

South African Kelp Farming Project (Phase 2 Feasibility study)

Standard Operating Procedure (SOP): General set-up & preparations

SOP number: BSASA-1

Date: 1 March 2025

Compiled by:

The Project Manager (Dr Lizeth Botes)
on behalf of BSASA

Version: 1

Review date: to be adapted and revised by industry

Introduction

The overall goal of the South African Kelp Farming Project (SA KFP) was to gather, analyse and disseminate evidence and research results to a broad stakeholder base, including the existing aquaculture industry and new potential entrants, to lay the foundations toward building a sustainable Kelp Aquaculture Industry in SA and the region.

One of the project objectives was to investigate and tailor the hatchery and nursery methods for our local kelp species (based on the kelp farming manuals from elsewhere that are already publicly available and accessible on the [SA KFP webpage](#)), which can then be adapted and revised by industry to suit their own needs. Although the temporary set-ups that were used in Phase 2 of the SA KFP were aimed at achieving the short-term project objectives, it was the first successful attempt to cultivate *Macrocystis pyrifera*, *Ecklonia maxima* and *Laminaria pallida* in South Africa, and also the first successful attempt to cultivate *E. maxima* and *L. pallida* anywhere.

Purpose of SOP:

The purpose of this SOP is to provide guidance in terms of the hatchery/nursery laboratory set-up, spool and media preparations that will be required during the hatchery/nursery stages of the kelp production cycle. Since very detailed kelp farming manuals are already available, these topics will be covered briefly and will refer to the manuals where relevant.

General set-up and facility preparations:

Note: consult the manuals available on the SA KFP webpage that provide detailed descriptions of the set-up and the required equipment, tools and consumables when deciding on the lay-out of the hatchery/nursery facility.

1. Basic set-up and conditions:

A basic kelp hatchery and nursery require a facility that will provide access to an airconditioned room, tanks, lights, seawater and freshwater as well as working space.

➤ Temperature:

To cultivate the 3 kelps *Ecklonia maxima*, *Macrocystis pyrifera* and *Laminaria pallida* it is advised to keep the air temperature in the room and the water temperature in the tanks at 15°C. This can be achieved by an air conditioning system for the room and/or chillers through which the water can be circulated to keep the water temperature in the tanks constant at 15°C.

➤ Water supply:

Apart from access to normal freshwater for general use and cleaning, distilled freshwater will be required on a weekly basis.

Access to filtered seawater (before the hatchery filtered from 50µm, 20µm to 10µm, in the hatchery filtered from 5µm, 1 µm, 0.5 µm and then to 0.2 µm) passed through Ultraviolet (UV) light will be required on a weekly basis.

- Tanks:

Depending on the size of the facility and shelves/trolleys available on which the tanks will be mounted, fish tanks (of approximately 75cm long, 40cm wide and 35cm high) will be required.
- Frames and grow lights:

PVC pipes (generally used in plumbing) are available in different sizes and can be used to construct a frame onto which grow lights (400-700nm) necessary for photosynthesis can be mounted. The intensity of the grow lights will have to be increased as the kelps grow bigger, and this can be achieved by adding additional light brackets to which additional lights can be attached as required. All lights must be connected to a timer so that a photoperiod of 16hrs day and 8hrs night can be maintained (12:12 cycle can also be used).
- Working space:

Sufficient clean bench space will be required on which laboratory work can be done. Access to safely installed electricity points must be available.

2. Tools & Equipment:

The basic pieces of equipment that will be required are glass tanks (in which the kelpings will be grown on spools), chillers (to keep the water temperature in the tanks constant), pumps (to pump the water through the chillers to maintain desired water temperatures), filter pumps and filter attachments (to filter, circulate and aerate the water in the tanks), UV steriliser (to sterilise utensils etc), aquarium thermometers, compound microscope, 7-1 water quality multi-meter, haemocytometer, cooler boxes, gel ice packs, plastic squeeze rinse bottles, plastic spray bottles, measuring jugs, pipettes, stirring spoons, dissection kit, laboratory coats.

3. Consumables:

The basic consumables that will be required are various sizes of filters (5µm, 1 µm, 0.5 µm and 0.2 µm), pipette points, growth media, germanium dioxide, hatchery twine, paper towelling, tin foil, permanent markers, hand sanitizer and soap, latex powder-free gloves, bleach, distilled water, 70% ethanol/isopropyl alcohol, tubing, tube cleaning brushes, cloths Perspex lids to cover tanks.

4. Suppliers:

The consumables, tools and equipment as well as safety and protective clothing are generally available at local outlets such as pet shops, general hardware and plastic shops, plumbing shops, scientific suppliers such as United Scientific, Sigma-Aldrich. Hatchery twine was ordered from [Langman Touw Fabriek](#) in the Netherlands.



Preparation of tanks:

1. The tanks must be cleaned before use with 70% ethanol/isopropyl alcohol, distilled fresh water and then sterilised filtered sea water (in that order).
2. Fill the tanks with filtered and sterilised sea water and cover with Perspex lids.
3. Set the chillers to 15°C.
4. Set the air-conditioned room at ~15-16°C.
5. To begin with, insert one LED light bulb (~30 µmol/m²/s) on either side of the tank. Additional LED light bulbs can be added as needed.
6. Set the light timers to 16:8 day-night cycle.

Preparation of spools:

1. Depending on the size of the facility and tanks, cut PVC pipes (~6-7cm diameter) to ~30cm-40cm lengths and drill 2cm diameter holes to allow water movement and air to escape. This is especially useful when having to handle the spools, so ensure some of the holes are also at the top through which one can stick one's fingers or cable ties (when being hung in Weaning).
2. Make sure that the ends are flat so that the spools do not lean toward one end once being placed down in the tank or in the canisters.
3. Use sandpaper to smooth the edges after cutting to minimise possible damage to the kelpings.
4. If the spools are not going to be used immediately, store the spools until use at a later stage.
5. If the spools will be used immediately; neatly wrap the PVC pipes with 1.6mm Seaweed twine



and fasten with cable ties at both ends. The twine should not overlap nor should there be gaps.

6. Sterilise the PVC spools wrapped with twine in the UV steriliser before use.

Preparation of canisters:

The canisters will be used when settling spores onto the spools in the hatchery/nursery as well as when transporting the spools with kelpings to weaning/grow-out.

1. Depending on the size of the spools, the canister PVC pipes must be wide enough to allow space between the spool and the canisters for 1-2cm kelpings, and slightly longer than the spool to comfortably fit the spools into the canisters.
2. Glue a screwable stop-end onto both ends.
3. Seal the bottom lid, so that only the top lid can be screwed on and off.
4. Leave the assembled canisters to dry, once dried place them into seawater for a few days until the strong glue vapours have dissipated.
5. Before use, test that the canisters are not leaking.



Preparation of culture media:

- For Provasoli's Enriched Seawater (PES) medium:
 1. Make up the PES as per page 78-79 of the New England Seaweed Culturing Handbook.
 2. Half strength PES has been found to be suitable for kelp, which means 10ml of the PES stock solution must be added to 1 litre of seawater (as opposed to 20m/l for full strength PES).
 3. Store in cool dark place (i.e. refrigerator or wrap in tinfoil and leave in the 15°C hatchery/nursery laboratory).
- For Guillard's (F/2) Marine Enrichment medium (which is already half strength "f" medium)
 1. Make up the F/2 solution as per Appendix 2 of the Aquaculture Production of Australian Laminarian Kelps manual or use the All-in-One Algae Nutrient Powder from Varicon Aqua (see Appendix 3 of the Aquaculture Production of Australian Laminarian Kelps manual).
 2. In the case of the All-in One Varicon Aqua (which is widely used in the South African aquaculture industry to grow diatoms), add 1.5ml of the stock solution to 1 litre of seawater.
 3. Store in cool dark place (i.e. refrigerator or wrap in tinfoil and leave in the 15°C hatchery/nursery laboratory).

Note:

- The Varicon Aqua F/2 medium contains silicate which seaweeds do not use and instead promotes diatom growth, thus increasing the likelihood and intensity of contamination.

Preparation of Germanium dioxide (GeO₂):

Diatoms are a common type of contamination in seaweed cultures, but its growth can be impeded with the addition of GeO₂.

1. Prepare the stock solution by dissolving 250mg of GeO₂ per 1 litre of deionized water and store in a refrigerator.
2. Add 2ml of the stock solution to 1 litre of seawater.

Note:

- Brown algae are also sensitive to high concentrations of GeO₂, so this concentration should not be exceeded. One to two weeks of treatment is usually sufficient.

