

2022-2023 PROJECT OUTPUT REPORT

South African Kelp Farming Project (Phase 2 -Project number: 300708-201)

Funded through UK aid by the UK government

Prepared by:

The Project Manager: Dr L Botes

On behalf of:

Bivalve Shellfish Farmers Association of South Africa (BSASA)

BSASA Chairperson: Mr V Pienaar

Declaration of the Project Manager

I hereby declare as Project Manager (on behalf of BSASA) and as per FCDO Accountable Grant Arrangement with BSASA that (please encircle):

1. All FCDO funding has, to the best of my knowledge, been used on the project's deliverables and assets as outlined in the Grant Arrangement

YES/NO (If no, please provide explanation)

2. All assets bought with FCDO funding to date are, to the best of my knowledge, are being recorded and can confirm that I have verified the assets, that they are in good working condition and being used for the purposes of the project.

YES/NO (If no, please provide explanation)

Buffellags site:

Project asset has been sent for repairs, asset to be delivered to Sea Point for use by Ms F Hill.

WCOG site: YES

DFFE Sea Point Aquarium site: YES

3. All progress of project deliverables are satisfactory and still within the FCDO Grant Arrangement time frames & budget, and that I have timeously reported on delays due to unforeseen circumstances.

YES/NO (If no, please provide explanation)

5. To the best of my knowledge, am not aware of suspicions or complaints of any incidences of sexual exploitation, abuse and sexual harassment (SEAH).

Confirm/Unable to confirm (If unable to confirm, please provide explanation)



Signature



Date

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Glossary

ADZ	Aquaculture Development Zone
AMC	Aquaculture Management Committee
BOM	Blue Ocean Mussels
BSASA	Bivalve Shellfish Farmers Association of South Africa
BST	Bio Soluciones Technicas
CPUT	Cape Peninsula University of Technology
CSIR	Council for Scientific and Industrial Research
DFFE	Department of Forestry, Fisheries and Environment
DSI	Department of Science and Innovation
EA	Environmental Authorisation
EMPr	Environmental Monitoring Programme
FAN	Free Ammonia Nitrogen
FCDO	Foreign, Commonwealth & Development Office
GSC	Global Seaweed Coalition
PM	Project Manager
PSSA	Phycological Society of Southern Africa
RA's	Research Assistants
RED	Research and Evidence Directorate within the FCDO
SA	South Africa
SSC	Safe Seaweed Coalition
TAN	Total Ammonia Nitrogen
TOR	Terms of Reference
UCT	University of Cape Town
UK	United Kingdom
VA	Viking Auquaculture
WCOG	West Coast Oyster Growers

1. Background

There has been a tremendous increase in interest in the last few years in seaweeds and their current and potential uses. Although almost all of the development of the industry in the last 50 years has been in East Asia, the rapid new acknowledgement of the potential for seaweeds in the western World has been called a 'Seaweed Revolution'. An example of this is on the website of the [Safe Seaweed Coalition \(SSC\)](#), which is a global organisation of more than 1000 seaweed stakeholders. Emeritus Prof John J Bolton was a founder member of the Advisory Board of the SSC. It is currently in the process of rebranding to the 'Global Seaweed Coalition (GSC)' and will in future be based at the United National Global Compact where John will continue as a member of the Scientific Council of the GSC.

On 9th February 2021 Dr Tristan Eagling, who was then the East African Science, Technology and Innovation advisor at the United Kingdom (UK) Foreign, Commonwealth & Development Office (FCDO), wrote to the SSC (Mr Vincent Doumeizel) about the possibility of funding seaweed projects, who passed the message on to Emeritus Prof Bolton. John then corresponded with Tristan and his Southern African counterpart, Ms Kristin Klose, from which eventually arose the UK FCDO-funded South African kelp farming project.

Wherever there are kelp forests around the world there are currently projects on kelp aquaculture, including in almost all coastal European countries (such as all four countries in the United Kingdom and even Belgium, which only has 65km of coastline, all sandy). Here in SA, there have been a few experimental efforts, most recently by Dr Mark Rothman (from the Department of Forestry, Fisheries and Environment [DFFE]) who grew *Ecklonia maxima* and *Laminaria pallida* through their life history for the first time, but there has never been a significant attempt to cultivate kelps in SA. John had long-term successful links in land-based seaweed aquaculture, with Mr Nick Loubser (Operations Director at Viking Aquaculture [VA]). They have also collaborated on kelp aquaculture since 2016, initially through the work of a postgraduate student at the University of Cape Town (UCT) namely Mr Michael Fleishman (now employed at KelpBlue Namibia) and co-supervised by Dr Mark Rothman. Michael carried out preliminary studies on growing *Macrocystis pyrifera* and demonstrated that *Macrocystis* is good feed for the local abalone, *Haliotis midae*. As a result, VA constructed its kelp hatchery at its Buffeljags Abalone Farm towards the end of 2020/early 2021. The hatchery was the first to produce *Macrocystis* gametophytes locally and successfully fertilise and settle these. During this time, VA was also approached by DFFE to collaborate with the FCDO project to conduct further research into kelp farming in Saldanha Bay since VA had already partnered with DFFE in conducting research on *Macrocystis* hatchery techniques at Buffeljags and farming in Saldanha Bay on their oyster and mussel farm at West Coast Oyster Growers (WCOG), a member of the Bivalve Shellfish Association of South Africa (BSASA).

To build on these initial efforts, and following communications with Ms Kristin Klose, the Foreign, Commonwealth & Development Office (FCDO) commissioned this project, first as a phase 1 pre-feasibility study (implemented from Dec 2021 - Mar 2022) and now leading into phase 2 as a feasibility study (for implementation from mid-2022 - March 2025).

2. Introduction

The world seaweed industry is estimated to be worth ca. US\$ 15 billion per annum. Just about all of it is based in East Asia, and almost half of it involves the cultivation (aquaculture) of large brown seaweeds known as 'kelps'. Two of the largest seaweeds in the world can be found naturally on the South African west coast and although SA already has an existing kelp industry based on wild kelp harvesting making out a mere 0.1% of total global production (wild harvested as well as farmed), there is currently no kelp farming industry despite global considerations of how kelp farming can responsibly be incorporated into aquaculture industries, potentially contribute to slowing down global warming, absorbing carbon dioxide, lowering ocean acidification, using kelp in biofuels, bioplastics and as a more eco-friendly substitute in food, fertilizers, textiles, nutraceuticals etc. SA's local wild kelp resource is not big enough to sustain local demand let alone international demand. Locally the demand for kelp to be incorporated into animal feeding regimes on abalone farms is ever increasing, while access to beach cast kelp and access to kelp harvested sustainably from concession areas are staying constant if not decreasing. This leaves us with an immense opportunity to develop a financially and environmentally sustainable kelp farming industry for SA that can, not only contribute to job creation in coastal communities in particular but also contribute to SA's GDP. It is within this context that the FCDO commissioned this project, first as phase 1 (implemented from Dec 2021-Mar 2022) and now leading into phase 2 for implementation from mid-2022 to March 2025.

2.1 Moving on from Phase 1 to Phase 2:

The Government of the UK of Great Britain and Northern Ireland acting through the Research and Evidence Directorate (RED) at the FCDO, deliver science and technology partnerships to maximise the UK's development impact internationally.

In 2021-2022 the FCDO commissioned the non-profit BSASA to conduct a short three-month pre-feasibility study (Phase 1) with the aim to investigate the potential for the commercial cultivation of three African kelp species (*Ecklonia maxima*, *Macrocystis pyrifera* and *Laminaria pallida*) along the West Coast of SA. The Phase 1 activities drew on expertise from several organisations including BSASA, DFFE, Council for Scientific and Industrial Research (CSIR) and Cape Peninsula University of Technology (CPUT), and the final output concluded/recommended that a Feasibility study (Phase 2) be conducted to further investigations into:

1. Increasing the sustainability and potential for diversification of aquaculture farming activities in the region by looking into which of the three local kelp species can be grown commercially and sustainably and how kelp can be sustainably integrated into the existing mollusc aquaculture industry.
2. Understanding regulatory enablers/barriers to industry sustainability and market access (e.g. food health and safety/certification and minimising environmental impact) by looking into the kelp value chain to identify downstream value-adding gaps and innovation opportunities.
3. Minimising negative environmental impacts when selecting appropriate sites and methods to cultivate seaweed at commercial scale and looking into which species would be best suited for optimum production and financial sustainability.

In 2022-2023, the FCDO commissioned BSASA to continue to Phase 2 of the project with the Accountable Grant Agreement signed at the end of July 2022, but only gaining momentum toward the end of 2022 when two Research Assistants and a Project Manager were appointed in late Nov 2022 as part of the implementation team made up of multiple entities/organisations as described below. The already established Saldanha Bay

Aquaculture Development Zone (ADZ) was identified as study area for grow-out trials to be conducted in/on already existing industry infrastructure & structures. Phase 2 is planned to be conducted over a 30-month period while looking into the following activities:

- Refining kelp hatchery/nursery technologies
- Trialling kelp grow-out technologies in Saldanha Bay
- Conducting food safety analyses that could inform future food safety standards and certification
- Monitoring environmental parameters and assessing environmental benefits/risks that could inform actions required as part of DFFE's Environmental Management Programme (EMPr)
- Do stakeholder engagements to disseminate information and obtain insights into Kelp Value Chain and employment opportunities
- Investigate the financial feasibility of kelp farming in SA

The main goal of the project in totality, is to make the information and research results available to a broader stakeholder base, existing industry and new potential entrants in order to build a sustainable Kelp Aquaculture Industry for SA.

2.2 Phase 2 Implementation team:

The project is being implemented with multiple organisations involved, each bringing different components and strengths to the project. Roles and responsibilities are briefly outlined below:

The Project Sponsor/Funder representatives:

Dr Sue Kinn (Team Leader, Southern Africa Research and Innovation Hub [SARIH], FCDO). [Dr Kinn has left the FCDO as of March 2023. The new Team Leader for the SARIH is Ms. Leanne Jones.](#)

Ms Kristin Klose (FCDO Technical Advisor- Science, Technology and Innovation)

Mr Jaco Louw (FCDO Policy and Partnerships Manager)

The Implementation team:

Industry:

Mr V Pienaar (Chairperson of BSASA as lead implementation and host organisation)

Mr M Tarrant (BSASA Secretary & Boland Financial Services)

BSASA member representatives and project participants:

Mr N Loubser (Viking Aquaculture's Operations Director of West Coast Oyster Growers [WCOG] & Buffeljags Abalone farm)

Mr M Viljoen (Manager at WCOG)

Ms M Loubser (Hatchery Manager at Buffeljags Abalone Farm)

Soon to be included:

Mr S Visser (COO of Blue Ocean Mussels [BOM])

Mr T Maswanganye (Assistant Farm Manager at BOM)

BSASA appointed

Dr L Botes (Project Manager)

Ms F Hill (Research Assistant)

Ms N Xulu (Research Assistant)

Government:

Department of Forestry, Fisheries and Environment (DFFE) Representatives:

Ms A Bernatzeder (Director of Aquaculture Research – strategic support)

Dr B Macey (Specialist Scientist: Aquaculture Research – kelp nutritional values)

Mr John Foord (Food safety officer)

Dr Mark Rothman (Specialist Scientist: Fisheries Research – seaweed research)

Dr Grant Pitcher (Specialist Scientist: Aquaculture Research – environmental monitoring)

Andre du Randt (Scientific Technician: Aquaculture Research – environmental monitoring)

Academia:

Representative:

Scientific Advisor: Emeritus Prof JJ Bolton (Associated with University of Cape Town [UCT])

Stakeholder Engagement Consultant:

Bio Solutiones Technicas (BST)

Representative: Ms B Brown-Webb

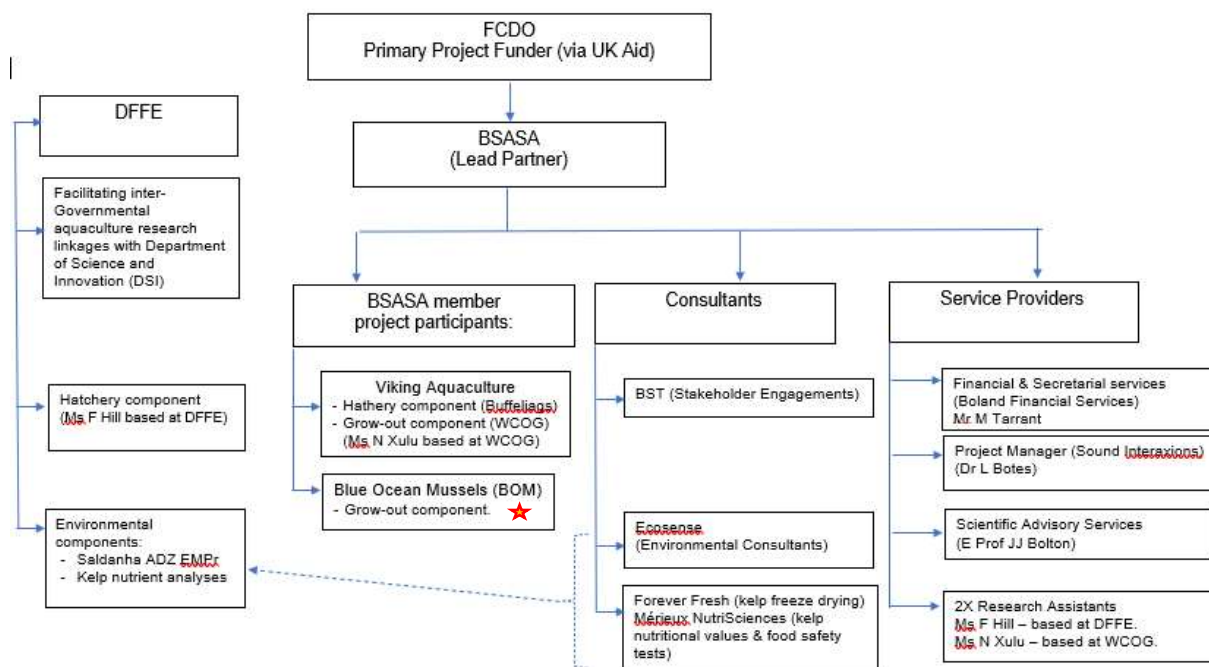


Figure 1. 2022-2023 Implementations team (★ BOM site to be added during 2023-2024)

3. Project management, reporting & monitoring

3.1 Project status report brief summary:

Upon appointment of the Project Manager, Dr L Botes submitted a Project Status Report (Annexure A) to the FCDO, which outlined the status of the project at the time, how she intended managing the project and how reporting and monitoring will take place. A brief summary thereof follows...

Lead partner: The lead implementing partner needs to adhere to the clauses stipulated within the FCDO Accountable Grant Agreement (via the BSASA chair, BSASA Secretary).

The BSASA Secretary (Mr M Tarrant from Boland Financial Services) will be responsible for ensuring that the project is complying with the financial clauses within the FCDO Accountable Grant Agreement.

As the lead partner, BSASA will be responsible for overseeing and managing the project (via the Project Manager).

Project Manager (PM): The project manager is responsible for overseeing and managing the project and will use the FCDO Agreement with BSASA as guidance document to do so. The PM will liaise on a continuous basis with the FCDO and BSASA for guidance and who will assist the PM to plan, execute, and finalize projects according to deadlines and within budget. The PM will liaise with the broader implementation team for inputs as explained in 4.2. This includes coordinating the efforts of team members, acquiring resources and third-party contractors or consultants in order to ensure progress according to project plan as captured in the FCDO Accountable Grant Arrangement. Where necessary, the PM will call ad hoc meetings to enable progress within specific components of the project.

The PM will also work closely with the FCDO to complete/update all FCDO documents as required by the FCDO 5 pillar Due Diligence processes and procedures. As per requirement of the FCDO Agreement with BSASA, the PM will keep record of all project assets at all sites which must at all times be used for project purposes, ensure that project assets are clearly labelled, on annual basis do physical site checks and upon completion of the project submit to the FCDO a project inventory list.

Research Assistants (RAs):

Ms F Hill situated at DFFE Sea Point Marine Aquarium reports to the PM, but is assisted on-site by DFFE's Dr B Macey if and when needed.

Ms N Xulu reports to the PM, but is assisted on-site by WCOG's Mr M Viljoen if and when needed.

3.2 Meetings with Implementation Team

During 2022-2023 the Implementation team met on a bi-weekly basis with the FCDO to discuss progress and challenges. Going forward these meetings will take place on a monthly basis. Since the FCDO Grant Agreement is with BSASA which has to see to it that downstream partners at all times comply with the clauses therein, oversight meetings between FCDO and BASA Chairperson, BSASA Secretary and Project Manager will too be held on a monthly basis, with Ms A Bernatzeder to represent DFFE as an invited member.

3.3 Financial Reporting & Monitoring

The BSASA secretary will be responsible for ensuring that the project is complying with the financial clauses within the FCDO Accountable Grant Agreement.

The PM will work closely with Mr Tarrant to track project budget against the project activities and also liaise with Mr Pienaar/Mr Louw for payment approvals. Mr Tarrant (& the PM) will also liaise on a quarterly basis with the FCDO to submit payments and money flowing to the project account held by BSASA. Budget expenses feedback will also be circulated to the implementation team on a quarterly basis.

For the 2022-2023 financial year, the FCDO Delivery Chain Map recorded expenses as per Annexure B. The BSASA secretary will ensure (on behalf of BSASA) that annual accounts are audited by an independent appropriately qualified auditor, hereto attached as Annexure C (still in progress)

4. Progress on project objectives & deliverables

The section below summarises the five project components providing an overview of progress to date, with more detailed description for further reading within the respective progress reports attached as Annexures.

4.1 Hatchery technologies of targeted species:

➤ DFFE Hatchery Facility:

Ms F Hill started in the beginning of Nov 2022 with setting up the hatchery facilities at the DFFE Sea Point Research Aquarium and has since regularly collected the 3 targeted species to practice sporulating, inoculating and incubating the kelps in order to build up culture stock to initiate various trials that can be transferred to Saldanha Bay every 2 weeks. She has also converted the Growth Chamber (incubator) that was purchased during phase 1, to serve as a red light area where kelp gametophytes can be kept at constant temperatures under constant light intensities for extended periods of time.

Ms Hill also attended a Kelp Workshop at the Phycological Society of SA (PSSA) Conference as well the online United States of America (USA) based GreenWave Initiative's Training sessions that spanned over several weeks in the beginning of 2023. The lessons learnt are summarised in her monthly reports hereto attached as Annexure D.

Different kelp seeding twine are being put to the test to determine which will be most effective for seeding. Along with Ms N Xulu, they have practiced out-planting of the hatchery sporophyte spools in Feb 2023 below the water surface (to minimise too much light exposure and sporophytes drying out) as opposed to the out planting effort done by Ms M Loubser (at the Buffeljags hatchery facility) in Dec 2022 above the water surface for ease of handling and sprayed with bottles containing sea water in order to keep the sporophytes moist.

In the new financial year (2023-2024), M Hill will spend her time fine-tuning hatchery protocols and expanding the hatchery facility to increase capacity to ensure regular out-planting as well as exploring methods to acclimatize the sporophytes to the surrounding conditions before out-planting.



(a)



(b)

Figure 2. (a) Ms F Hill pointing out the kelp sorus area (b) *M. pyrifera* gametophytes being kept in the growth chamber with red light (Photo credits: Ms Hill)



(a)



(b)



(c)

Figure 3. (a) Ms Hill's sporophyte hatchery tank set-up (b) graded filtration system to prevent contamination (c) Spool with kelp sporophytes prior to outplant. (Photo credits: Ms Hill)

➤ **Viking Aquaculture's Buffeljags Abalone Farm Hatchery Facility**

Ms M Loubser is permanently employed as the Hatchery Manager at Buffeljags Abalone Farm with an interest in growing *Macrocystis pyrifera* as a sustainable alternative to harvesting kelp as feed for the two abalone farms owned by Viking Aquaculture. Their interest is also in farming kelp at their mussel and oyster farm in Saldanha bay at WCOG.

Ms Loubser with the rest of the team did an out-plant trial during early Dec 2022 and also hosted the two Research assistants where they spent time acquainting themselves with MS Loubser's hatchery red light area where she keeps her gametophyte cultures. In Jan 2023, Ms Loubser attended the PSSA conference and subsequently used the lessons learnt at the conference to improve her hatchery set-up from having her sporophyte spools together in one tank to having the spools in separate containers to minimise contamination in her hatchery.



(a)

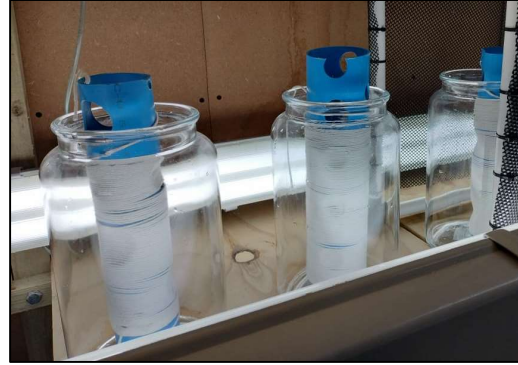


(b)

Figure 4: (a) Mr Viljoen & Ms Loubser during Dec 2022 outplant (b) red light area in Ms Loubser's Buffeljags hatchery



(a)



(b)

Figure 5: (a) Ms Loubser's sporophyte spools all together in one tank (b) Sporophyte spools in separate containers to minimise contamination. (Photo credits: Ms Loubser)

4.2 Grow-out trials & Monitoring of environmental parameters:

➤ Viking Aquaculture's West Coast Oyster Growers (WCOG) facility:

Ms Xulu started in the beginning of Nov 2022 by learning from Mr M Viljoen on how to add rope ladders to the long-line structure based at WCOG, taking part in the out planting of the hatchery sporophyte spools from Buffeljags Abalone farm in Dec 2022 as well a short introductory diving course. Ms Xulu also attended a Kelp Workshop at the Phycological Society of SA (PSSA) Conference as well as the online USA based GreenWave Training sessions that spanned over several weeks in the beginning of 2023. She also took part in the out planting of spools from the DFFE Sea Point Hatchery facility in Feb 2023 as detailed in her monthly reports attached hereto as Annexure E. She has subsequently received the environmental sensors/probes with which she is now able to collect data on temperature, pH, dissolved oxygen, light intensity, and conductivity at the proposed grow out site in Saldanha Bay.

Initial data presented confirmed concerns that the WCOG grow-out site may be a bit too close to the beach for sufficient cold nutrient rich water to reach that far in, as well as a bit shallow as the bottom rope ladder may be dragged on the ocean floor during low tide and exposed to very low oxygen levels. Since then, it was decided to move the rope ladders in the new financial year from 2m, 4m and 6m referred to in the research protocol to 1m, 3m and 5m as well as to add another site (managed by Blue Oceans Mussels [BOM] as mentioned below) that is both deeper and closer to the mouth of the bay.

In the new financial year (2023-2024), Ms Xulu will start taking water samples with the Niskin bottles that arrived early Apr 2023 to analyse Total Ammonia Nitrogen (TAN) trends while working on finalising protocols for her component of the project.



(a)



(b)



(c)



(d)

Figure 6: (a) Sporophyte outplant during Dec 2022 with WCOG team (b) Sporophyte outplant during Feb 2023 with DFFE Seaweed section team (c) Ms Hill and Ms Xulu at the PSSA conference banquet (d) Ms Xulu with the environmental monitoring equipment (Photo credits: Dr L Botes & Ms N Xulu)

➤ Blue Ocean Mussels' (BOM) facility

In the new financial year (2023-2024), BOM will liaise with DFFE to apply for a research permit that will allow the project to explore grow-out trials on the raft structures situated in deeper waters closer to the mouth of the Bay that will allow greater access to cold nutrient rich water from the cold Benguela Upwelling System. It is envisaged that this site is better suited than the one currently located in Saldanha Bay as mentioned above.

4.3 DFFE Environmental Management Programme (EMPr) update:

This component of the project was proactively commissioned due to the fact that while the cultivation of *Gracilaria gracilis* was authorized in the Environmental Authorisation (EA) issued by DFFE in 2018, the three species targeted by this project (i.e. *M. pyrifera*, *L. pallida* & *E. maxima*) were not. Thus, a Change of Scope to the EA is required.

The Environmental Consultancy named Ecosence was commissioned to do a desktop risk and/or benefit assessment to:

- Determine whether there is sufficient information available on the cultivation of the three targeted species to apply for a Change of Scope without further specialist studies;

- Document changes required to the existing Saldanha Bay Aquaculture Development Zone (ADZ) Environmental Management Programme (EMPr) to accommodate cultivation of the three targeted species in the future;
- To assess whether the Change of Scope would require a Part 1 or 2 application.

After careful consideration and identification of the benefits and risks, only one risk was identified by Ecosense as possibly having a high severity of impact. This related to the potential entanglement of marine animals in the cultivation structures and although it is unlikely to happen, the impact to the animal if it does happen may be severe. The recommendations therefore include that final raft designs be approved by the Saldanha Bay ADZs Aquaculture Management Committee (AMC), marine specialists and the South African Whale Disentanglement Network prior to installation. A number of recommendations for designs to prevent entanglement and response in the unlikely event of an entanglement occurring are detailed as per Ecosense report hereto attached as Annexure F. Finally, it was noted that none of the impacts identified constituted a change to the environmental outcomes of the EA. Going forward, the document will be sent the Saldanha Bay ADZs Aquaculture Management Committee (AMC) for inputs after which a decision will be taken as to type of amendment required.

4.4 Food safety testing of kelp:

The aim of the investigation is to study the nutritional value and potential food safety risks of wild kelp vs farmed kelp. The data will eventually be used toward the drafting of food safety standards for the kelp industry and serve as a comprehensive overview of the potential for kelp use in human and animal nutrition.

Initial data from the three candidate species collected in the Kommetjie region (as part of phase 1) showed that all three kelp species had a high mineral content, and the essential minerals were within the range recorded for other seaweed species, with the exception of Fe, Mn, and Zn, which were notably higher. Furthermore, all toxic elements fell within the range of values reported for other brown seaweed species, except for *M. pyrifera* that showed the highest Al, Pb, and Cd contents. More detailed discussions of these results are attached hereto as Annexure G.

For phase 2 of the project, wild kelp collected in Saldanha Bay has been freeze-dried by Forever Fresh and sent to Mérieux NutriSciences laboratories for testing and data received from the testing laboratories will soon be analysed. Once farmed specimens of the three candidate species are available, the kelps will be tested and compared to those from the wild specimens.

4.5 Stakeholder Engagements & Information dissemination activities:

Bio Solutiones Technicas (BST), represented by Ms B Brown-Webb and Ms W Long, has been contracted to assist with stakeholder engagements focussed on creating awareness of the project, gathering information and obtaining initial insights into the existing Kelp Value Chain in order to identify where the gaps and opportunities for development lie.

Since Ms B Brown-Webb was part of phase 1 while employed at the CSIR, she attended the PSSA Conference in Jan 2023 to not only disseminate the Phase 1 outcomes, but also to use the opportunity to network and obtain in principal agreement from targeted presenters to attend the workshops as set out in her phase 2

contract. A summary of the PSSA Kelp workshop was written by Emeritus Prof JJ Bolton and Ms B Brown-Webb attached hereto as Annexure H.

As part of her phase 2 contract, Ms Brown-Webb's tasks were to:

- a. Identify stakeholders from various constituencies to be captured into a stakeholder database from which invitations could be sent out to stakeholders to attend the phase 2 workshops. A stakeholder map was drawn up and can be accessed in the Annexure I hereto attached.
- b. Obtain initial insights about potential value-chain opportunities and future socio-economic impacts.
- c. Arrange a half-day online Phase 1 feedback and Phase 2 progress workshop on 13 Feb 2023.
- d. Arrange a half-day online Kelp Value Chain workshop on 28 Feb 2023 aimed at engaging with stakeholders that are involved in processing and value addition of kelp and those who would like to get involved in processing and value addition of kelps.

Dr L Botes, Ms A Bernatzeder, Ms F Hill and Ms N Xulu assisted Ms B Brown-Webb and Ms W Long with the workshops and a draft summary report of the above is attached hereto as Annexure I which summarises the outcomes of the above in more detail.

Going into 2023-2024, the stakeholder engagements will be extended to having a:

- a. Face-to-face mini-workshop in mid-May 2023 with focussed community and civil society groupings in the West Coast region to explore ways of getting involved in project components where possible.
- b. Arrange a hybrid Kelp Value Chain workshop early July 2023 aimed at engaging with stakeholders that may be interested in getting involved in the value chain as kelp farmers/producers.

5. Challenges & Recommendations

5.1. Challenges experienced in each project component with accompanying recommendations

5.1.1 Hatchery technologies of targeted species:

➤ **Hatchery facility at DFFE Sea Point facility**

While the wet-laboratory space is ideal in that it is split into two sections, each with the ability to be temperature controlled, the space however is very small and the water quality coming into the laboratory can at times cause a negative impact due to the plumbing system design of the relatively old building. Ms Hill also indicated that she is currently only able to build gametophyte capacity for *M. pyrifera* as she only has access to one growth chamber/incubator. Since *E. maxima* and *L. pallida* need to be maintained at a different temperature to *M. pyrifera*, another growth chamber for this would be required.

Recommendation:

It is recommended that we explore the possibility of allocating a bigger wet-lab space (in principal agreement already obtained from Ms A Bernatzeder) possibly with water flow-through, and getting access to another growth chamber/incubator. Ms Hill has purchased a movable graded filtration system which was recently installed so she needs to closely monitor if her water quality issues have been resolved.

➤ **Hatchery facility at Viking's Buffeljags Abalone farm hatchery**

It is recommended that:

- a) a short monthly hatchery progress report be sent to the PM in exchange of FCDO funding support of hatchery consumables.
- b) the growth chamber at Buffeljags be sent for reparations and subsequently be used by Ms Hill at the Sea Point hatchery facility.

5.1.2 Grow-out trials & Monitoring of environmental parameters:

➤ **Grow-out facility based at Viking's WCOG**

~Space & water quality -

Although the long-line structure at WCOG is ideal, the area where it is situated is less ideal in terms of water quality. After some consideration, the option of including the BOM's site which is closer to the mouth of the bay and thus improved water quality was supported, even though there is some degree of concern about the raft structure shading out light necessary for photosynthesis.

Recommendation:

It was recommended that the BOM raft structure be included in the project and to just ensure that the kelp rope ladders be installed on the sunny side (North facing side) of the rafts. The project team to assist BOM with its research proposal to accompany the research permit application and ensuring their permit is in-line with the research protocol of the project. Further discussions could also be held to explore possibility of including a Big Bay site although it has been indicated that logistical arrangements (time, access to boats and crew etc) may be challenging with a Big Bay site.

~Monitoring of Environmental parameters

After some issues with several HOBO sensors disappearing over a 4-week period, it was decided to

remove the sensors until such a time that the new sensors arrive and a more suitable method of launching and subsequent securing of the sensors could be devised. Subsequently, during March 2023, an underwater anchor system with five concrete blocks which weighed a total of 103 kg on land were joined together by splicing ropes attached on these blocks to act as a single anchor. Incisions were made on respective depths on the main deploying rope (attached on the anchor blocks) to create points of attachment for the data sensors. Three midwater floats were deployed half a meter below surface, and the first position for the loggers was placed half a meter below the midwater float, i.e. one metre below surface. The subsequent depths were two metres apart from each other.

Although the Niskin bottles to sample sea water for nutrient analyses arrived, there has been a concerning delay with the consumables needed for the process from sampling to analysing. Clarity must also be obtained as to the frequency of sample collection, number of samples to be collected and at which depths.

Recommendation:

Dr B Macey suggested we meet to discuss the above mentioned issues for inclusion into the project research protocols. PM to follow-up regarding date & time.

5.1.3 DFFE Environmental Management Programme (EMPr) update:

Follow-up required on the document submitted by Ecosense to the AMC.

5.1.4 Food safety testing of kelp: Dr B Macey to provide an update on progress of analysing results obtained from Mérieux NutriSciences laboratories.

5.1.5 Stakeholder Engagements & Information dissemination activities:

Logistical challenges and limited time to organise the workshops played a role in finalising deliverables. BST also has limited human resources, minimal access to software and audio-visual equipment to run the workshops independently.

Recommendation:

It is recommended that an events organiser be contracted to assist with arranging and, where appropriate, facilitating hybrid workshops in the new 2023-2024 financial year.

5.2. General recommendations:

- The Year-end Output Report must precede the budget forecast exercise to allow the PM and BSASA secretary enough time to liaise with the team for inputs. For this reason, the PM would like to request, for the 2023-224 financial year, that all project component reports as well as external consultant reports be finalised by the end of Feb 2024 (BSASAs financial year-end) so that March 2024 can be utilised for compiling the Project Year-end report and budget planning for submission to the FCDO at the end of March 2024 (FCDO financial year-end).
- The RA's submitted requests to use results of their respective project components toward MSc degrees. Some initial discussions indicated that the UCT guidelines for supervisors and co-supervisors should be consulted. It is recommended that once all the required information has been obtained, the PM call a meeting with relevant parties to further discussions.

➤ Value Chain analysis

An eagle-eye viewpoint (based on the 28 Feb workshop discussions) provides some initial insights into the flow of product in the current value chain (see figure 2 below) and needs to be properly unpacked by a Value Chain Analysis (and market research) in order to inform where the value chain gaps/opportunities for research, development and innovation lie which would/could eventually lead to the strengthening and expansion of the value chain and therein creating more jobs for local communities. The Value Chain analysis should also investigate and identify supply chain risks that could affect research and/or opportunities. Currently the biggest constraint to strengthening the value chain lies in the fact that there is a need for increased biomass which is a gap that we hope a new kelp farming industry can fill.

The BST Stakeholder Engagement Summary report of all 4 stakeholder engagements will form the basis of a follow-up Value Chain analysis. It is recommended that TOR for advertising be drafted asap so that this component can commence as quickly as possible.

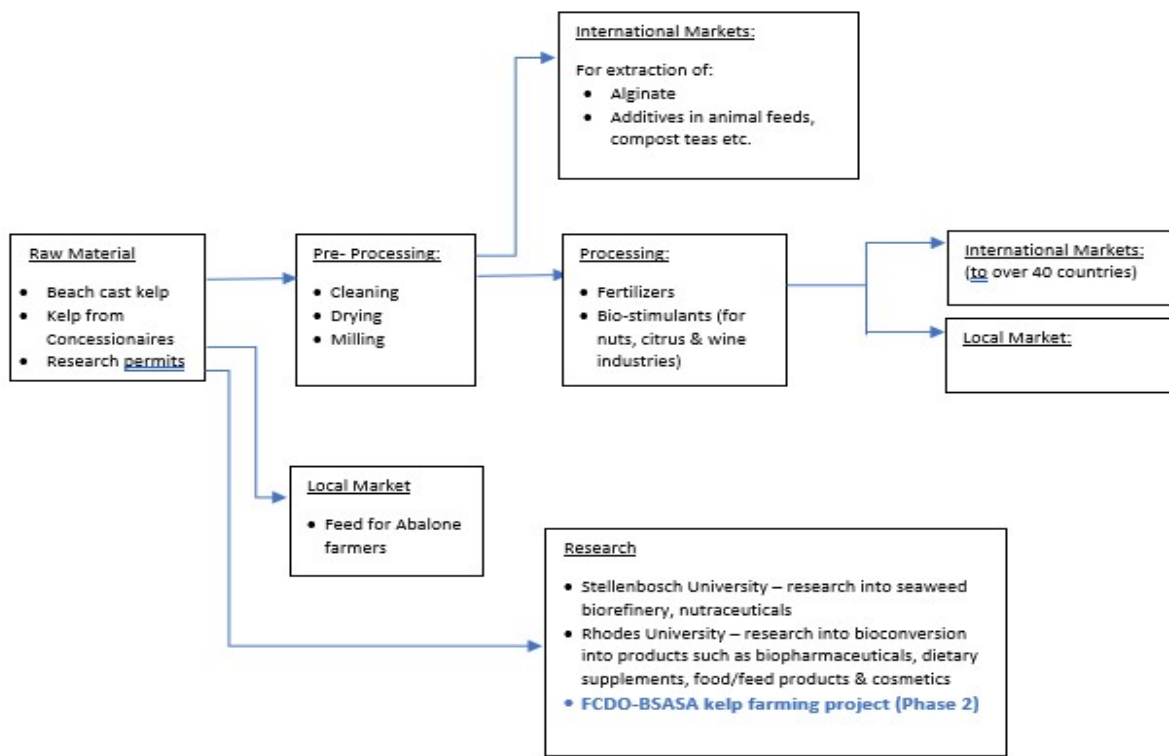


Figure 7: Diagrammatic summary of the current value chain based on discussions during the 28 Feb 2023 workshop.

6. Closing remarks & Thinking ahead

6.1 Closing remarks

As PM, there is no doubt in my mind that this project can be a flagship project opening up an entirely new kelp aquaculture industry, provided we work together as a team. It is therefore important that we constantly and continuously ask ourselves during all our endeavours “what is best for the sake of the project?”. This project is unique in nature because the members of the implementation team are all from different organisations, some of whom have to fit the project duties into their daily tasks as part of their organisational responsibilities. Although this can be both a strength and a weakness, we can choose to work together as a team and build on our strengths with the aim to work toward a pilot project that could lead to the establishment of a South African kelp industry to the benefit of all interested parties.

6.2 Thinking ahead

6.2.1. Anticipated work for the 2023-2024 per quarter

Project deliverable	2023-2024											
	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	April	May	June	July	August	September	October	November	December	January	February	March
Hatchery trials <i>(Frances' next outplant scheduled for 14 Apr 2023 ??)</i> <i>(Michelle's next outplant schedules for end of Apr ??)</i>	[Yellow bar spanning April to March]											
Grow-out trials	[Green bar spanning April to March]											
Environmental monitoring	[Green bar spanning April to March]											
Food Safety Testing 1. Analysing results obtained in March 2023 2. Testing farmed kelp	[Blue bar spanning April to March, with a gap in February marked with '??']											
Stakeholder Engagements: community mini-workshop 1. Drafting of TOR 2. Mini-workshop/meeting with community members to unpack possible involvement 3. Value-chain workshop focussed on kelp farming component	[Pink bars: April-May, May-June, July-August]											
Value Chain Analysis & market research 1. Drafting of TOR 2. Advertising 3. Study commence	[Purple bars: April-May, May-June, June-July, July-August, August-September, September-October, October-November, November-December, December-January, January-February, February-March]											
PM physical check of assets at all sites PM output report & budgeting	[Orange bar in April, Red bar in March]											

6.2.2. Considerations for 2024-2025 and beyond

Provided we are successful with the hatchery and grow-out trials, the following will also need attention....

- Awareness Creation & Education programme aimed at the public (to minimise future resistance toward the development of a seaweed farming industry)
- Plan for research use and dissemination
 - Portal of sorts where interested parties and possible new-entrants can access relevant information such as permit application processes, funding avenues, available kelp farming manuals and research (from our projects and elsewhere in the world). Since BSASA does not have a website, we may want to explore options to either set something up or making use of a platform already in place.

- Roadmap for setting up a kelp farm
 - Financial costing for start-up initiatives including what's needed ito equipment, boats etc.
 - Red-tape Road map (steps & time) for new entrants ito licencing, permits etc.
 - Resources available ito access to funding and mentorship

- Volunteer & training programme for new-entrants
 - PM can could possibly start giving some thought as to exploring how endeavours such as these can be implemented.

7. Acknowledgements

The PM would like to thank (on behalf of the BSASA and the implementation team) the FCDO for funding support without which this project and research would not have been possible.

The PM would also like to thank the implementation team and consultants for inputs that contributed to compiling this report, especially Emeritus Professor JJ Bolton for providing the background information of the background section.

8. Appendixes

(Note: please contact the project manager to obtain access to annexures)

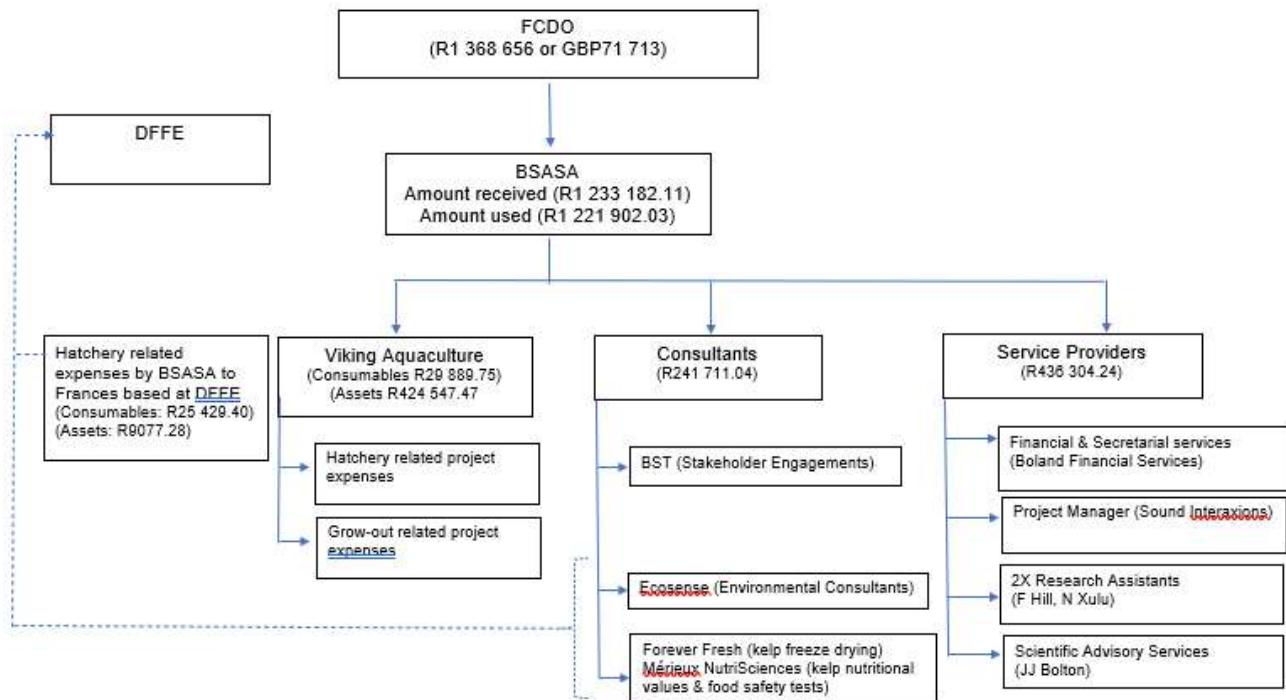
8.1. Annexure A: Project status report



Project status report & schedule v.

8.2. Annexure B: FCDO Delivery Chain Map

Delivery Chain Map (DCM) for the South African Kelp farming project – as on 31/3/2023



Other (Travel & subsistence, Conference etc): - R54 942.85

8.3. Annexure C: Letter from Independent Auditor

Letter from an Independent auditor confirming that phase 2 funds were spent on the project as well as confirming phase 1 surplus.

Meiring to circulate once completed

8.4. Annexure D: Ms F Hill Monthly reports



Hatchery Assistant Monthly Report - Nk
Hatchery Assistant Monthly Report - D
Hatchery Assistant Monthly Report - Ja
Hatchery Assistant Monthly Report - Fe
Hatchery Assistant Monthly Report - M

8.5. Annexure E: Ms N Xulu Monthly reports



N. Xulu November 2022 Monthly Report
N. Xulu December 2022 Monthly Report
N. Xulu January 2023 Monthly Report
N. Xulu March 2023 Monthly Report.pdf
N. Xulu February 2023 Monthly Report

8.6. Annexure F: EcoSense report



Kelp Farming in Saldanha Bay - impa

8.7. Annexure G: Dr B Macey report



BM_ Nutritional Studies_Phase 1 anc

8.8. Annexure H: Emeritus Prof JJ Bolton – PSSA Newsletter article



PSSA Newsletter_Volume

8.9 Annexure I: BST DRAFT Stakeholder Engagement report



BST_Stakeholder Engagement Works