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South African Kelp Farming Project (Phase 2 Feasibility study)

Standard Operating Procedure (SOP): Water changes and maintenance

SOP number: BSASA-7	**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 a breakdown of steps required to do water changes and maintenance on a weekly basis until the kelplings are ~1cm and ready to be out-planted.

Preparation of workspace:

1. While wearing powder-free surgical gloves, clean and sterilise the work surface and make sure enough paper towels are available.
2. Sterilize all utensils and glassware that will be needed for the procedure.
3. For water changes to take place, it is advised that there is always one spare open tank available to which spools can be transferred.
4. Clean the open jars/tanks, tubing, plexiglass lids etc with 70% ethanol/isopropyl alcohol, distilled fresh water and then sterilised filtered sea water (in that order).

Water changes:

1. After cleaning, add 2ml/l of GeO_2 and 10ml/l PES and fill the jars/tanks with the desired amount of 15°C filtered sea water.

Note:

- Autoclaving seawater may affect the macronutrient and micronutrient composition of seawater. While it's a reliable method for sterilisation, the high temperature and pressure may alter the chemical concentrations of certain nutrients for example, it may affect the concentrations of nitrate and phosphate. Autoclaving may also change the bioavailability of certain nutrients, making them less readily usable. This is particularly relevant for trace elements and organic matter, which may be altered/degraded by the process.

- At the DFFE Sea Point hatchery facility, autoclaving was done but at the Paternoster Oyster Company (POC) hatchery facility the sea water was cleaned mainly with the use of different size filters which were regularly changed to minimise contamination. At POC, we did attempt to do tyndallization, however this proved to be very time consuming and not practical for the seawater volumes that were needed, considering the small staff component that was available to the project.

2. If it's the 1st water change (thus the 2nd week), then the spools must be carefully transferred back into cleaned jars.
3. If it's the 2nd water change (thus the 3rd week) and all the water changes thereafter, then the spools must be carefully transferred into the cleaned tanks directly.
4. If glass slides are being used to track the development under the microscope, then the glass slides must also be carefully transferred to their corresponding jars/tanks.
5. From the 3rd week, the gametophytes would have started to develop into sporophytes and an additional LED light bulb can be added, as well as filter pumps which will (a) cause water circulation which is very important to circulate nutrients through the tank and (b) cleaning and aerating the water.
6. An additional LED light bulb can be added around the 5th or 6th week. If all goes well, the sporophytes should be ~1cm after 7 weeks (or 50 days). **See figure 2.**

Maintenance tasks:

The following maintenance tasks (weekly and daily) is crucial to maintaining the sporophytes and ensuring they reach ~1cm in length in order to be out-planted:

1. Check that the day:night cycle is set on 16:8, the chillers are maintaining their set temperatures at 15°C and that the room's air temperature maintained at ~15-16°C.
2. On a daily basis, turn the spools by 90° to ensure that all sides of the spools get equal light exposure.
3. On a daily basis, clean and replace the sponge filter in the filter pumps.
4. A daily check list should include items such as (but limited to) date, time, air temperature, water temperature, pH, spool rotation, cleaning routine, reporting irregularities and contaminants etc.
5. Micro-algae contaminants are common in a kelp hatchery (see figure 1). When tanks are being cleaned on a weekly basis, special care should be taken to cleaning the corners of the tanks properly.

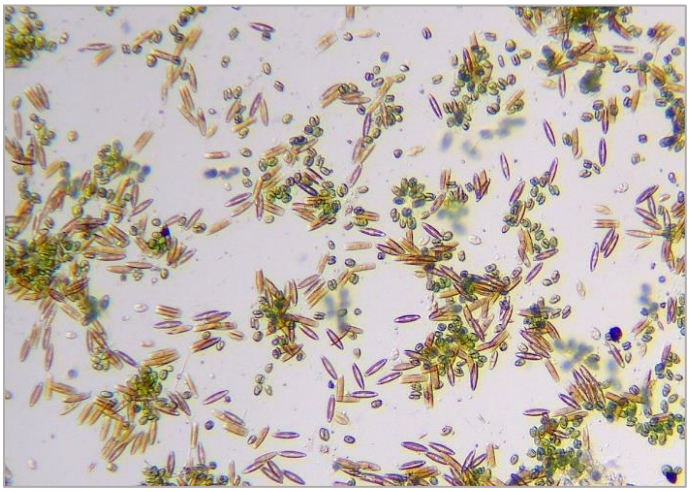


Figure 1. The most common contaminants in the hatchery included diatoms (such as *Navicula* spp.) and single cell green algae (likely *Chlamydomonas* spp.). (Photo credit Mr Musadiq Schalkwyk)

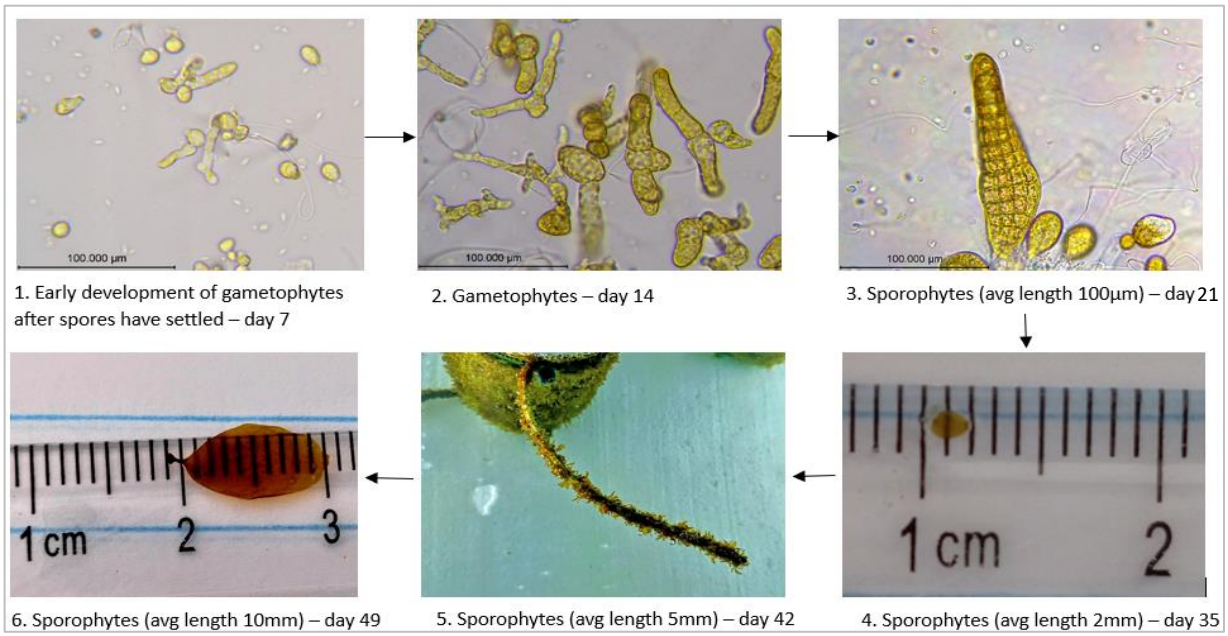
Note: The daily checks include weekends, thus weekend duty is a must for hatchery staff but should not take longer than 40mins on a Saturday and 40mins on a Sunday.

Cleaning workplace:

1. Clean the workplace and discard in the appropriate manner all used paper towels and gloves.

Once the sporophytes have reached ~1cm in length, continue to SOP8.

(a)



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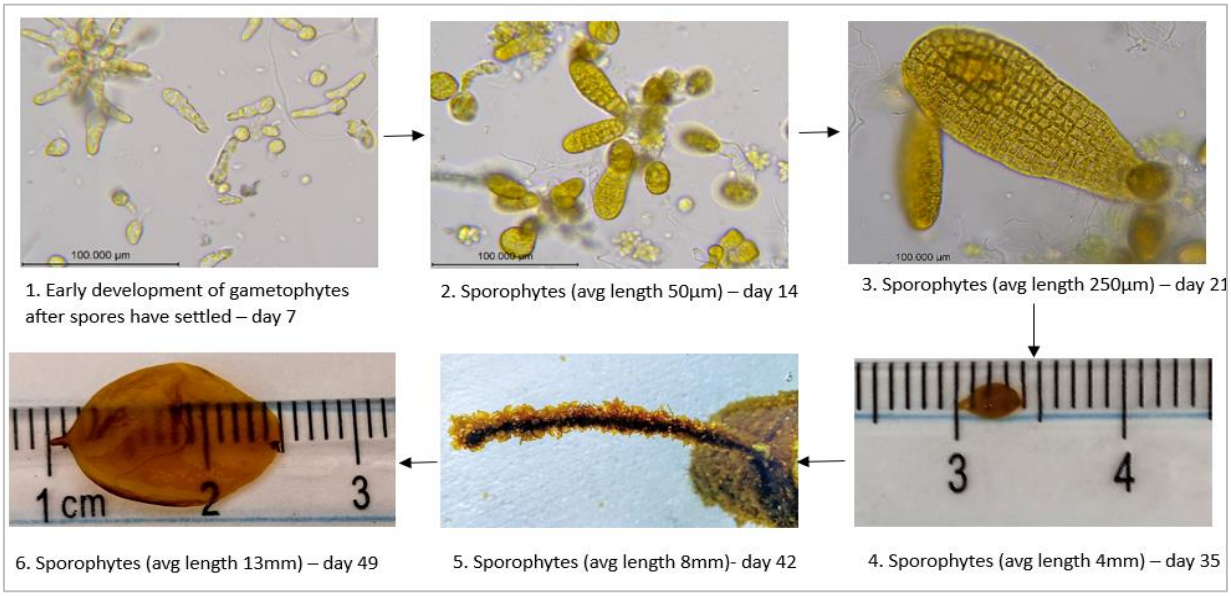

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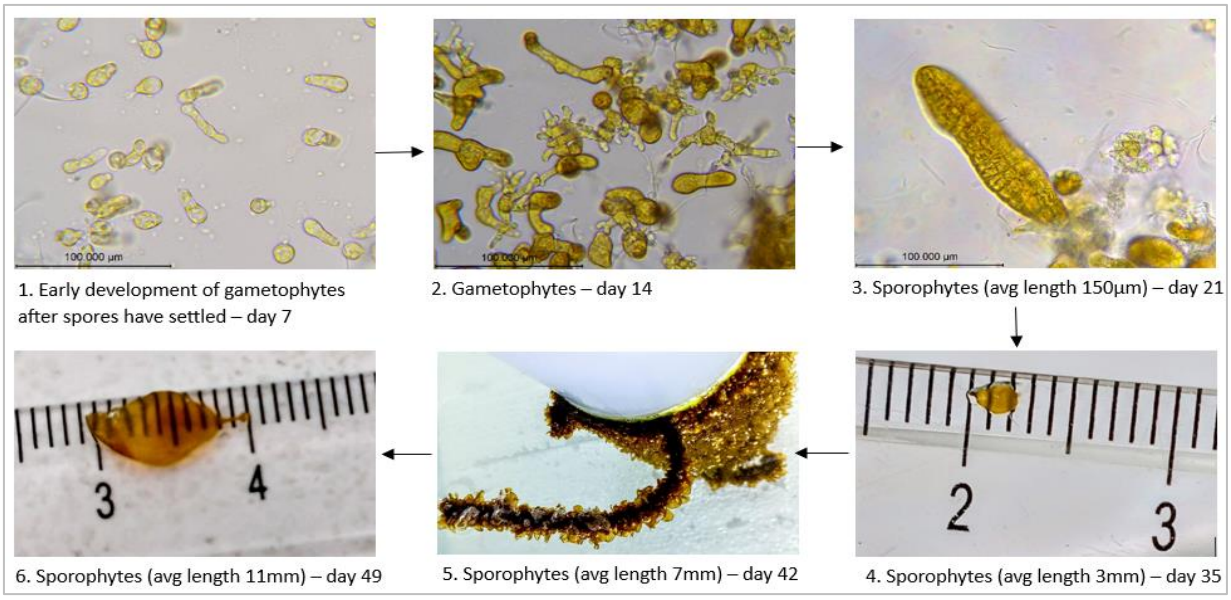

Figure 2. Developmental stages up to day 49 in the Hatchery/Nursery of (a) *Ecklonia maxima*, (b) *Laminaria pallida* and (c) *Macrocystis pyrifera* as tracked by Mr M Schalkwyk at POC (Photo credits: Mr Musadiq Schalkwyk)