed at the prevention of pollution from ships caused by operational or accidental causes.	Prevention of pollution by sewage, oil and garbage from ships in the sea, Prevention of air pollution from ships and prevent pollution by Harmful Substances carried in sea in packaged form.
Convention on the Prevention of Marine Pollution by dumping of wastes and other matters, 1972 (as amended by the protocol of 1996).	This convention protects the marine environment from human activities such as pollution.	Take practicable steps to prevent pollution of the sea, promote the effective control of all sources of marine environment caused by dumping at sea; (black and grey list).
International Convention on Oil Pollution Preparedness, Response and Co-operation of 1990 (OPRC Convention) with its Protocol of 2000 (OPRC-HNS Protocol).	Convention was developed by the International Maritime Organization (IMO) to further prevent pollution from ships and it requires coastal states to prepare and response to oil spills risks.	Convention compels states to carry onboard oil pollution emergency plan in order to effectively respond to oil pollution incidents.
Internal Convention on Biological Diversity	Among others, this Convention aims at conservation of biological diversity and promote sustainable development of biological components.	Conservation of biological diversity, sustainable use and equitable sharing of utilization of biodiversity, ecosystem assessment and monitoring and mitigation of adverse environmental impacts.
International Convention on the Control of Harmful Anti-fouling Systems on Ships (2001)	The convention prohibits the use of harmful organotin in anti-fouling paints used and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.	It is preferable to minimize the accumulation of biofouling on vessels and movable structures.

3.5. Discussions, conclusions, and recommendations

A major challenge in the field of environmental law are environmental legislations and policies that cut across divisional laws. This is because they constitute provisions for regulating other (traditional) fields of law other than the field of environmental law. Even more important, these pieces of legislations and policies are multiple and evolved compared to novel environmental legislations and policies. For example, policies and laws that regulate traditional documentations (e.g. identification document, birth certificate, passport, driver's license, vehicle license, fishing permits/licenses, exclusive prospective license, permit to import/transport live animals and others) are well obeyed compared to novel environmental permits (e.g. ECC, water discharge and abstraction permits, etc). This is a challenge to authorities and the judiciary system when litigating court cases and it raises a critical question: *is there a need for establishment of environmental courts in Namibia?*

When analyzed in terms of the coastal environment, where different economic sectors operate within a limited space, the above challenge is even more overwhelming. With increase in blue economy activities, there is a need for a blue economy policy in Namibia which will harmonize economic sectors operating within the coastal and marine environments.

CHAPTER 4

4. PROJECT DESCRIPTION

4.1. Introduction

The proposed farming technology is the submersible cage. This choice of technology was selected taking into consideration the local environment. Waters off Lüderitz are rich in nutrients due to persistent upwelling; which is good but this also present a challenge of biofouling organisms. Submersible fish cages will be an ideal technology in order to avoid clogging caused by biofouling organisms (such as mussels, barnacles, tunicates, jellyfish infestation, seaweeds, etc).

Submersible cages will be built with a rigid frame; allowing them to freely move up and down via a hydraulic system created by properties of 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.

4.2. Site description

During the project alternative, it was explained that this site was selected because of its location away from bird islands. Additionally, the site does not overlap with fishing grounds or spawning areas of the Rock lobster and line fish resources. Furthermore, there is a Blue Kelp Array farm experimental site as shown in the map and effluent or organic waste generated from the proposed farm could help the kelp grow faster. This means the two activities could complement one another.

However, the site is located within ML (mining licence) area which belongs to Diamond Field Resources (PTY) LTD and the proposed farm may negatively affect future diamond mining activities. The Proponent had been engaging the Project Manager at Diamond Field Resources (PTY) LTD. Initially, Diamond Field Resources (PTY) LTD proposed to the proponent 4 stations but station 2 and 3 were too shallow. Discussions are at an advanced stage with Diamond Field Resources (PTY) LTD to allocate the most ideal location around station 1 and 4.

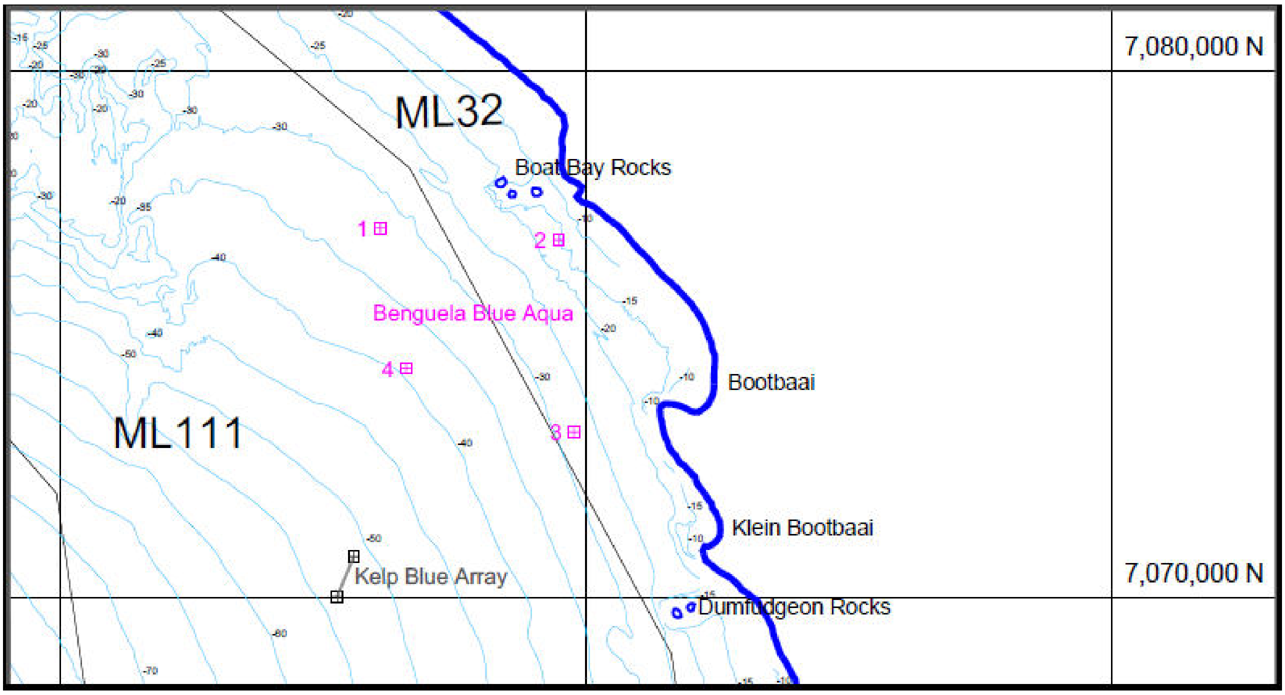

Figure 2: proposed site indicating 4 stations proposed as well as kelp experimental area (source: Diamond Field Resources (PTY) LTD).

4.3. Fish cage structure and specifications

The cages will 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 will be equipped with a movable cover fitted with a net to sort out the fish for harvesting. The service crane for operation and maintenance will be operated from the service vessel.

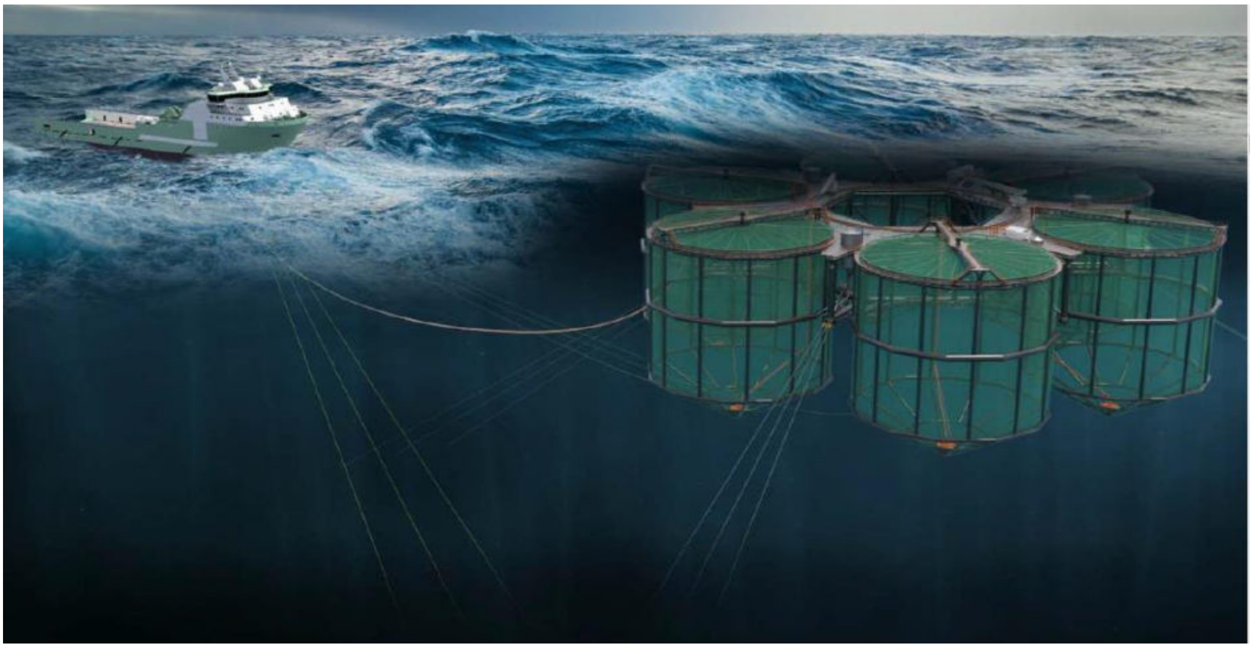

Figure 3**:** submersible cages operating in rough sea conditions (BW FishFarm, 2021).

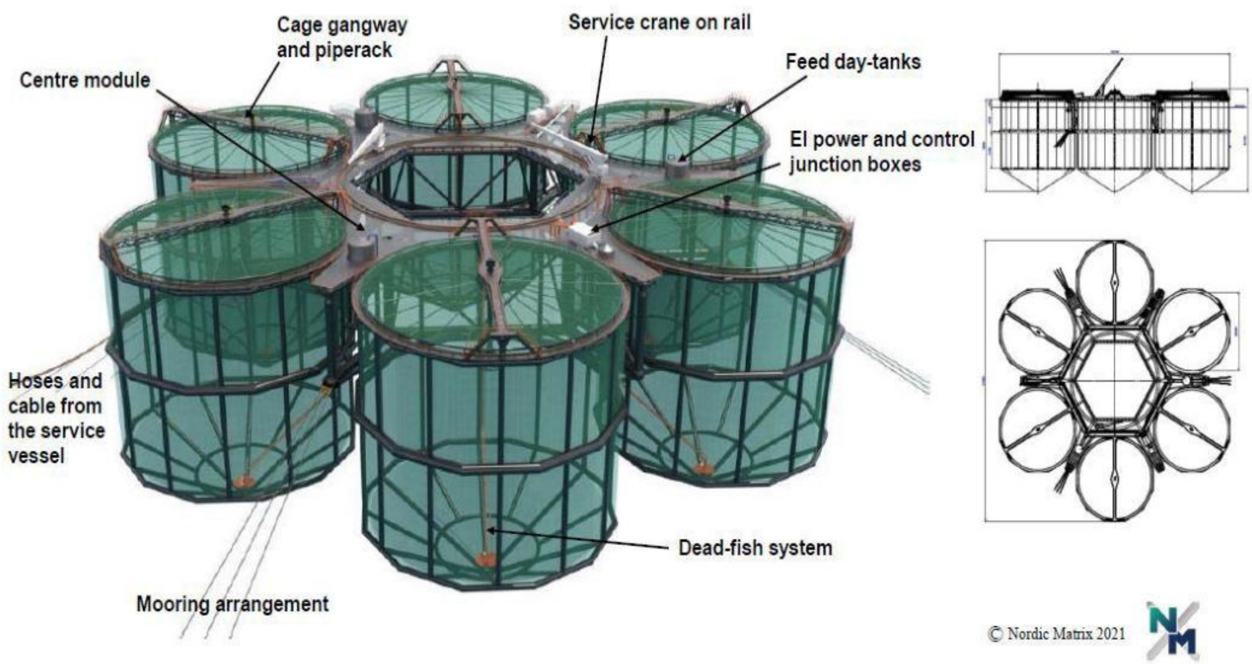

Figure 4: illustration of the selected fish cage structures and specifications developed by BW Fish Farm (BW Fish Farm, 2020).

4.3.1. 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 site. 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. To anchor the cage clusters safely to the seabed, BW Fish Farm (2021) has designed, according to international standards, a structure which has a spread mooring arrangement appearance.

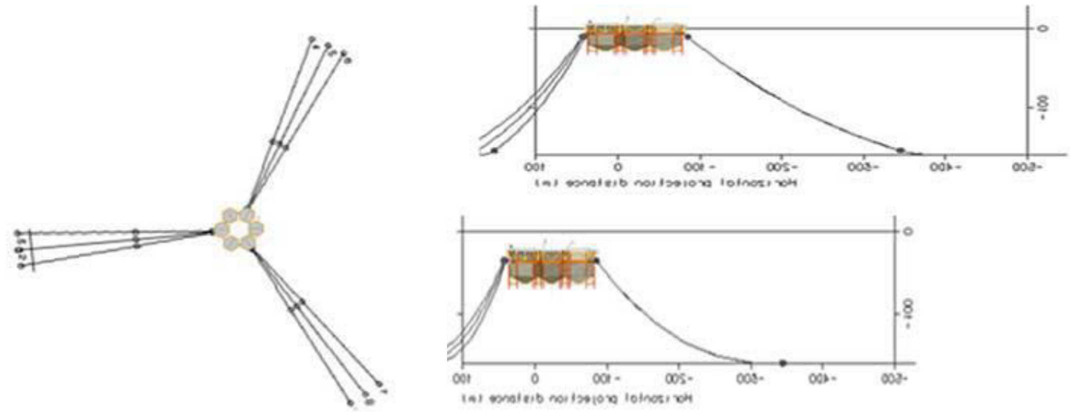

Figure 5**:** The mooring arrangement per cage cluster to the seabed (BW FishFarm, 2021).

4.4. 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 water treatment units (filters, oxygenators, heating and cooling). It will also include a fish processing, freezer facility, storage and an administration block.

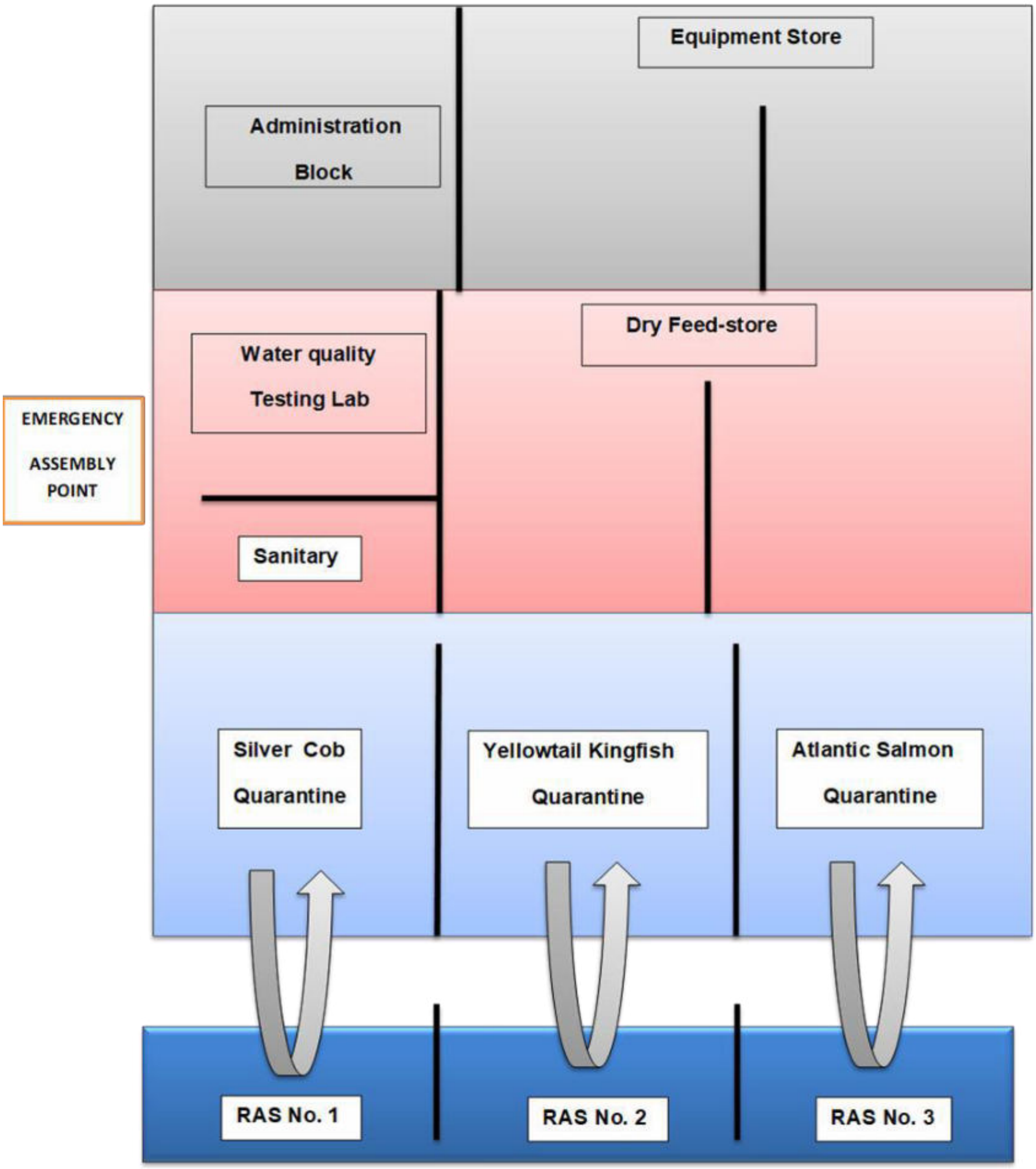

Figure 6: Schematic presentation of the onshore facility.

4.5. Offshore farm concept

4.5.1. Offshore proposed farm layout

Figure 7 shows a bird's eye view of the fin fish farm layout of a cage cluster.

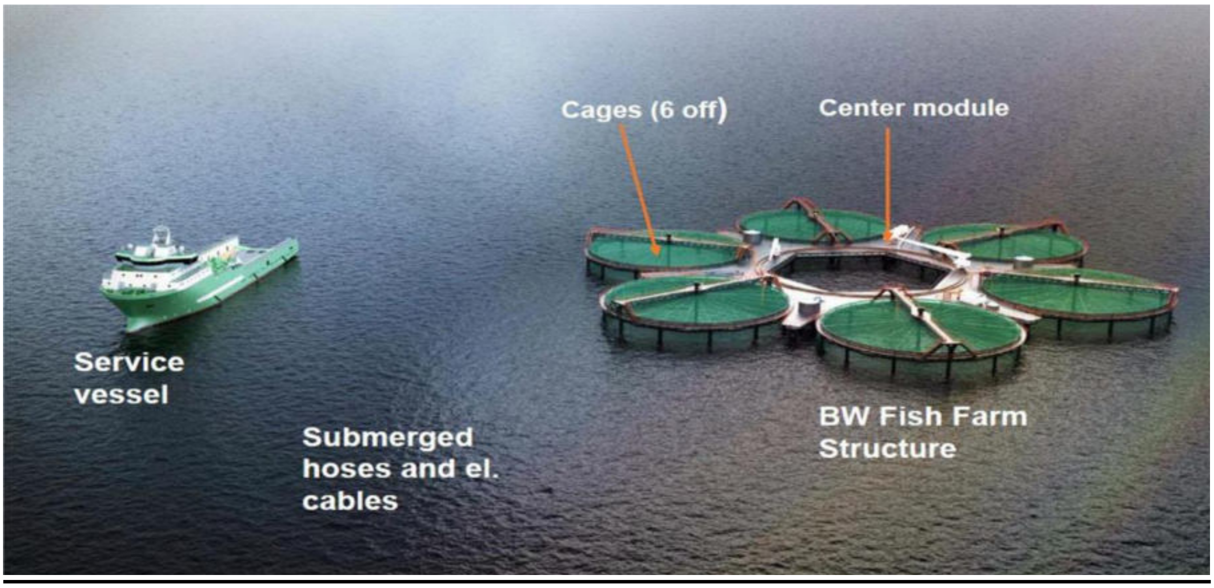

***Figure 7*:** Bird's view of the offshore farm.

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 during phase 1 and 6 sub-units in phase 2 for each fish species.

The fish species cluster cages will be located 250 m apart to ensure each fish species is well managed.

4.5.2. Phase 1 offshore cage layout and installation

Three (3) fish cage clusters, each with 4 sub-units, will be deployed for yellowtail kingfish, Atlantic salmon, and silver cob as schematically illustrated in ***figure 8***. The Center module is operated from the service vessel for feeding, cleaning, and harvesting. Three (3) cluster cages are to be positioned in series perpendicular to the current (250 m apart) to ensure that each cage cluster has a constant flow-through of fresh oxygenated seawater.

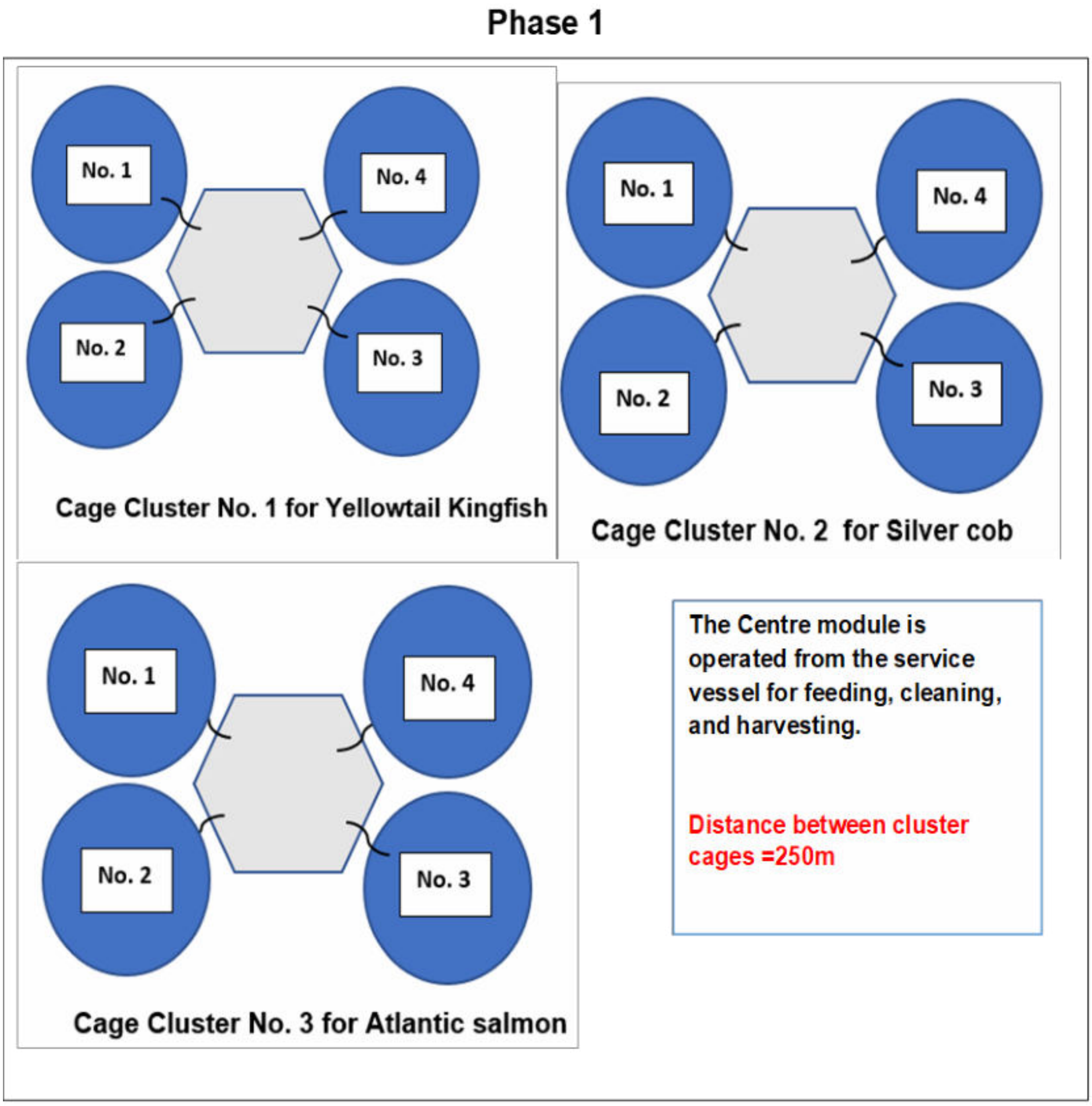

Figure 8: Phase 1 schematic presentation of the fish cage installation layout offshore.

4.5.3. Phase 2 design

Phase 2 (***figure 9***) will be an extension of phase 1 layout (***figure 8*****).** In Phase 2, 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**.**

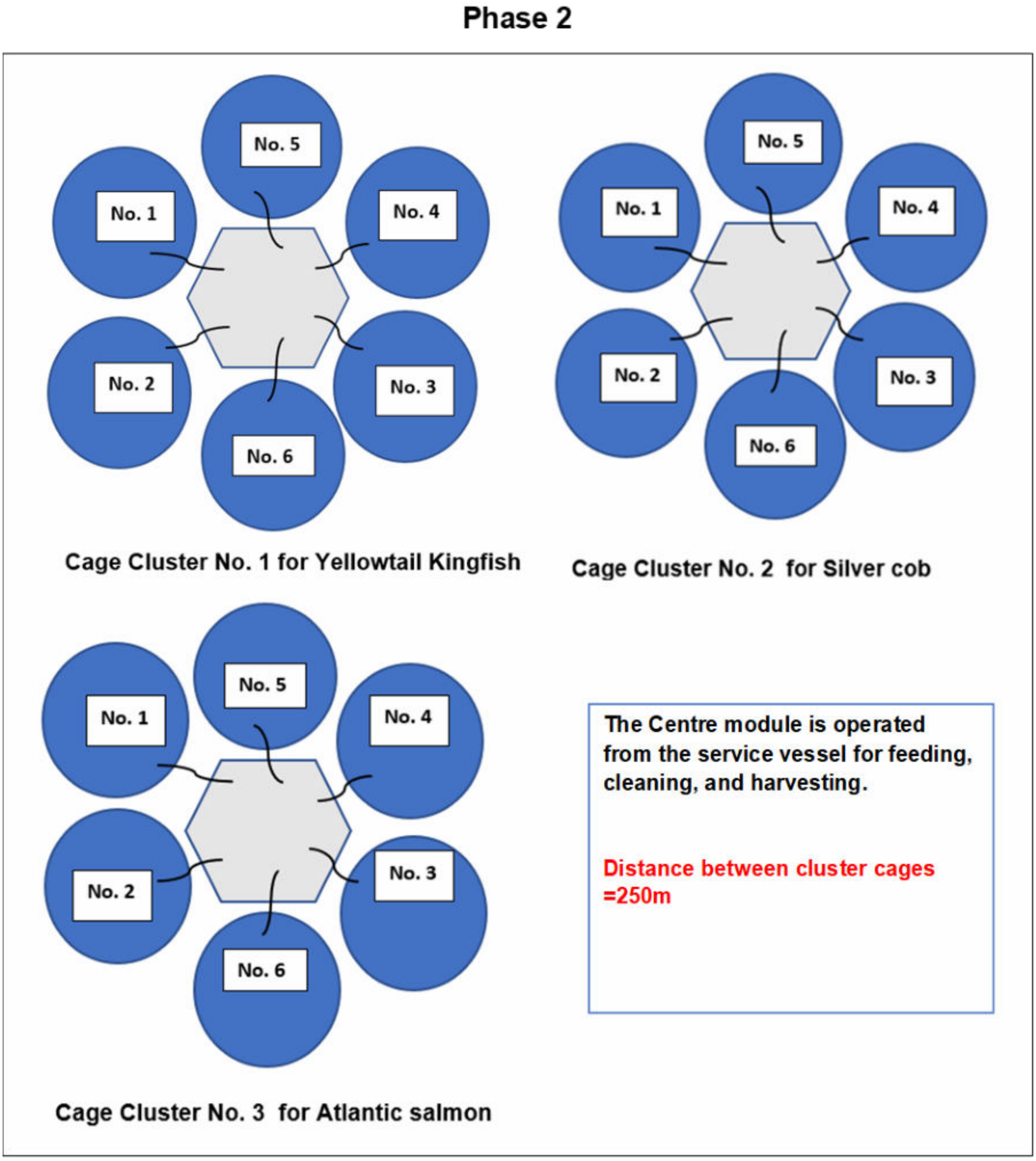

Figure 9**:** Phase 2 schematic presentation of the cage layout and installation.

4.5.4. Phase 1 and 2 cage production capacity

For Phase 1:

- **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**:**

- 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.

4.5.5. Future expansion

After 8-10 years of operation (pending on maximum capacity having been reached), phase, 1 and 2 will 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 250 ha 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 tones for each species respectively.

4.6. Husbandry

The proposed Finfish Cages Farm will also incorporate several enhanced farm management measures including good husbandry practices, dedicated staff tasked with fish nutrition, fish health and biosecurity, the use of biological and physical application to ensure cleaner fish, water treatments and hydrolyses where it is appropriate.

4.7. Production cycle

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. 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.

4.8. Stocking

A functional boat referred to as a well-boat 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.

Before transport, fingerlings will be pre-conditioned in tanks with sufficient aeration and water drips for 1 or 2 days. The fish will be deprived of food during this stage to clear their digestive tracts. This minimizes fouling of the transport system and reduces oxygen consumption. Fish will be 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.

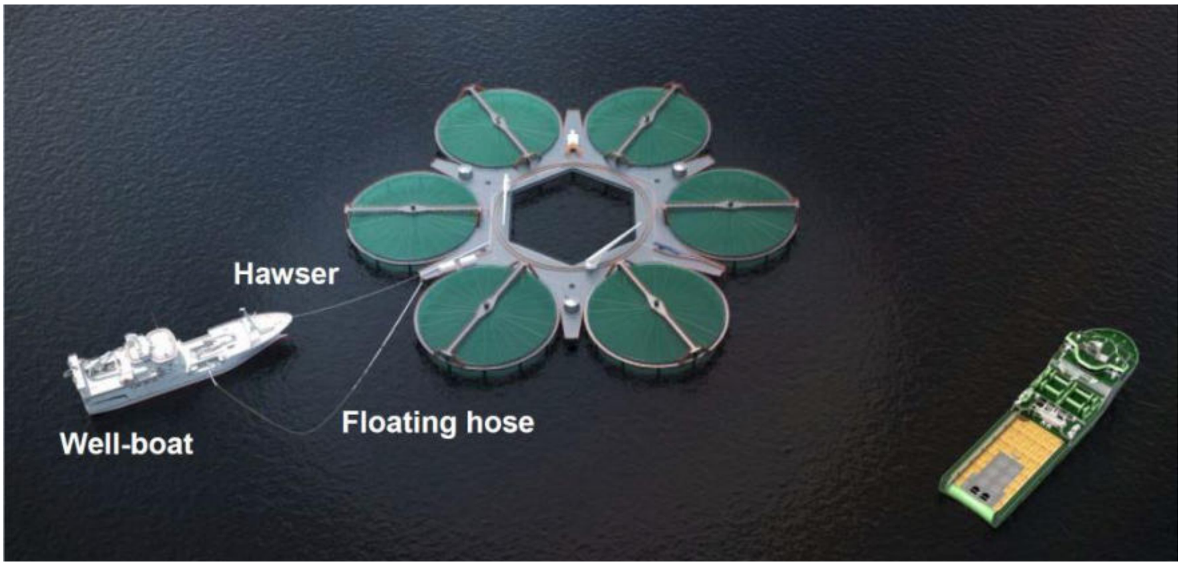

***Figure 10*:** stocking with a well-boat or a 'pituya' (RHS) for larger quantities (BW FishFarm, 2020).

4.8.1. Feed barge, feeding system and Sea Spine

The feed barge would be fully automated, with a feed capacity of 600 tonnes. The barge could 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 (***figure 11***). 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.

The Proponent is working with leading feed suppliers in South Africa (East London, Eastern Cape) to source the highest quality feed. Aqua Management Technologies (AMT) is a reputable fish feed producer providing fish feed to current and emerging aquatic farmers. The feed is manufactured under contract in the AVI Products ISO 22000 approved factory in Cato Ridge, South Africa. All accreditation certificates can be provided as required.

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 ***Figure 11*** 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 minimized a FCR of 1:1.2 can be achieved.

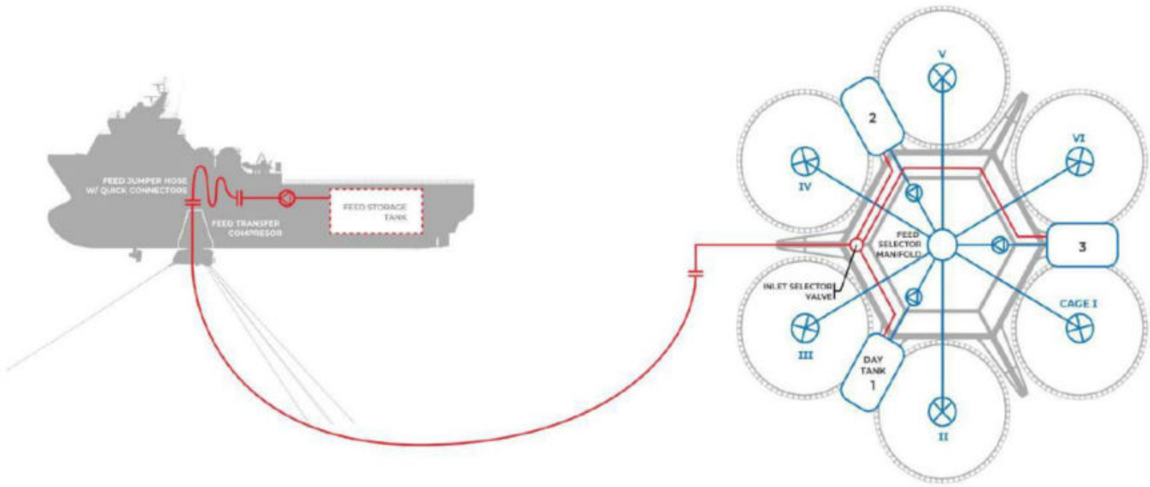

Figure 11: Feed barge and feeding system designed by BW Farm (BW FishFarm, 2020).

4.8.2 Sea Spine

A Sea Spine 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.

4.8.3. 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.

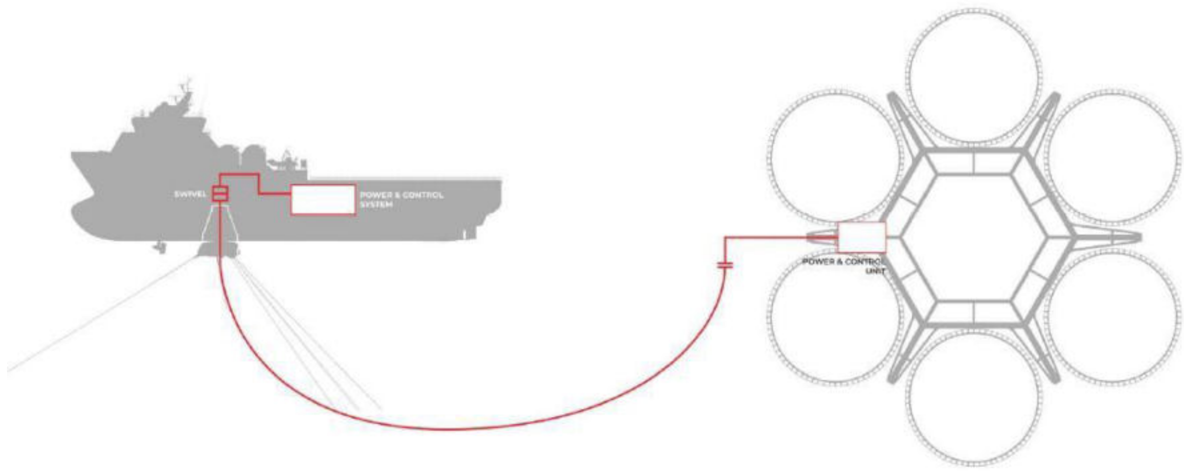

Figure 12: power and control system operated from the Service Vessel to each cage cluster (BW FishFarm, 2020).

4.8.4. 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 hose, 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.

4.8.5. 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 ***Figure 13.***

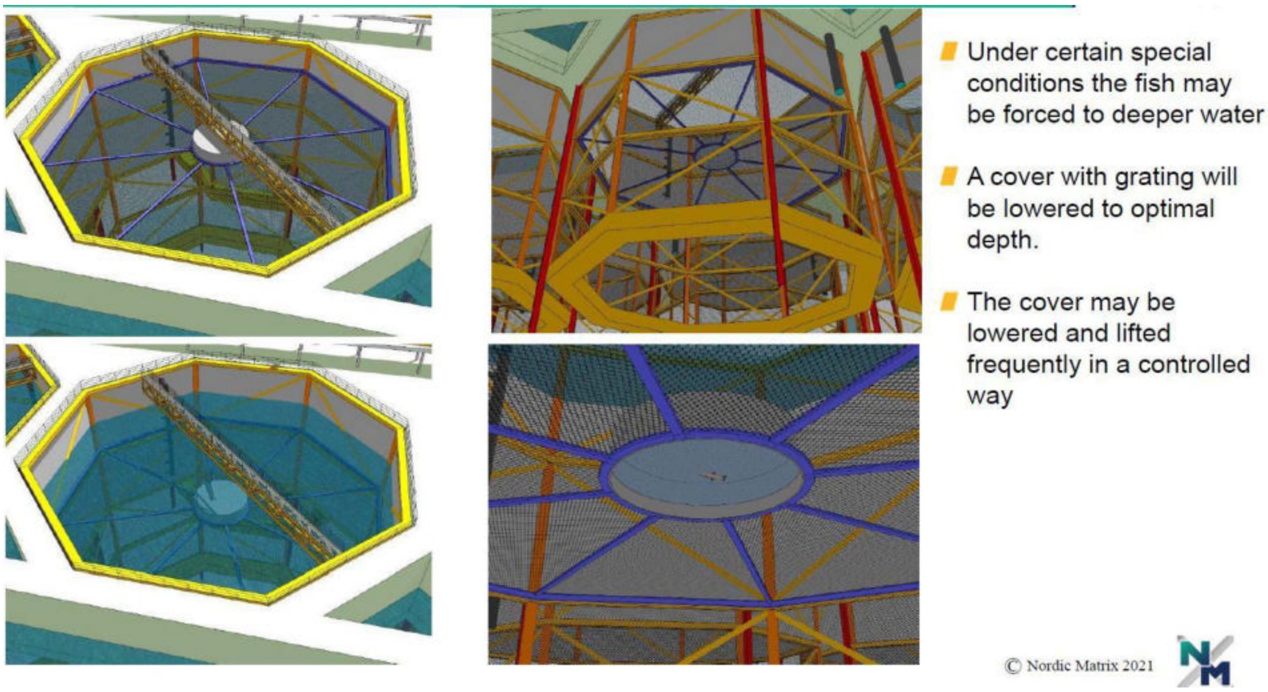

Figure 13: Movable cover for harvesting designed by BW Offshore Farm (BW FishFarm, 2020).

Fish will be transported live 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 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.

4.9. Farming management

4.9.1. Fish health and welfare

Benguela Blue Aqua 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 contract 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 Sea Spine is designed to allow the Proponent 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.

4.9.2. Mortalities

Dead fish are collected in the centre 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 ***figure 14.*** 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.

The Proponent's management will ensure that the contractor complies with the relevant aquaculture waste management regulations. BB Aqua 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), BB Aqua 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. When 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.

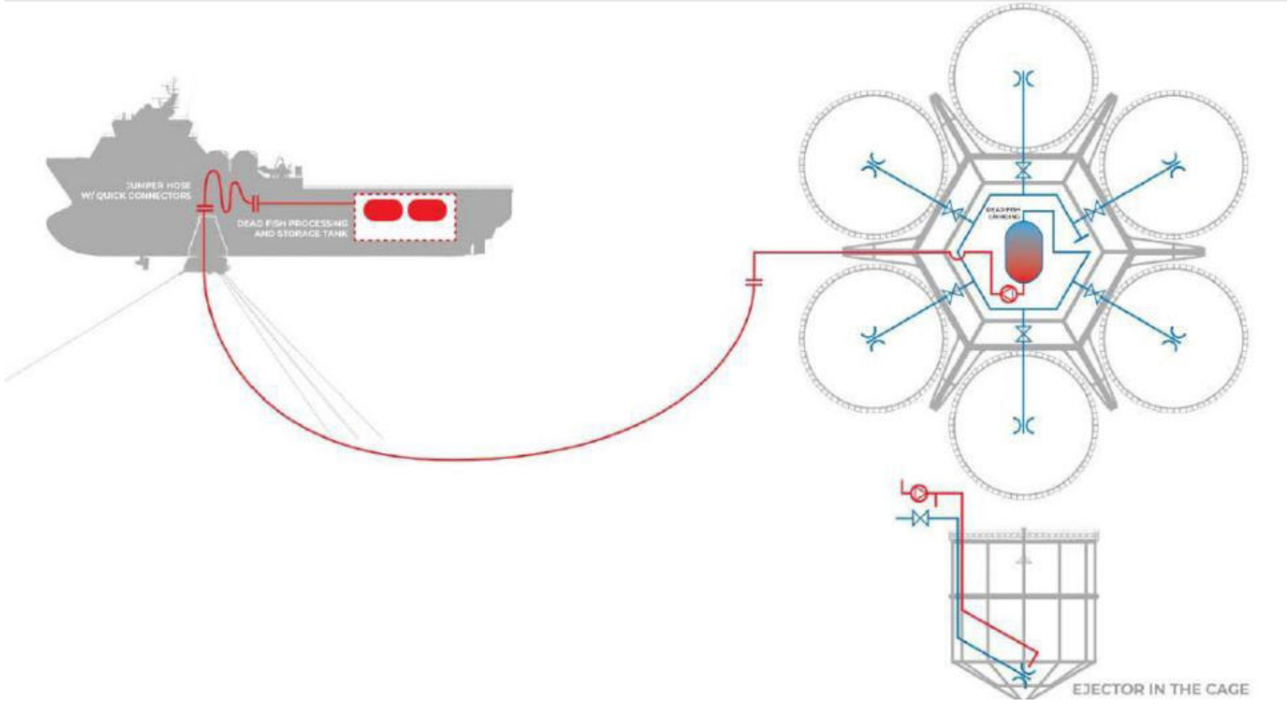

Figure 14: A schematic presentation of the processing of dead fish on the Service Vessel as designed by BW Offshore Farm (BW FishFarm, 2020).

4.9.3. Predator control

The Environmental Management Plan (EMP) will detail 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.

4.9.4. 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.

4.9.5. 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 **(figure 15),** and fish feed will be carefully monitored to ensure that none is wasted, 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 mussels, barnacles and 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**.** 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).

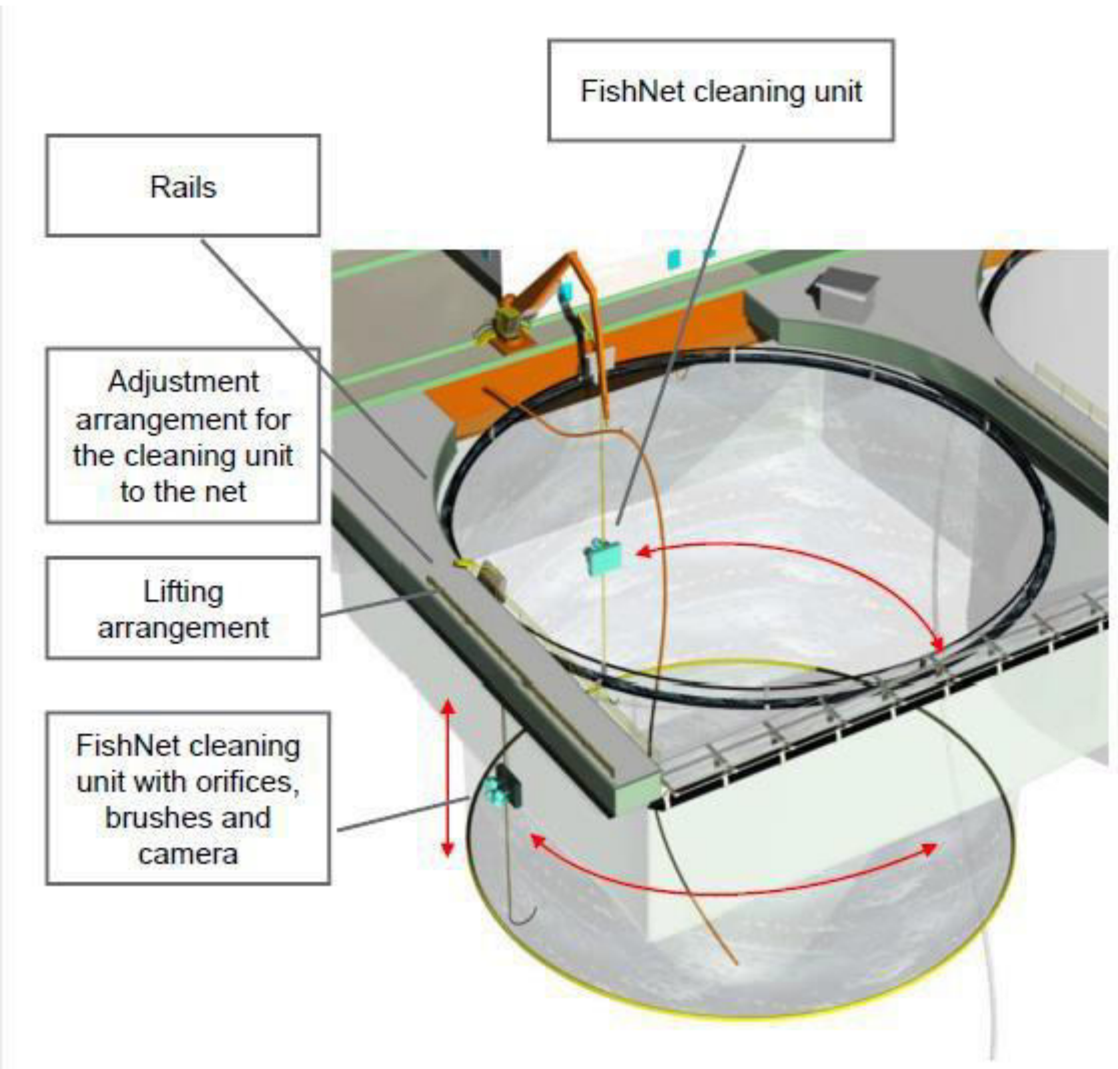

Figure 15: FishNet cleaning unit which includes cameras, brushes and orifices as per design of BW Offshore Farm (BW FishFarm, 2020).

4.9.6. 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.

4.10. 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 **(*figure 16*)** 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.

The Remote technology system, as depicted in ***figure 16,*** 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.

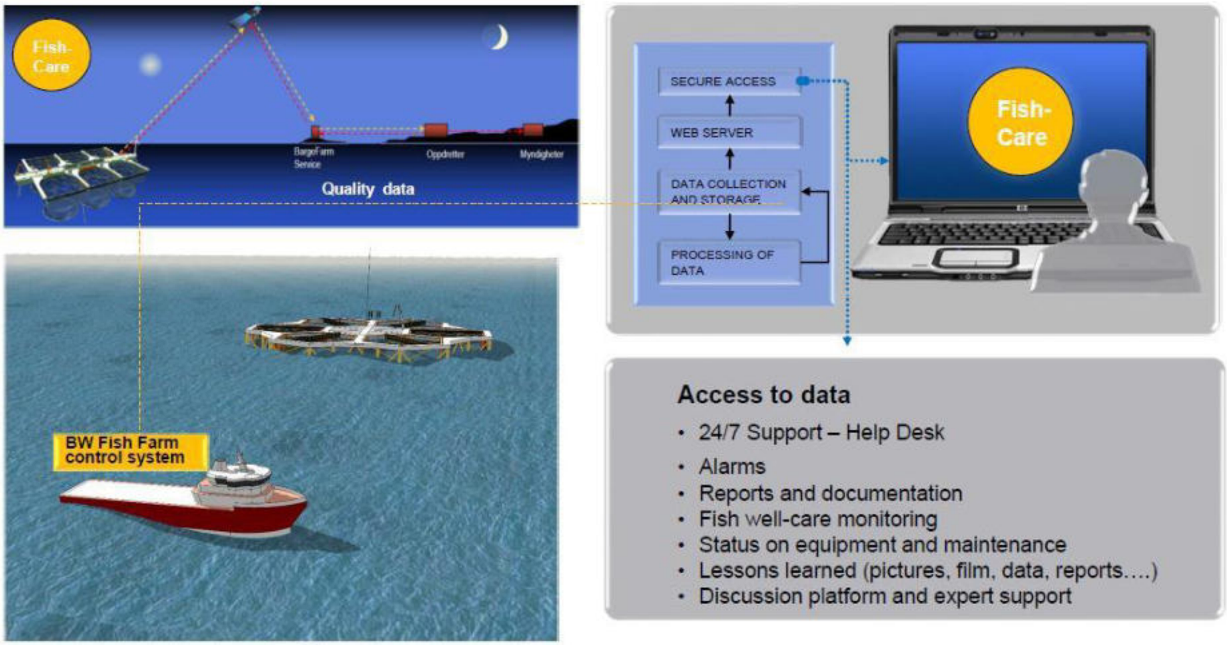

Figure 16: remote monitoring and logging technology system, designed by BW Offshore Farm, which will be installed (BW FishFarm, 2020).

CHAPTER 5

4. BASELINE PHYSICAL ENVIRONMENT AND BIOLOGICAL DIVERSITY

4.1. Introduction

The proposed site is located within the Namibia Island Marine Protected Area (NIMPA) (regulated under NIMPA regulations). Furthermore, the area is located within the Lüderitz upwelling cell and is important for the Cape Rock lobster and line fishery resources as well as marine birds and cetaceans in the surrounding Islands. Although NIMPA regulations allows for mariculture development activities, there are anticipated environmental impacts that will need to be mitigated. VECs that will be more affected include seawater quality and invertebrate fauna (zooplankton and benthic invertebrates) and birds. The main focus will be on these VECs and these had been investigated during the Specialist Studies (see Annex I and II).

4.2. Climate and weather

Climate in the south east Atlantic Ocean is mainly influenced by the cold Benguela Current Upwelling System and to a less extent, the Agulhas and Angola warm currents. As part of the Benguela upwelling current system, the BCLME (Benguela Current Large Marine Ecosystem) is driven by southerly winds, which induces transportation of deep cold and nutrient-rich waters near the coast (Mann & Lazier 1999). The resulting coastal upwelling process lead to primary and secondary production in the BCLME.

Among others, several physical factors that play a critical role during the upwelling process are Carbon dioxide (CO_2), SSTs (sea surface temperatures), DO (dissolved oxygen), sun radiation and nutrients. When describing the central BCLME based on SSTs and DO; generally, the ecosystem appears to display low mean annual SSTs and low DO throughout the year. Although, there are years were SSTs are unusually higher and DO extremely low, physical conditions in the southern BCLME sub-system seem to be characterized by colder and higher DO waters compared to the central and northern BCLME sub-systems (Strϕmme 1995; Bakun 1995).

The proposed site is strongly influenced by the Lüderitz upwelling cell; which is the most intensive upwelling cell in the BCLME. Strong surface currents in upwelling contributes to vertical mixed water column and weak stratification. Vertical mixing is common in upwelling zones along the eastern boundaries and contributes to higher ecosystem diversity and biological productivity.

4.3. Ecosystem diversity

Ecosystem diversity refers to variation in habitats. Oceans are classified into different types of ecosystems and habitats depending on geographical locations, weather, climate and biogeography. LMEs (Large Marine Ecosystems) are distinct geographical areas in oceans with similar weather and climate as well as biogeographic characteristics. LMEs only make up a small proportion of the world's ocean, however they support up to 95% of the world's fisheries (Bakun 1995). Although climate and weather in LMEs is influenced by large-scale processes, there are also small-scale variations within LMEs which create niches for breeding, feeding and nursery. These small-scale variations in micro-site and micro-climate determine biological diversity, species richness as well as resilience to negative environmental impacts. Heterogeneous ecosystems provide variable micro-climate sites that favors different species at different times of the year (Raven & Johnson 1999). Subsequently, heterogeneous ecosystems are likely to be less susceptible to negative environmental impacts. In contrast, homogeneous ecosystems tend to be sensitive and may only support specialized species that are unable to survive changing environmental conditions.

EBSAs (Ecologically or Biologically Significant Marine Areas) are 'hotspots' for marine biodiversity in oceans because they contain or support rare or specialized biodiversity and they provide valuable ecosystem services. EBSAs are established based 7 scientific criteria as recommended by CBD (Convention on Biological Diversity) (Clark et al. 2014).

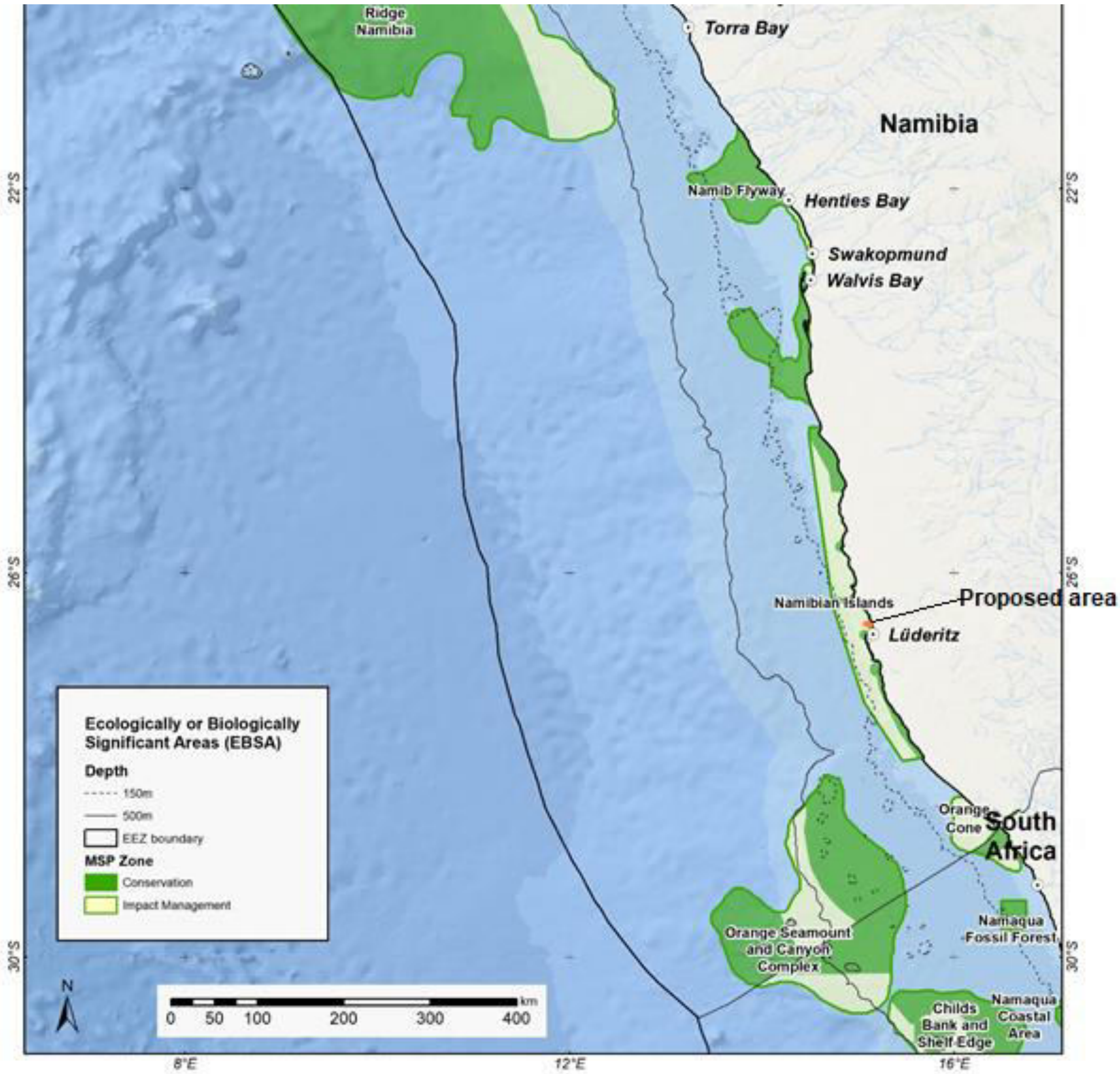

Figure 17: map showing EBSAs off the coast of Namibia (source: MFMR).

4.3.1. Orange Sea Mount and Canyon Complex

The OSCC (Orange Sea Mount and Canyon Complex, formerly the Orange Shelf Edge) is located in the Orange basin. The OSCC was classified as EBSA based on 3 criteria viz. 'importance for threatened, endangered or declining species and/or habitats' as well as 'Biological diversity' and 'Naturalness'. In terms of ecosystem diversity, the OSCC is diverse; being comprised of about eleven (11) ecosystem types including Tripp Sea mount and shelf-identing submarine canyon (Sink et. al 2019). Although productivity is low due to absence of upwelling cells, this EBSA supports a higher abundance (but low species diversity) of demersal fish species.

Marine fauna in the OSCC, particularly commercial fish species had been a target of capture fishing activities since commencement of commercial fishing in Namibia.

OSCC far is from the proposed finfish cage mariculture farm, which is based in Lüderitz.

4.3.2. Orange cone

The OC (Orange Cone) was declared based on an EBSA criteria 1, 2 and 3. The main feature is the Orange River Estuary and its habitat structures which provide suitable conditions for pelagic fish spawning.

OC far is from the proposed finfish cage mariculture farm but could be affected in case of an escape of the introduced Atlantic Salmon.

4.3.3. Namibia Island Marine Protected Area

The Namibian Island Protected Area (NIMPA) includes offshore islands (Mercury, Halifax, Ichaboe and Possession). This EBSA features the Lüderitz upwelling cell, which is the most intense and persistent upwelling cell in the BCLME. Several habitats in the NIMPA provides favorable conditions for spawning, nursing and breeding of marine fauna. The Rock lobster fishery is one of the popular ecosystem services that provide socio-economic benefits locally.

The proposed area is located in the NIMPA and environmental impacts on marine fauna will need to be mitigated.

4.4. Flora diversity

4.4.1. Plants and trees

Flora diversity is very limited as observed from the absence of trees and bushes or shrubs due to local arid conditions. There is hardly any vegetation cover on the islands and the surrounding coastline as it is either covered by sandy or rocky areas. On some islands there are few *Lycium* bushes/shrubs and the coastline have a few grass species as well as *Lycium* bushes (MFMR, 2009). Off the Namibian shelf, the most dominant sediment is biogenic diatomaceous mud.

4.4.2. Phytoplankton diversity

Phytoplankton is important because it forms a basis for marine productivity. There are phytoplankton species that are toxic to humans when ingested through consumption of shellfish. Harmful phytoplankton species are associated with HABs (harmful algae blooms). The season for HABs is from July to October with a peak in August. Eutrophication is a main contributing factor to HABs and is caused by several natural factors but anthropogenic factors such as river run-off, sewage discharge and others also contribute. Higher upwelling in the BCLME mainly accounts for HABs when nutrient-rich waters are transported near the coast and in the euphotic zone (Chikwililwa, et. al. 2019). It is postulated that HABs could also be induced by anthropogenic activities; however, this has not been scientifically proven.

A list of species found during the field survey undertaken in April 2022 is provided in Annexure I.

4.4.3. Seaweeds

Below is a list of seaweed species that are expected to be found in the area.

Table 7: seaweeds.

Seaweeds Species	**Ecological and conservation**
Ulva sp.	Potential commercial value, widespread
Laminaria pallida	Potential commercial value, widespread
Gymnogongrus glomeratus	Not known
Rhodymenia obtuse	Not known
Pachymenia carnosa	Not known

4.5. Marine fauna diversity

Fauna diversity comprises several phyla as explained in this section.

4.5.1. Marine invertebrates

Marine invertebrates are drivers of nutrients dynamics and energy flows in oceans and seas. For example, benthic polycheats play a role similar to terrestrial insects by burrowing through muddy sediment and displace huge volumes of sediment; thereof creating new habitats for other organisms (Bruschetti, 2019). Additionally, filter feeding epifauna play a key role in ecosystem functioning by filtering suspended solids or particulate organic matter from the water column and releasing them back into the water column as waste. In turn, deposit feeding invertebrates (e.g., crabs) feed on this organic matter and store it as tissue or re-mineralize it back into the water column. Marine invertebrates are the most abundant fauna in marine systems and because of this they displace a large volume of organic matter in the sediment and water column. Similarly, they filter large volumes of water and reduce phytoplankton biomass; which subsequently decrease water turbidity, recycle nutrients; thereby mitigating effects of eutrophication marine ecosystems.

4.5.2. Fish

Fish species that are expected to occur within the proposed site and surrounding areas are: rock lobster, small mullet, skates, rays and various line fish species.

<u>4.5.2.1. Cape Rock lobster</u>

Cape Rock lobster (*Jasus lalandii*) is one of the commercially important fishery resources and its exploitation had led to a well-established fishery with land-based processing factories and fishing vessels in Lüderitz (Beukes 2009). As a subtidal predator (mainly feeding on mussels, sea urchins and kelps), its role in the subtidal is quite significant (Bianchi et al. 1993).

The Cape Rock lobster resource occurs at shallow depths (5-200 m) and is mainly found in rocky bottoms. Locally, there are to sanctuaries off Lüderitz and at Ichaboe Island. The resource had declined from 327 tonnes in 2000 to 175 in 2018. More catches are recorded in the northern sanctuaries than in the south (Shuuluka, 2019).

Fishing and spawning grounds for this fishery do not overlap with the proposed site.

Figure 18: distribution of Cape Rock lobster (Shuuluka, 2019).

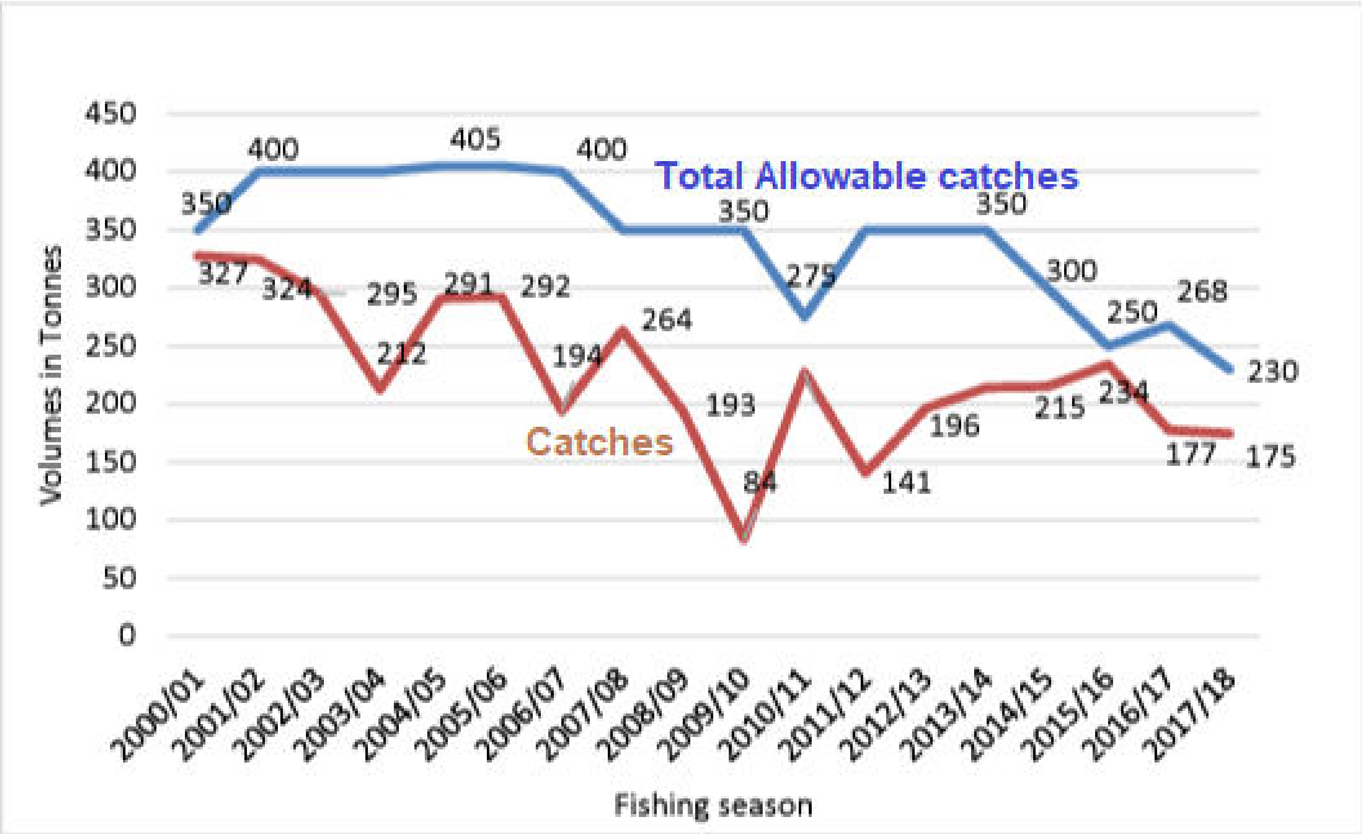

Figure 19: total allowable catches and catches of Cape Rock lobster (Shuuluka, 2019).

4.5.2.2. Mullet

Southern mullet (*Liza richardsonii*), also locally known as 'harder' occur in shallow coastal waters in Lüderitz. As omnivourous the fish feed on diatoms, microscopic algae and fine sand particles. Southern mullet is caught using beach seine nets mainly in the Lüderitz lagoons areas. Because of the low cost of operation, locals are able to participate. The species is of low value and the fishery is not as commercialized as the Cape Rock lobster fishery. However, it plays an important socio-economic role as a cheap source of protein.

The resource is found in shallow waters mainly in the lagoon areas and will not be affected by the proposed farming activities.

4.5.2.3. Other fish species

Other species such as Manned blenny (*Scartella emarginata*) and Pelagic goby (*Sufflogobius bibarbatus*) will be expected in the proposed area.

4.5.3. Reptiles and amphibians

No reptiles and amphibian species are expected to occur in the proposed area.

4.5.4 Whales

Marine mammals occurring off the southern African coast includes several species of whales, dolphins and one resident seal species (Hutchings et al, 2021). Whales comprise of 33 species of whales and dolphins determined from sightings and or strandings. Information on the Namibian shelf and deeper waters has been poorly studied with most available information in deeper waters (>200 m) arising from historic whaling records.

The seasonal distribution of sightings of the right whales in Namibian waters, from June to December with a peak in September, is supported by the seasonal occurrence of southern right whales in other calving areas in Australia, Patagonia, and South Africa. Although aerial surveys of northern Namibia have not been undertaken consistently over time, there has only been one sighting of a cow-calf pair right whales seen at Conception Bay (23°57.75'S) on 19 September 2003. The present-day distribution of right whales therefore seems to be concentrated largely in southern Namibia. Additionally, southern right whales in Namibia are said to be an immigration from South Africa (Roux et al. 2020). They calve and nurse in bays protected from high winds and swell e.g. Conception Bay and Chameis Bay. Southern right whale (*Eubalaena australis*) and the pygmy right whale (*Caperea marginata)* have been recorded in Namibian waters, primarily off the continental shelf during winter months.

The humpback whales are migratory species with a summer distribution in polar waters and a winter distribution in lower latitudes. These whales have been found off the Namibian coast in summer (Pulfrich et al., 2020) but are not likely to use the proposed site as migratory route when they migrate between June and December. Records of Dwarf (*Kogia sima*) and pygmy *(K. breviceps)* sperm whales, were investigated by Elwen et al., (2013), who found them to occur in pelagic waters around southern Africa, including Namibia. A further 11 species are resident within the offshore area of the Namibian coastline in water depths of over 500m. These include the long-finned pilot whale (*Globicephala melaena*), Grays beaked whale (*Mesoplodon grayii*), Layard's beaked whale (*Mesoplodon layardii*), Bryde's whale (Balaenoptera edeni), false killer whale (*Pseudorca crassidens*), sperm whale (*Physeter macrocephalus*), Cuvier's beaked whale (*Ziphius cavirostris*), Pygmy killer whale (*Feresa attenuata*) and killer whales (*Orcinus orca*) which are found throughout Namibian waters.

Whales are not likely to be directly affected by the proposed activities through entanglement in the cage nets. Additionally, where necessary measures will be undertaken to ensure they are not entangled in net cages while attempting to predate on the farmed fish.

4.5.5. Dolphins

The endemic Heaviside's Dolphin (*Cephalorhynchus heavisidii*), and the dusky dolphin (*Lagenorhynchus obscurus*), are found in the extreme nearshore region between the northern Namibian border and Cape Point. Moreover, the Heaviside's dolphins are a common sighted cetacean along the Namibian coast in water less than 125m deep, with most sightings occurring from Walvis Bay to the southern Namibian border, particularly through autumn, spring and summer in high waters. It has a restricted distribution to inshore waters, seen within 5 nautical miles off the shore.

For the dusky dolphin, they are the least known of the 'coastal' dolphins of southern Africa. In Namibia, they hardly ever come close to shore (Namibian Dolphin Project, 2022). The majority of sightings were recorded in the Lüderitz area, within the Namibian Islands' Marine Protected Area (NIMPA). Most of the Namibian EEZ is predicted to be a suitable habitat for dusky dolphins, especially the NIMPA and north of the EEZ in autumn, however, model predictions by De Rock et al., (2019), predicted absence, in waters deeper than 2000 m. The deepest sighting of a dusky dolphin was reported at 2,970 m depth and 90 km from shore, during summer. Other species such as, the southern right-whale dolphins *(Lissodelphis peronii*) have an extremely localised year-round distribution associated with the continental shelf and the shelf-edge in the region between 24° and 28°S.

4.5.6. Cape fur seals

Cape fur seals (*Arctocephalus pusillus pusillus*), are marine mammals commonly found along the Namibian coast, with several large breeding colonies, occurring from south of Lüderitz to Cape Frio in the Skeleton Coast (Namibia Tourism, 2022). Two species of seals occur off the southern African west coast, of which the Cape fur seal is the most common. The breeding of Cape fur seals occurs at the same time every year, between late October and early January, with adult males arriving at the breeding colony in October to establish territories and the pregnant females begin to arrive in late October–early November. Births usually occur by mid-December. After birth, mothers alternate between foraging at sea and suckling on shore, until the pups are weaned about 8-11 months later (corresponding to around July–November) (Skern-Mauritzen et al., 2009). Cape fur seals, typically dive to depths less than 100m, swimming primarily near the surface. The risk these mammals may face is entanglement in vessel propellers and fishing gears (Hutchings et al., 2020).

4.5.7. Avifauna

Seabirds as top predators, forms a fundamental component of the marine ecosystem and are excellent indicators of changes in the marine environment and good indicators of the health status of the environment. Namibia has a lot of offshore islands, islets and rocks (all are within the Namibian Islands Marine Protected Area) that are inhabited by different species of seabirds such as Bank Cormorants, Cape Cormorants, Crowned Cormorants, White-breasted Cormorants, African penguins, Cape gannet, kelp gulls, swift terns, African black oystercatchers and many more. These seabirds breed along the Lüderitz peninsula along the coast as well as on shipwrecks, islands, islets, caves and unused and abundant jetties. The islands are all located in southern Namibia in the Lüderitz vicinity and access to the islands is very strict and is managed and controlled by the Ministry of Fisheries and Marine Resources. The offshore islands and the Lüderitz peninsula provide breeding and roosting grounds for all the different seabird species of high economic and conservation importance. However, seabirds are facing some serious threats such as competing with commercial fisheries for prey that has been exploited in the past (Kemper, 2007). Other factors threatening seabirds are diseases, predation, natural disasters, unsustainable harvesting practices and human activities such as aquaculture and mariculture farming activities.

The Avi-fauna Specialist study was undertaken as part of the EIA and EMP. The study focused on marine seabirds within NIMPA and the surrounding areas of Lüderitz Islands and how the seabirds will be affected by the proposed construction and operations of the proposed finfish cage mariculture farm. The Report is attached as Annexure II.

4.6. Discussions, conclusions, and recommendations

The proposed site is located in the NIMPA and Impact Management Zone of the Namibia Islands Ecologically or Biologically Significant Area (EBSA) in the southern region of the BCLME within the Lüderitz upwelling cell. The proposed activities will have various impacts on the ecosystem. VECs that will be more affected include seawater quality, phytoplankton and invertebrate fauna (zooplankton and benthic invertebrates), cetaceans and seabirds.

The specialist studies undertaken focused on the planned activity's ecological and physiochemical impacts on the environment as well as on seabirds and results are included in annexure I and II.

4.6.1. Release of feed waste and fish feces

Annexure I provide details with regards to the potential ecological impact of detritus in the form of unconsumed feed and fish waste (dissolved and particulate organic matter). It is noted that the BCLME is the most productive LME and it is estimated that the annual new production in the Benguela system is 4.7×10^{13} gC/y, making it 30-65 times more productive per unit area than the global average ocean. On average, it is expected that the proposed activities will contribute less to the productivity of the system. The main fraction of the waste released during farming is bound in faeces and sinks rapidly (4–9 cm/s) towards the sea bed (Chen et al. 2003). The sinking speed of 4-9 cm/s is slow compared to the average surface flow speed of 20-50cm/s in the Lüderitz area.

Aqua Management Technologies (AMT) and Specialized Aquatic Feeds (SAF) are two specialist aquaculture feed companies based in South Africa. Additional alternative feed supply options are from Europe (Skretting, Bio-Mar, Altech-Coppens etc.). Should the project be successful, AMT has plans to construct a feed plant in Namibia in order to supply the farm. All of the above feed suppliers do not supply feed with drugs, antibiotics or hormones included.

4.6.2. Diseases and pathogens

There is no OIE listed fish diseases present in the Southern African marine aquaculture industry. The Proponent is not expecting to vaccinate against any viral diseases. Problems with bacterial diseases are not expected, but may arise, and vaccines may need to be administered to prevent any pathogenic impact. If any vaccines are applied, it will be done in the hatchery (on land) before the fish go out to sea. As a result, any potential impact on wild fish populations will be mitigated against or negligible.

4.6.3. Use of growth hormones

At the basis of the mariculture concept is increased production, which implies reducing energy used by fish while searching for food or avoiding predation. Fish farmed in optimal environmental conditions grow up to twice the speed of wild populations as they are fed on demand, do not need to migrate or starve and do not need to avoid predation. The fish can thus focus their energy on growth. This mean no hormones will be needed in fish production in order to accelerate growth. The focus of the Proponent will be to provide optimal environmental conditions in order to facilitate optimal animal health and growth without use of growth hormones.

4.6.4. Use of artificial light and effects on plankton fauna

The only artificial lighting that may be used will be camera lighting or general lighting on the boats/ships used to service the production systems out at sea, much the same a standard fishing vessel. Expected impacts from such lighting on natural phytoplankton or zooplankton communities will be negligible.

4.6.5. Introduction of Atlantic Salmon

Atlantic Salmon are an anadromous fish species, meaning that they are hatched in freshwater, spend most of their lives in saltwater and return to freshwater to spawn. Typically, Atlantic Salmon spawn in the clear, cold mountain streams of the Northern Hemisphere cold temperate mountainous regions. There are no rivers of this nature in Namibia, South Africa or Angola, so the chances of this species establishing a wild breeding population in Namibia is highly improbable or negligible.

Furthermore, based on previous aquaculture activities and experience, farming the same species in the lower reaches of the Benguela System in South Africa (Saldanha Bay and Kleinbaai), there has been no establishment of a naturalized population of this species in natural environment, despite escapes from these aquaculture farms having been confirmed. In light of this, the Proponent is confident to include this species in the proposed activity from the outset.

CHAPTER 5

5. HUMAN ENVIRONMENT

5.1. Introduction

The term blue economy is used in economics to describe exploitation of resources from the coastal and marine environment for socio-economic benefits. The term, according to the United Nations Economic Commission for Africa (2016), emerged from exploitation of ocean resources; particularly within environmental and development policy and practice in Africa. A related term used to describe the exploitation of agricultural resources is the green economy. Although the green economy still plays a significant economic role in Namibia, particularly in terms of employment creation, it is threatened by climate risks. The blue economy vows to improve human wellbeing and equity, reduce climate risks and scarcity through various maritime activities (Childs & Hicks, 2019) such as mariculture, maritime transport, seabed mining, fishing and seawater desalination.

Although the concept is touted as a catalyst in achieving long-term sustainable and equitable growth (Carver, 2019), the blue economy discussions in Namibia remain rhetoric. Paradoxically, the country remains to sufficiently benefit from the blue economy despite a huge base of renewable and non-renewable resources when compared to other coastal nations.

5.2. A scenario analysis of the Namibia mariculture sector

Scenarios planning is a tool used to predict future possibilities based on past trends. This section attempted to predict the future of the Namibian mariculture sector from 2000 to 2030. It is shown that since the year 2000, the sector was booming (Scenario 1); but growth slowed down around 2008/9 and switched to Scenario 2 being characterized by a downward trend until 2020/21. From 2022, the mariculture sector is predicted to be growing slowly (Scenario 1) until 2023 where it will be expected to enter a rapid growth phase until 2030.

5.2.1. Scenario 1

In the early 2000's, aquaculture was booming as a result of GRN's incentives to invest in the sector, including the establishment of various "Aquaculture Parks". This boom phase was followed by a stagnant face due to sulphur eruptions and low DO. These climate and weather factors forced closure of many farms between 2008 and 2009. Unfortunately, this forced the sector to switch into Scenario 2, instead of continuing to grow.

5.2.2. Scenario 2

Apart from risks of sulphur eruptions and low DO the lack of diversification also hampers growth of the mariculture sector. Dependence only on shellfish species as well as limited production systems are some of the main factors limiting development of the mariculture sector. Shellfish species farmed include pacific oysters (*Crassostrea gigas*), European oyster (*Ostrea edulis*), surf clam (*Donax serra*) and others.

There is a potential and interest in finfish farming with various species including Cob fish species, yellowfish tuna from various Proponents including Benguela Blue Aqua Farming (PTY) LTD. An opportunity also exists in seaweed farming.

Critically, a window of opportunity exists in the mariculture sector. This is window coincides with development of the blue economy in Namibia and many other social changes like the impacts of COVID-19. If these opportunities are seized, this will likely to slowly increase growth of the sector until 2023. Further investments are likely to boost growth of the sector until it reaches a peak in 2030.

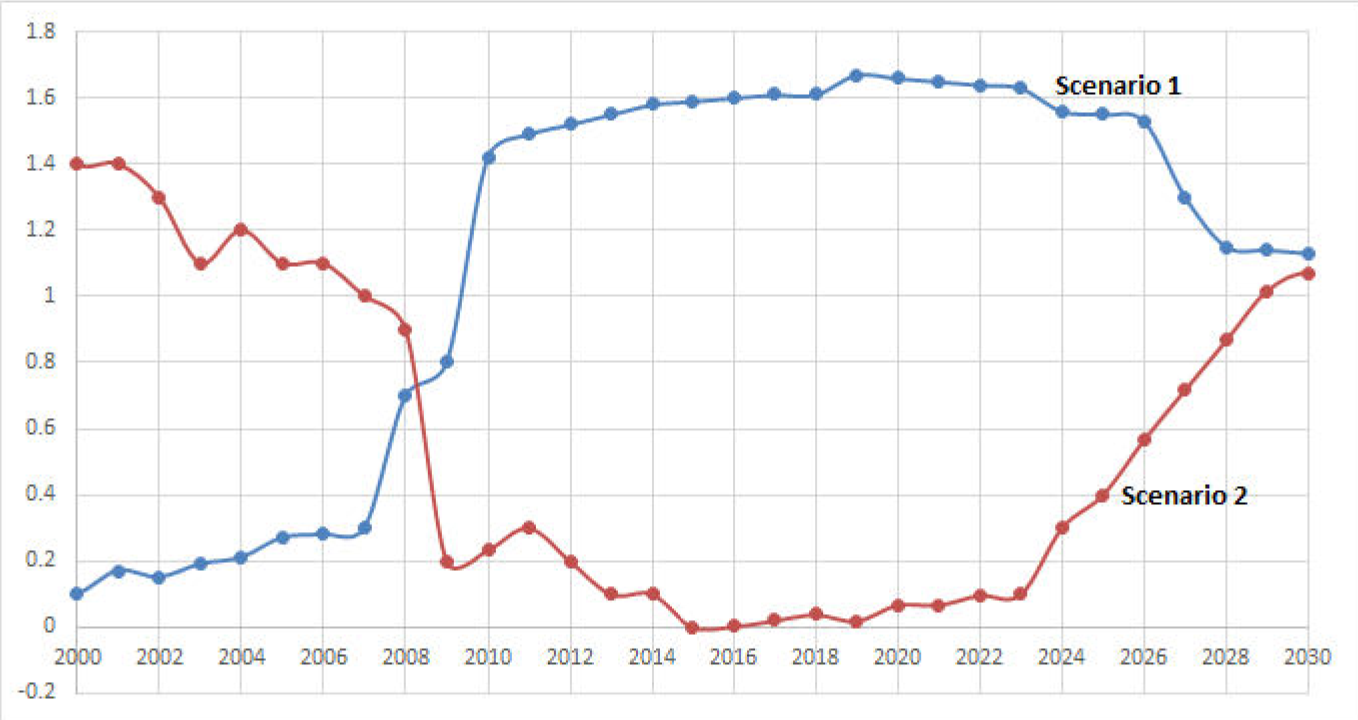

Figure 20: scenario analysis of the mariculture sector.

Table 8: shellfish farming facilities in //Karas region (https://www.globalseafood.org/).

Institution/facility	**Status**	**Location**	**Species**	**System**
Lüderitz Research Center/MFMR	Regulation/research	National	N/A	N/A
University of Namibia	Hatchery/on-growing of finfish and shellfish	National	Sliver Cob Oysters	N/A
Lüderitz Abalone Company	Hatchery/on-growing	Lüderitz	*H. midae*	Land-based
Elonga			*C. gigas*	
Lüderitz MC			*C. gigas*	
Ocean Grown			*C. gigas*	
Five Roses Aquaculture	On-growing	Lüderitz	*C. gigas*	Off-shore longlines
Lagoon Aquaculture	On-growing	Lüderitz	*C. gigas*	Off-shore longlines

5.3. //Karas region

5.3.1. Climate and weather

The Benguela upwelling current system largely influence local climate and weather along the western parts of all 4 Namibia's coastal regions including //Karas region. Subsequently, this climatic force had led to formation of the Namib Desert. Precipitation in the region is low and occur mainly in the form of fog. The fog supports less vegetation and only small-livestock farming is commonly practiced in //Karas region. The region mainly depends on exploitation of mineral and capture fisheries resources. The trend observed globally associated with declining capture fisheries will soon affect the town of Lüderitz, which mainly depend on capture fisheries. The town is more vulnerable compared to Walvis Bay town, given the limited port facilities and fish processing factories.

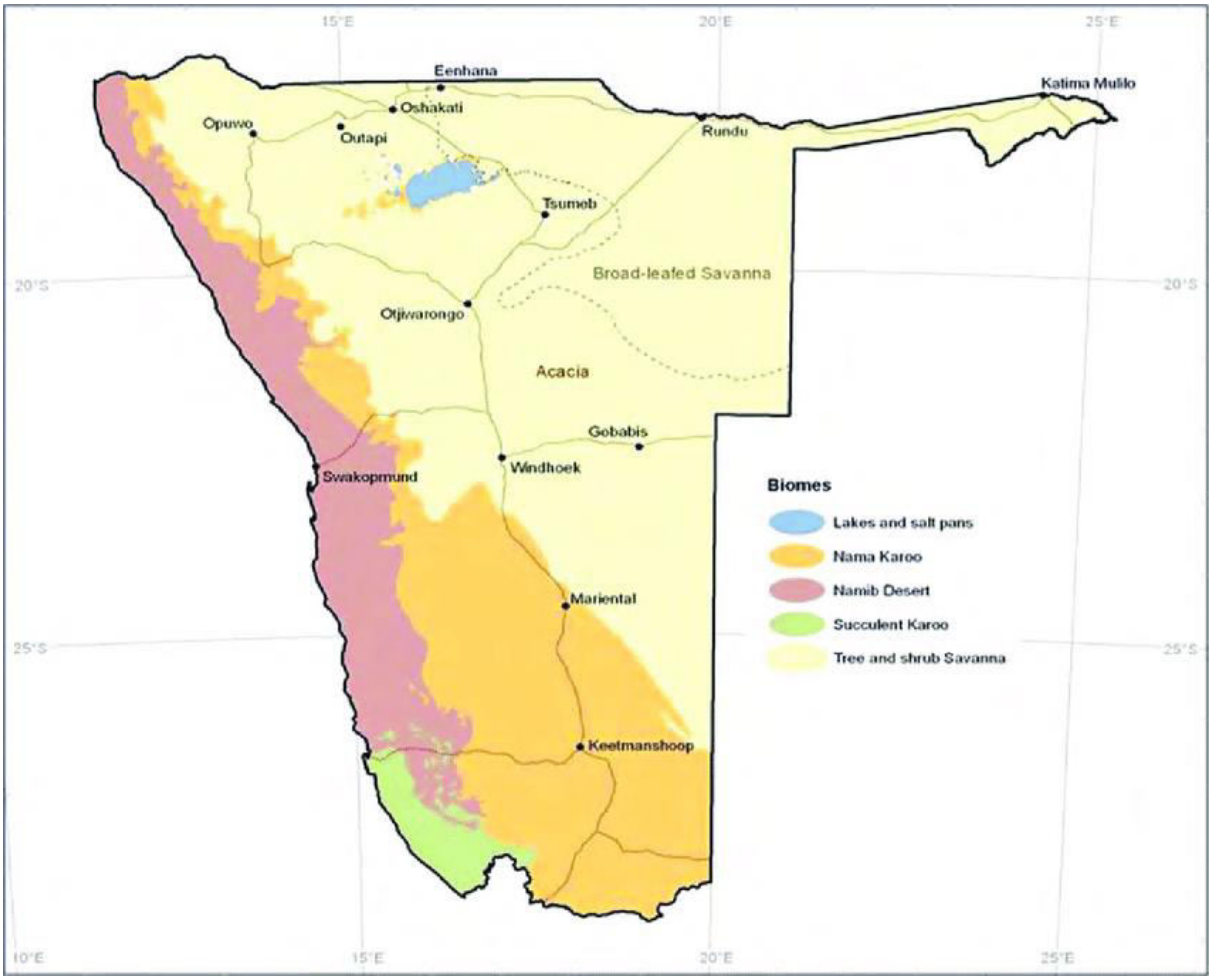

Figure 21: Namibia's biomes (source: Dieckmann et. Al. 2013).

5.3.2 Demography

There are 4 regions along the Namibian coast, namely //Karas, Hardap, Erongo and Kunene. //Karas region is the largest but yet the least densely populated compared to other regions. This is mainly due vast land which is inhabitable and also partly due to lower population growth rate of only 1.1%. There are 77,421 people in //Karas region based on the 2011 population census (NSA, 2011). The most commonly spoken languages are Afrikaans (36%), Oshiwambo (27%) and Damara/Nama (23%). Age composition is similar to other regions; being dominated by persons between 15 and 59 years of age.

***Table 9**:* selected demographics in Namibia's 4 coastal regions (NSA, 2011).

Demography	**//Karas**	**Hardap**	**Erongo**	**Kunene**
Population size	77,421	79,507	150,809	86,856
Annual growth rate %	1.1	1.5	3.4	2.3
% living in Urban	54	60	87	26
% living in rural	46	40	13	74
Population density	0.5	0.7	2.4	0.8
Age composition				
<5 years	11	11	11	17
5-14 years	19	21	17	25
15-59 years	63	59	67	51
60+ years	6	7	6	7
Citizenship				
Namibian	97	98	96	97
Non-Namibian	1	2	4	3
Literacy rate	97	91	97	65
% of people employed	68	65	70	64

Main source of income in %				
Farming	5	7	3	32
Wages & Salaries	72	64	73	41
Cash remittance	5	7	5	5
Business (non-farming)	5	4	9	8
Pension	11	15	8	12

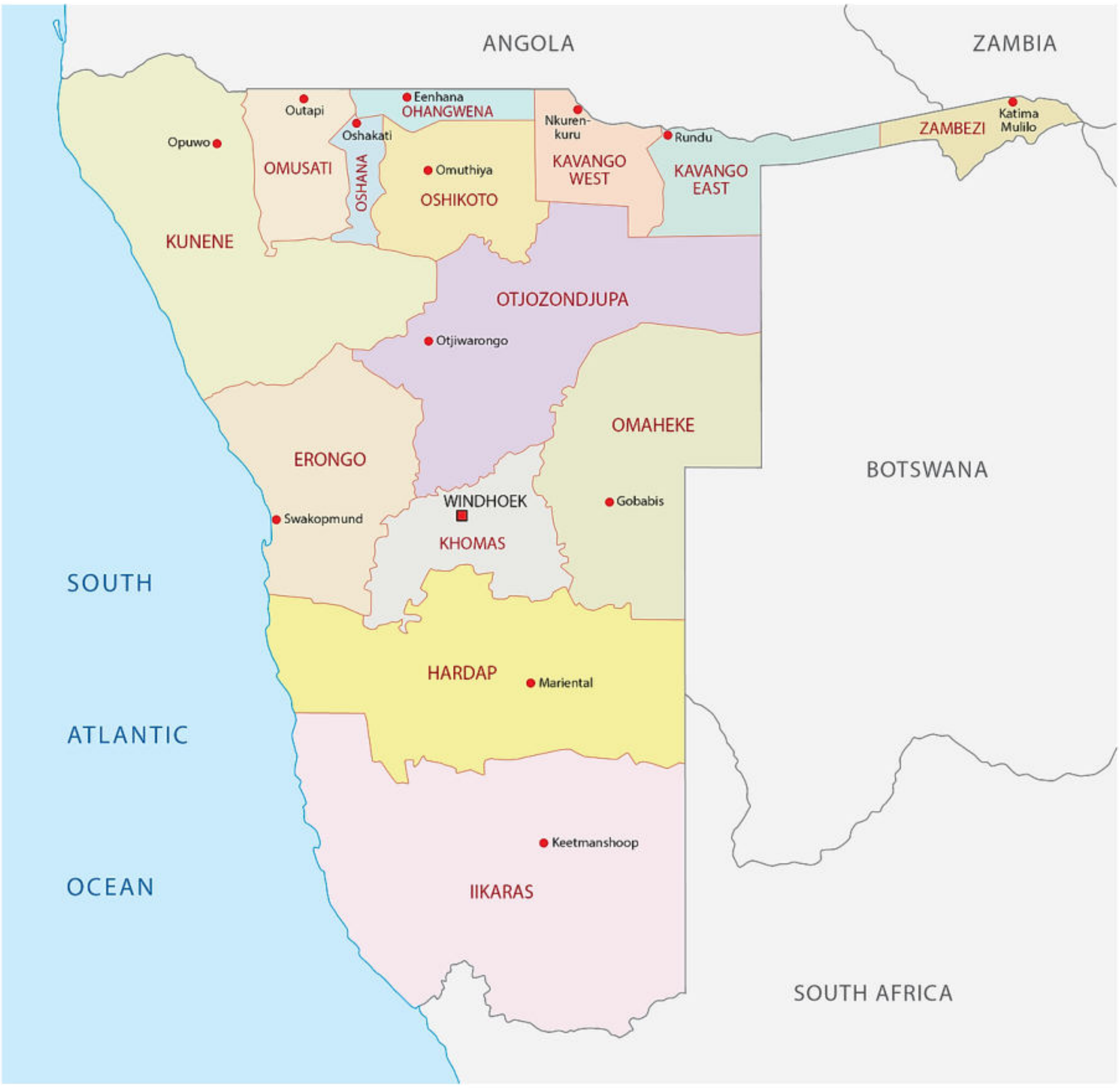

Figure 22: Namibia map and regional boundaries (Source: [Namibia Maps & Facts - World Atlas]).

5.3.3. Economy

Due to aridity, farming is predominantly small-livestock; being comprised of sheep and goats. The main source of income is wages and salaries (72%), followed by pension (11%), farming (5%) and other sources. There are several minerals exploited in //Karas region; namely diamond, lead, zinc, precious and semi-precious metals as well as Kudu gas offshore. Diamond mining is the main economic activity, followed fishing.

Contribution by lead and zinc mining is insignificant due to reduction in operations at one of the mines in 2020.

Lüderitz is the mega economic epicenter in //Karas region mainly due to a well-developed fishing sector as well as port and docking facilities. Lüderitz is the second largest port in Namibia and is important for import and export of commodities. The port provides docking facilities for fishing vessels and cargo vessels of limited capacities.

5.4. Socio-economic challenges

Various threats facing the coastal social-economy include over-exploitation of resources (e.g. fisheries and minerals resources), marine pollution, IAS and harmful pathogens, habitat modification, climate change and variability. Other threats include HIV-AIDS, lack of skills, slow economic growth, lack of accountability and governance and infectious pathogens and new pandemics.

5.4.1. Overharvesting of resources

Namibia has experienced overharvesting of marine natural resources over the past 100 hundred years. Discovery of diamond in Lüderitz by Zacharias Lewala prompted the so-called ‘diamond rush’ in Namibia. After reaching a peak, many diamond mining (land-based) operations ceased and were diverted offshore. Similarly, since commencement of fishing in Namibia in the early 1950s, many fisheries resources were heavily overfished.

5.4.2. Environmental injustice

The term environmental injustice is used to define violations of human rights (especially rights of women and children) in terms of distribution of natural resources; exposure to environmental risks (e.g. risks of pollution and climate change). Environmental injustice also manifests in a way the judiciary system operates whereby legislations are discriminatory either during formulation and implementation as well as when litigation proceedings are selective or biased.

Lastly, environmental injustice could also be observed at sectoral and institutional levels whereby some sectors are more favored or when institutions are selective in promoting development of certain sectors. Mariculture has a small foot print compared to offshore diamond mining but strict regulations make it difficult to obtain aquaculture licenses compared to mining licenses.

5.5. Economic outlook

It is important to analyze the Namibian economy in context of the COVID1-19 pandemic. Outbreak of the COVID-19 had triggered economic stagnation and social disruption across the globe and in Namibia. COVID-19 is an infectious disease caused by a coronavirus and it was first diagnosed in China in 2019. Infected victims of COVID-19 experience mild to moderate symptoms which include fever, dry cough, tiredness and headaches. There is no treatment for COVID-19 and the disease is currently a higher risk threat with local and global economic impacts.

COVID-19 negatively affected all sectors of the Namibian economy including maritime transport, fishing, tourism, mariculture and others. GRN should be laudably applauded for providing a safety net which protected citizens from directly absorbing negative impacts of COVID-19 between April and August 2020. The safety net rolled out was valued at N$8.1 billion and comprised of N$5.9 billion in direct support to businesses, households and cash flows acceleration payments for services rendered to GRN.

Furthermore, negative impacts of COVID-19, have led to a drastic increase in prices of food and other commodities in Namibia. Especially, the increase in food prices which was being absorbed by GRN through COVID-19 relief measures are now being felt by consumers as relief measures had been lifted.

Namibia heavily depends on imports of cereals, oil and many other commodities and with increase in prices of these commodities, Namibian consumers need to embrace for the worse and start looking for cheaper or alternative sources of food, and also take required health precautions.

5.5.1. Fishing sector

Fishing commenced in the early 1950s, reaching a total annual catch at approximately 2 million tons in 1968. Commercially important fisheries resources include hake, horse mackerel, monk, snoek, kingklip and rock lobster. In Namibia, the fishing sector is now well developed, and the country's fisheries capture is ranked 3rd on the continent lagging behind South Africa and Morocco, and the 30th in world fisheries capture indicators (Finke et al, 2020). Namibian waters have one of the richest fishing grounds in the world and the fishing sector immensely contribute to the country's GDP. The sector has since grown to become the third economic sector; contributing 7.7% to the GDP. More so, the country's fish and fisheries products are valued at about N$10 billion, making fisheries the second largest forex earner after mining and it contribute 15% to the country's total exports (Leandrea, 2019). In addition, the marine fisheries total landings have been estimated at 550 000 tonnes. Despite the recent major fraud in the 'fishrot' scandals resulting in job losses, the sector directly provides livelihood to over 16,000 employees both onshore and offshore (Adam, 2019). Particularly, the fishing sector is important to the Walvis Bay local economy where fish processing and port/dry-dock facilities are located.

Several measures are used to manage fisheries resources including fishing rights, TACs, fishing permits, by-catch fees, closed fishing season and others. Permits can however be occasionally suspended on species such as pilchard and orange roughy to allow fish stocks to recover. In the event of rights expiration depending on the fish species, the MFMR (Ministry of Fisheries and Marine Resources) publicly announce new applications, after which dully processes rights are awarded. Fishing quotas are on annual basis allocated to rights holders up until such a time the rights expire. The fishing period rights varies between 7 and 20 years depending on the species i.e., horse mackerel is 15 years while hake is 20 years. Ironically, the sector as noted by Remmert (2019) has over the years been constrained by unprecedented tension between economic interests and environmental protection, hence, disagreements, conflict and legal actions are a regular occurrence with which without effective changes and new operational approaches the sector could soon be in jeopardy.

5.5.2. Offshore diamond mining

Namibia has a vast geographical coastal coverage, stretching along the South-East Atlantic for about 1,572 km. Namibia's territorial waters and EEZ extend over 562,431 km^2 (Remmert, 2019).

According to Schneider (2020), systematic seafloor diamond mining with purpose-built barges later occurred in Namibian waters 50 years which saw Namibia emerge as the leading nation in marine diamond mining. Noting that heavier diamonds are often concentrated near river mouths while the lighter ones were taken further offshore by shore currents, marine diamond mining activities shifted to offshore reserves where over 90% of diamonds are of gem quality (Leeuwerik et al., 2021). Among other things, detailed exploration and technological enrichments on the other hand made deeper waters potential mining sites. Garnett (2017) reveals that large-scale marine diamond mining as an outcome of many years of exploration began a decade ago backed by government support and important technological developments most notably in positioning and geophysical exploration. Moreover, major sampling and mining systems were successfully developed in the process. Developments worth citing is the successful hiring of diamonds recovery equipment from the seabed borrowed from other industries, and the increased total output of sea diamonds from Namibian waters to 0.8 million carats annually and exceptionally exceeding diamonds from all the country's onshore sources (Garnett 2017). Despite other significant but smaller public companies are in various stages of development, NAMDEB - a corporation owned jointly with the government - is the principal marine diamond producer for which De Beers Marine acts as a contractor (Garnett, 2017). The government has thus entered into a 50% stake partnership agreement with De Beers. It is no doubt that marine diamond mining in Namibia is an economic lifeline with significant contributions to both treasury and employment creation and further potential higher production, lower grades, and increased throughput expected in future. The sector contributes 20% of foreign earnings making it the country's biggest foreign exchange generator (Anon, 2014) and has in 2013 contributed more than 188 million US$ in royalties, taxes and dividends.

Notwithstanding raising concerns of transparency and degree of stakeholder engagement in environmental monitoring and environmental impact assessments, the precise nature of environmental impacts and future social and economic benefits among others, maritime diamond mining remains a significant sector of the Namibian economy and society.

Of particular importance though, success achieved by diamond mining should be used as a flagship to support other less fortunate sectors. Critically, marine diamond mining should be inclusive and operations in diamond mining operation areas should allow other maritime activities such as mariculture. Promoting of such collaborations and inclusivity should not be left GRN alone but users of ocean space should also take responsibility and initiate stakeholder processes to maximize efficient use of ocean space for sustainable development.

The Proponent, Diamond Field Resources (PTY) LTD and Blue Kelp (PTY) LTD should be laudably applauded for initiating a dialogue which will eventually lead to sharing of the ocean space without intervention by GRN.

5.5.3. Renewable energy

As amplified in the International Energy Agency (IEA) 2020 Energy Progress Report, the Sustainable Development Goal (SDG) 7 aims to achieve universal access to affordable, reliable, sustainable and modern energy by 2030 (IEA et al. 2020). Abundantly blessed with plenty of renewable energy resources such as wind, solar, bioenergy, hydropower and ocean resources, Namibia can potentially harness low-carbon energy. With a well-established electricity supply industry (Amesho, 2019), renewable energy accounts for a slight portion of the country's energy consumption and largely depends on power imports. According to Kruger et al. (2019), over 60% of Namibia's electricity demand is met through imports from the Southern African Power Pool (SAPP) which is primarily governed by bilateral contracts with South Africa, Zambia, and Mozambique. The government has however acknowledged this significant potential towards energy generation from renewables and has prioritized development of solar and wind energy projects. According to the United Nations (2017) Namibia has the second-highest level of solar irradiation in the world with estimated power output at insolation of 2,200 kWh/m2/a, and a potential wind energy power estimated ranging between 27,201 MW and 36 TWh per year (Hamulungu, 2018).

Coastal climate conditions particularly in Lüderitz are suited for wind energy generation and investors are recognizing Namibia as a prime investment destination in clean energy. Namibia's first wind farm, Ombepo near Lüderitz with a capacity of 5 MW, has been generating power since August 2017. Another sizable wind energy project near Lüderitz, the 44 MW with expansion plans to increase it to 90 MW, Diaz wind farm is currently underway at an estimated total cost of US$106.9 million. Expected to be fully operational in 2022, Diaz Wind Power's - a part of United Africa Group (UAG) - construction is in line with domestic utility NamPower's new corporate strategy and business plan that seeks to make Namibia energy self-sufficient in the next five years. A 25-year power purchase agreement (PPA) has already been entered into and the project is expected to supply electricity to 10,000 Namibian homes. In part, Diaz Wind Power is also committed to upgrading the Namib substation and the Kokerboom substation. By 2019, Namibia has installed numerous renewable energy power plants with a combined capacity of 594 MW.

5.5.4. Maritime transport sector

In 2018, the United Nations Conference on Trade and Development (UNCTAD) revealed that over 80% of global trade by volume and more than 70% of its value are carried onboard ships. According to Walker (2019), maritime transportation drives 80-90% of global trade, moving containers, solid and liquid bulk cargo in billions of tonnes across the world's oceans. In Namibia, the country's only two ports of Walvis Bay and Lüderitz constitute important trading routes for goods and commodities for export, import as well as re-export. Between April 2016 and March 2017, Namibian ports facilitated over 1.5 million tons of cargo shipments export worth around N$27 billion and have in the same year contributed 2.1% to the country's GDP.

5.6. Competing blue economy activities

Blue economy activities are taking place in a limited space – the coastal and marine environments. Within this space when such activities are interlinked, and they economically and environmentally benefit each other; it is good for the GRN. On the contrary, not all blue economy activities and developments are mutually beneficial. A case to this point is mining and fishing which rarely complements one another and the same is also true for mining and tourism.

5.6.1. Blue economy policy

Namibia has no blue economy policy; however, efforts are under way to formulate this policy. Namibia has since independence established legal and regulatory instruments for environmental protection. Article 95 of the Namibia Constitution lays a foundation for this as it reads: *"maintenance of ecosystems, essential ecological processes and biological diversity of Namibian and utilization of living natural resources on a sustainable basis for all the…".* The blue economy does not appear in the country's National Development

Plan (NDP) 1-4, however, it appears in the 5th National Development Plan (NDP5) - 2017/18 to 2021/22. Without providing a succinct definition of the blue economy, NDP 5 speaks of a blue economy that capitalizes on and equitably distributes, the economic benefits of its EEZ and resources therein. The NDP5 states: "*By 2022, Namibia will have implemented a Blue Economy governance and management system that sustainably maximizes economic benefits from marine resources and ensures equitable marine wealth distribution to all Namibians.*"

Moreover, the blue economy is one of the main focuses for AU (African Union) Agenda 2063 and 2050 Africa's Integrated Maritime Strategy (2050 AIM Strategy). The blue economy in Agenda 2063 is viewed as the catalyst towards achieving socio-economic change, whereas, in the 2050 AIM Strategy, the blue economy is mentioned in Africa's Integrated Maritime Strategy and is prioritized as the "new frontier of African Renaissance" (Nagy & Nene, 2021). Adapted in 2014 and later embedded in the African Union's Agenda 2063 in 2015 as a priority goal for Africa's inclusive growth and sustainable development, the 2050 African Integrated Maritime Strategy (AIMS) amongst others seeks to coordinate the maritime policies of the African Union members and African regional economic communities in strategic sectors such as knowledge and protection of the ocean space, transport, shipbuilding, energy, aquaculture, and marine law enforcement.

5.7. Discussions, conclusions, and recommendations

Namibia possesses a remarkable coastline and a vast marine area and in the last two decades, the country commenced to embrace the concept of the blue economy, as well as, adopting the blue economy narrative. As noted by Finke (2020), Namibia's marine and coastal environment are both unique and pristine which in some cases intensely utilized for trade and economic activities. Given the vastness and uniqueness, it is beyond doubt that marine and coastal resources are a significant asset for the country both for the economy and livelihood. The blue economy in this respect is touted as a new mechanism through which Namibia can achieve long-term sustainable and equitable growth.

Compared to neighboring Angola and South Africa, Namibia has a comparative advantage in fisheries as well as offshore diamond mining. The country's capture fisheries is ranked 3rd on the continent lagging behind South Africa and Morocco, and the 30th in the world. It is the third contributing sector to Namibia's GDP contributing 7.7% and the second-largest forex earner after mining.

The conflict between economic interests and environmental protection resulting in disagreements, conflict and legal actions are regular occurrences negating the blue economy. The blue economy is thus increasingly impacted by the ocean stressors hence a call for stakeholders' engagements and collaboration. In the absence of effective changes and new operational approaches, the country's promising blue economy could face challenges in the future. Notwithstanding the GRN's ample provisions for environmental protection and sustainable use of natural resources, and commitment to growing the economy in a sustainable inclusive manner, the sustainable management of coastal and marine environments and resources is of utmost priority in the new frontier of its blue economy.

In realizing the fact that Namibia will soon be the epicentre of mariculture development, Namibia should not operate in isolation and should learn from other coastal states that have successfully developed their mariculture sectors. Lastly, the mariculture sector has the potential as a climate resilient solution to climate change and variability as well as other impacts currently threatening the capture fisheries.

CHAPTER 6

6. PUBLIC PARTICIPATION AND FEEDBACK

6.1. Introduction

This chapter describes steps involved in the public participation process during this EIA study. The role of I & APs in the public consultation process is extremely significant. NEMA regulations (regulations of 2012), and specifically section 21 is explicit in guiding the public consultation process. As stipulated in section 21(2), notices were given as explained below.

6.2. EIA/Scoping study (phase 1)

The proponent conducted the scoping study from December 2020 to August 2021; consisting of public notices in newspapers (18 December 2020 and 3 February 2021) as well as public meetings in Lüderitz, Walvis Bay and Swakopmund.

6.2.1. Adverts in newspapers

During phase 1, notices were placed in 2 (two) local newspapers, namely Namib Times and the Namibian newspapers once a week for 2 consecutive weeks as summarized below.

***Table 11*:** newspaper adverts.

Newspaper name	Round 1	Round 2
The Namibian	18 December 2020	3 February 2021
Namib Times	18 December 2020	3 February 2021

6.2.2. Minutes from public meetings

Public meetings were held as provided below.

***Table 12*: public meetings.**

Town	Date
Lüderitz	23 February 2021
Walvis Bay	12 January 2021
Swakopmund	13 January 2021

6.2.3. Issues & Responses

During the meeting a number of issues were raised by participants and are summarized below.

***Table 13*:** Issues and responses (minutes) at a public meeting in Lüderitz.

Organization	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. Based on experience in the lower Benguela in South Afica, no established wild populations have been confirmed in the Benguela despite escapes having been confirmed.

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 The 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.	This input was considered the and Proponent chose Boat Bay.
MFMR	**Dr. Kollett Grobler** Halifax Island has high numbers of penguins.	This input was considered and the Proponent chose Boat Bay.

Table 14: Issues and responses (minutes) at a public meeting 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. H du P 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?	No live fish will be imported but rather triploid eggs will be imported and hatched at a land-based hatchery.

Table 15: Issues and responses (minutes) at a public meeting in Swakopmund.

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?	Based on this advice, the site has been moved to Boat Bay.
Benguela SkiBoat 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 is noted and will be addressed in the EIA and EMP report.
MFMR	**Dr Beau Tjizoo** What is the source of feed for the proposed fish species?	This is noted and will be addressed in the EIA and EMP report.
MFMR	**Mr Ferdinand Hamukwaya** What produceres will be used when vaccinating the fish?	When needed the vaccines will be administered on a land-based facility.
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 input.	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.

6.3. Full EIA (Phase 2)

At the end of the scoping study, MFMR recommended that the proponent should undertake a full EIA supported by specialist studies. During phase 2, emphasis was more on baseline environmental studies than on the public consultations. However, all draft reports were shared with stakeholders as well as MFMR for comments and inputs.

6.4. Discussions and conclusions

During the EIA/Scoping phase, various issues raised were summarized and incorporated into the EIA/Scoping Report. Unfortunately, due to lack of specialized studies, the EIA/Scoping Report was unable to address a number of issues. These issues were communicated to the Proponent in a letter by MFMR dated, 19 August 2022; specifically addressing 7 (seven) issues. In summary, the letter recommended that the Proponent should undertake a full EIA which should be supported by specialist studies.

The Proponent takes environmental conservation and pollution prevention seriously; hence committed additional resources to undertake a full EIA, supported by specialist studies. Based on issues and concerns raised by the MFMR in a letter addressed to the Proponent, the appointed Consultants identified 4 (four) components which the specialist studies needed to address, namely:

- Seawater quality;
- Sediment quality;
- Introduced aquatic species, and
- Avifauna.

Reports from these studies had been prepared and compiled to support application for this ECC and are attached as Annexure I (Baseline Environmental physiochemical and invertebrate Reports) and Annexure II (Seabirds Specialist Study Report).

CHAPTER 7

7. ENVIRONMENTAL IMPACT ASSESSMENT

7.1. Introduction

This chapter predicts, determines, and assess impacts of the proposed activities on the environment. Mapping the receiving environment entails classification into various environmental resources that will be affected. Additionally, the environmental resources are subdivided into various environmental components which are well known as VECs (valued environmental components).

It is predicted that this project will affect several environmental resources. These impacts will vary in duration, significance and intensity. The sections below describe different types of environmental resources. This will be followed by other sections describing VECs and how they will be affected by the proposed project activities.

7.2. Impacts prediction and description

Impacts were predicted and described as per below.

Table 15: prediction and description of impacts.

Environmental resource	**Description of VEC (valued environmental component)**	**Description of impacts**
AIR AND CLIMATE	**Technosphere** (also known as anthroposphere).	Heavy fuel and marine diesels consumed by vessels have a higher carbon concentration compared other types of Diesels. These impacts are already taking place in the absence of mariculture activities. Poor ambient air quality and health implications to residents due to emissions of GHGs (greenhouse gases). Release of dust and metals particles into the air during drilling and blasting.
	The **air composition** of the earth's atmosphere is different from air of other planets in that it consists of nitrogen (78%), oxygen (21%), water vapor (1%), inert gases (0.97%) and Carbon Dioxide (0.03%).	Ocean acidification due to Carbon Dioxide emission. Invertebrates are directly and more affected than other marina fauna; hence the need for specialist studies to focus on invertebrate fauna.
CRYOSPHERE	**Glaciers, icebergs, ice sheets and permafrost** are all valued component of the cryosphere.	Melting of the cryosphere due to global warming causes sea level rise. This is indirectly related to heavy diesel consumption (although there are other sources of GHGs).
OCEAN AND SEAS	**Seawater quality**	Release of waste from fish feed and feces into seawater contributes to organic matter content. Organic matter will: • Increase turbidity and reduce water clarity; • Reduce water clarity decreases light penetration which could in turn decrease photosynthesis and primary productivity;

		• Increase in dissolved nutrients which could lead to eutrophication and subsequent increase in abundance of harmful algal blooms (HABs).
LITHOSPHERE	**Sediment morphology** entails classification of sediments into various categories either based on size (fine, coarse, etc), origin (lithogenous, biogenous, hydrogenous, etc) or color. Sediment characteristics have effects on bentho-fauna diversity in the sediment. Furthermore, different sediments are affected differently by anthropogenic activities such as dredging or hull cleaning.	Naturally, sediment transport and morphology are influenced by waves, currents and wind. Mariculture activities, such as the release of organic matter, fixing of mooring anchors on the seabed; solid waste disposal; connection of mooring buoys or cages to the mooring anchors also influence sedimentology. The above will affect benthic fauna; however, impacts will be a function of sinking rate of fish feed and feces (measured by their particle size and weight) and hydrodynamic vortex force created by waves, currents and wind. Since fish feeding behavior, waves, currents and wind depend a lot on season, when mitigating these impacts the Proponent need to adjust feeding management according to fish size and demand for feed. Sediment modification will negatively affect benthic fauna diversity and there is a need for monitoring of areas adjacent to the cage culture system and implementation of mitigating measures where necessary.
	Sedimentation is the process of sediment settling or deposition on the seabed.	Apart from natural factors, mariculture activities such as the release of organic matter, fixing of mooring anchors on the seabed, solid waste disposal, connection of mooring buoys or cages to the mooring anchors will influence sedimentology. However, impacts will depend on intensity and duration of mariculture activities and under which phase of the project such activities take place; for example, activities during construction will be temporary and their impacts will be localized.
	Land surface will be impacted through waste generation, litter and illegal dumping.	Generation of solid and liquid waste and lack of waste management will negatively affect land surface.

	Land use conflict	Mariculture operations will not be the only activities taking place within the port limits. There are activities such fishing, mining, fish processing, marine tourism, shipping and kelp farming. The potential impacts these activities will have on one another and the environment will include increased traffic volume, illegal dumping, waste generation, air and water pollution, dredging, habitat modification and marine biodiversity loss.
BIOSPHERE	**Ecosystem and biological diversity**	The target site location in the NIMPA and environmental impacts of the proposed activities on ecologically or biologically significant habitats locally. Environmental impacts of introduced finfish species in case of an escape. Sediment modification and effect on epi-fauna and benthic fauna diversity.
	Anoxia is a common anomaly in the BCLME and is a result of decomposition in the absence of oxygen which lead to total depletion of dissolved oxygen.	Higher sedimentation rate could cause incomplete decay of organic matter leading to de-oxygenation and anoxic conditions.
	Decreased primary productivity	Reduced water clarity increases light absorption which in turn decrease photosynthesis and productivity.
	Marine biota	Effects of AIS and harmful pathogens on marine biota
		Impacts of underwater noise on marine biota.
HUMAN ENVIRONMENT	Blue economy development (driving force)	The proposed activity is a blue economic development within the marine food and transport sub-sector.
	Policy response (legislation and policy)	Establishing a coastal DPSIR framework for Namibia dates back to a year when NACOMA was formed to-date when the MSP (Marine Spatial Planning) tool was adopted. Currently no blue legislation exists and this makes it difficult to regulate various blue economy activities.

	Occupational safety and public health	Mariculture activities are nationally and internationally regulated activities and there are many good management examples from which Namibia could draw from.
		Proposed activity of the cage finfish mariculture operation.
		Vessel preparation
		Injury on duty (IOD)
		Reporting of incidents
		Termination of mariculture operation or suspension of aquaculture license thereof is provided for in the Aquaculture Act (Act 18 of 2002)
		Containment of finfish species of domestic or international origin is addressed in the "Regulation relating to Import and Export of Aquatic Organisms and Aquaculture Product, Number 17 of 2010, based on the Aquaculture Act 18 of 2002"
		Release into water of finfish species of domestic or international origin is addressed in the "Regulation relating to Import and Export of Aquatic Organisms and Aquaculture Product, Number 17 of 2010, based on the Aquaculture Act 18 of 2002"
		Type of vessel to used, cleaning equipment and other equipment
		Calibration and servicing of the equipment
		House keeping
		Inspection

Table 16: Receiving environment sensitivity.

IMPACTS	PHYSIO-CHEMICAL COMPONENT					BIOLOGICAL COMPONENT						HUMAN COMPONENT					
SENSITVITY RATING 1 Negligible 2 Low 3 Medium 4 High 5 Very high	Air Quality	Seawater Quality	Seabed & topography	Sediment Quality	Organic matter & nutrient content	Phytoplankton & zooplanktons	Benthic Communities	Fishes	Turtles	Seabirds	Cetaceans	Fishing Industry	Mineral exploitation & mining	Other mariculture users	Tourism & Recreation	Maritime Transport	Public health and sustainability
1. Use of higher rich carbon oil and release of GHGs	1	2	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1

2. Ocean acidification due to increased atmospheric Carbon Dioxide.	1	2	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1
3. Release of dust and metals particles into the air during grit blasting	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
4. Release of waste from fish feed and	1	4	4	4	4	4	4	2	2	2	2	2	1	1	1	1	1

feces into seawater																	
5. Increased dissolved nutrients	1	4	4	4	4	4	4										
6. Settling or deposition of organic waste and increase in sediment thickness.	1	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1
7. Effects of artificial lights on 'free-floating' plankton	1	1	1	1	1	2		1	1	1	1	1	1	1	1	2	1

communities.																	
8. Release of viable adult, juvenile and larval stages of 'introduced' Atlantic Salmon.	1	1	1	1	1	1	1	2	2	2	2	2	1	1	1	1	1
9. Entanglement of seabirds and cetaceans in cages	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1
10. Accidental striking of seabirds and	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1

cetaceans by propellers																	
11. Exclusion of other users from the area	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
12. Dumping of marine litter such as plastics	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	2	2
13. Risks of diving including decompression sickness (DCS), arterial air embolism	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2

and drowning.																	
14. Communicable diseases and CVD (cardiovascular diseases).	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
15. Injuries on duty (IODs) including being hit by falling objects, slipping on greasy, wet or	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2

dirty surfaces.																	
16. Fire, drowning, risks of ships grounding or sinking.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
17. Accidental oil and chemical spills.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
18. Tripping over loose objects on floors, stairs and platforms.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2

Table 17: magnitude.

IMPACTS	PHYSIO-CHEMICAL COMPONENT					BIOLOGICAL COMPONENT						HUMAN COMPONENT					
0 No observable impact 1 Low impact 2 Tolerable impact 3 Medium high impact 4 High impact 5 Very high impact	Air Quality	Seawater Quality	Seabed & topography	Sediment Quality	Organic matter & nutrient content	Phytoplankton & zooplanktons	Benthic Communities	Fishes	Turtles	Seabirds	Cetaceans	Fishing Industry	Mineral exploitation & mining	Other mariculture users	Tourism & Recreation	Maritime Transport	Public health and sustainability
1. Use of higher rich carbon oil and release of GHGs	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2. Ocean acidification due to increased	2	2	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0

atmospheric Carbon Dioxide.																	
3. Release of dust and metals particles into the air during grit blasting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Release of waste from fish feed and feces into seawater	0	4	4	4	4	4	4	3	3	3	3	0	0	0	0	0	0
5. Increased dissolved nutrients	0	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0

6. Settling or deposition of organic waste and increase in sediment thickness.	0	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
7. Effects of artificial lights on 'free-floating' plankton communities.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
8. Release of viable adult, juvenile and larval	0	3	3	3	3	3	3	3	3	3	3	3	0	0	0	0	0

stages of 'introduced' Atlantic Salmon.																	
9. Entanglement of seabirds and cetaceans in cages	0	3	3	3	3	3	3	3	3	3	3	0	0	0	0	0	0
10. Exclusion of other users from the area	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	
11. Risks of diving including decompression sickness (DCS),	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

arterial air embolism and drowning.																	
12. Communicable diseases and CVD (cardiovascular diseases).	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
13. Injuries on duty (IODs) including being hit by falling objects, slipping on greasy, wet or	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

dirty surfaces.																	
14. Fire, drowning, risks of ships grounding or sinking.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
15. Accidental oil and chemical spills.	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
16. Tripping over loose objects on floors, stairs and platforms.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table 18: Duration.

IMPACTS	PHYSIO-CHEMICAL COMPONENT					BIOLOGICAL COMPONENT						HUMAN COMPONENT					
T: Temporary; P: Permanent	Air Quality	Seawater Quality	Seabed & topography	Sediment Quality	Organic matter & nutrient content	Phytoplankton & zooplanktons	Benthic Communities	Fishes	Turtles	Seabirds	Cetaceans	Fishing Industry	Mineral exploitation & mining	Other mariculture users	Tourism & Recreation	Maritime Transport	Public health and sustainability
1. Use of higher rich carbon oil and release of GHGs	P	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
2. Ocean acidification due to increased	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T

atmospheric Carbon Dioxide.																	
3. Release of dust and metals particles into the air during grit blasting																	
4. Release of waste from fish feed and feces into seawater																	
5. Increased dissolved nutrients																	

6. Settling or deposition of organic waste and increase in sediment thickness.																	
7. Effects of artificial lights on ‘free-floating’ plankton communities.																	
8. Release of viable adult, juvenile and larval																	

stages of ‘introduced’ Atlantic Salmon.																	
9. Entanglement of seabirds and cetaceans in cages																	
10. Exclusion of other users from the area																	
11. Risks of diving including decompression sickness (DCS),																	

arterial air embolism and drowning.																	
12. Communicable diseases and CVD (cardiovascular diseases).																	
13. Injuries on duty (IODs) including being hit by falling objects, slipping on greasy, wet or																	

dirty surfaces.																	
14. Fire, drowning, risks of ships grounding or sinking.																	
15. Accidental oil and chemical spills.																	
16. Tripping over loose objects on floors, stairs and platforms.																	

Table 19: Geographical coverage.

IMPACTS	PHYSIO-CHEMICAL COMPONENT					BIOLOGICAL COMPONENT						HUMAN COMPONENT					
L Localized impacts or limited to location O Impact of importance to municipality R Regional impacts N National impact I International	Air Quality	Seawater Quality	Seabed & topography	Sediment Quality	Organic matter & nutrient content	Phytoplankton & zooplanktons	Benthic Communities	Fishes	Turtles	Seabirds	Cetaceans	Fishing Industry	Mineral exploitation & mining	Other mariculture users	Tourism & Recreation	Maritime Transport	Public health and sustainability
1. Use of higher rich carbon oil and release of GHGs																	
2. Ocean acidification due to increased atmospheric Carbon Dioxide.																	

3. Release of dust and metals particles into the air during grit blasting																		
4. Release of waste from fish feed and feces into seawater																		
5. Increased dissolved nutrients																		
6. Settling or deposition of organic waste and increase in																		

sediment thickness.																	
7. Effects of artificial lights on ‘free-floating’ plankton communities.																	
8. Release of viable adult, juvenile and larval stages of ‘introduced’ Atlantic Salmon.																	
9. Entanglement of seabirds																	

and cetaceans in cages																	
10. Exclusion of other users from the area																	
11. Risks of diving including decompression sickness (DCS), arterial air embolism and drowning.																	
12. Communicable diseases and CVD																	

(cardiovascular diseases).																	
13. Injuries on duty (IODs) including being hit by falling objects, slipping on greasy, wet or dirty surfaces.																	
14. Fire, drowning, risks of ships grounding or sinking.																	
15. Accidental oil and																	

chemical spills.																	
16. Tripping over loose objects on floors, stairs and platforms.																	

Table 20: Probability.

LP	**Low** probability (possibility of impact occurring is low, below 25%).
P	**Probable** (there is a distinct possibility that it will occur, approximately 50%).
HP	**Highly probable** (the impact is most likely to occur, 75%).
D	**Definite** (the impact will occur, 100%).

IMPACTS	PHYSIO-CHEMICAL COMPONENT					BIOLOGICAL COMPONENT						HUMAN COMPONENT					
	Air Quality	Seawater Quality	Seabed & topography	Sediment Quality	Organic matter & nutrient content	Phytoplankton & zooplanktons	Benthic Communities	Fishes	Turtles	Seabirds	Cetaceans	Fishing Industry	Mineral exploitation & mining	Other mariculture users	Tourism & Recreation	Maritime Transport	Public health and sustainability
Use of higher rich carbon oil and release of GHGs																	
Ocean acidification due to increased atmospheric Carbon Dioxide.																	

Release of dust and metals particles into the air during grit blasting																	
Release of waste from fish feed and feces into seawater																	
Increased dissolved nutrients																	
Settling or deposition of organic waste and increase in sediment thickness.																	
Effects of artificial lights on ‘free-floating’																	

plankton communities.																	
Release of viable adult, juvenile and larval stages of ‘introduced’ Atlantic Salmon.																	
Entanglement of seabirds and cetaceans in cages																	
Exclusion of other users from the area																	
Risks of diving including decompression sickness (DCS), arterial air																	

embolism and drowning.																	
Communicable diseases and CVD (cardiovascular diseases).																	
Injuries on duty (IODs) including being hit by falling objects, slipping on greasy, wet or dirty surfaces.																	
Fire, drowning, risks of ships grounding or sinking.																	
Accidental oil and chemical spills.																	

Tripping over loose objects on floors, stairs and platforms.																	

***Table 21**:* Significance.

IMPACTS	PHYSIO-CHEMICAL COMPONENT					BIOLOGICAL COMPONENT						HUMAN COMPONENT					
Major 5/5 Moderate 4/5 Minor 2/5 None 1/1	Air Quality	Seawater Quality	Seabed & topography	Sediment Quality	Organic matter & nutrient content	Phytoplankton & zooplanktons	Benthic Communities	Fishes	Turtles	Seabirds	Cetaceans	Fishing Industry	Mineral exploitation & mining	Other mariculture users	Tourism & Recreation	Maritime Transport	Public health and sustainability
Use of higher rich carbon oil and release of GHGs																	
Ocean acidification due to increased																	

atmospheric Carbon Dioxide.																	
Release of dust and metals particles into the air during grit blasting																	
Release of waste from fish feed and feces into seawater																	
Increased dissolved nutrients																	
Settling or deposition of organic waste and increase in sediment thickness.																	
Effects of artificial lights on ‘free-floating’ plankton communities.																	

Release of viable adult, juvenile and larval stages of ‘introduced’ Atlantic Salmon.																	
Entanglement of seabirds and cetaceans in cages																	
Exclusion of other users from the area																	
Risks of diving including decompression sickness (DCS), arterial air embolism and drowning.																	
Communicable diseases and CVD (cardiovascular diseases).																	

Injuries on duty (IODs) including being hit by falling objects, slipping on greasy, wet or dirty surfaces.																	
Fire, drowning, risks of ships grounding or sinking.																	
Accidental oil and chemical spills.																	
Tripping over loose objects on floors, stairs and platforms.																	

7.3. DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

Although mariculture activities are permitted in the NIMPA, there is a need to mitigate expected environmental impacts without limiting the potential for mariculture development in Namibia. In order to develop a sustainable fin-fish farm in Namibia, it is important to understand mariculture production systems as well as negative impacts beyond the immediate production area. Due to lack of finfish farms in Namibia, impacts of the newly proposed finfish cage farms will need to be predicted based on similar production systems in the BCLME, for example in South Africa, which is part of the BCLME. Where there are research gaps studies done elsewhere could be used to understand impacts of mariculture activities on various components of the environment (Gowen & Ezzi 1994; Soto & Norambuena 2004; Pitta et al. 2006; Kaymakci Basaran et al. 2010; Skejić et al. 2011).

Critically, Namibia needs to generate baseline information about various aquaculture activities. Efforts by MFMR to develop the Aquaculture Master Plan (2013-2023) needs to be supported and strengthened. The Aquaculture Master Plan provides direction on how the mariculture should be developed and highlights the need for monitoring and research:

- Enhancement of the current Water Quality Monitoring Programme;
- Establishment of a National Aquatic Animal Health and Biosecurity Plan, and
- Establishment of Radiation Management Plans (RMPs) in research laboratories.

GRN has established an enabling environment; which is a good opportunity for the private sector to invest in the mariculture sector. The Proponent has demonstrated willingness to invest in the mariculture sector while generating data and information required to understand environmental impacts on the receiving environment.

Based on impacts evaluation from the current EIA study, eleven (11) impacts that were identified will be localized except air pollution, to which other maritime activities also contribute. Although impacts are less significant, there is a need to mitigations.

Environmental components that will be more affected are seawater and sediment quality as well as plankton and epifauna/benthic invertebrates mainly due to release of organic and inorganic matter. Zooplankton invertebrates in the open water column will be less affected compared to epifauna and benthic fauna living on and below the sediment.

It is recommended that, the ECC should be granted provided the Proponent design an effective EMP. Among others, the EMP should:

- Focus on monitoring abundance of benthic species and epifauna invertebrates;
- Provide an environmental monitoring plan indicating the type of parametres to be monitored and the frequency (e.g. per month or per year or as recommended by MFMR);
- Monitor changes in physical water quality by measuring pH, conductivity, salinity, turbidity and other physical parameters that may be affected by the proposed activity quarterly or as recommended by MFMR;
- Measure concentration of nutrients (e.g. ammonia, nitrites, nitrates, phosphates, etc) that may be affected by fish feed input into the seawater quarterly or as recommended by MFMR;
- Focus on monitoring abundance, distribution and species composition of planktons and other aquatic invertebrates (including bio-fouling organisms) quarterly or as recommended by MFMR;
- Water samples should be taken before, during and after feeding operation quarterly or as recommended by MFMR;
- Sediment samples should be taken twice a year (or as maybe recommended by MFMR) to determine impacts on benthic fauna;
- Submit 2 (two) environmental monitoring reports to MFMR or other GRN authorities, and
- Keep the above records and present such records upon request by MFMR or GRN authorities at any time or during renewal of the ECC or Aquaculture licence.

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