

South African Kelp Farming Project (Phase 2 Feasibility study)

Standard Operating Procedure (SOP): Monitoring and maintenance

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Compiled by:

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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 weaning and grow-out 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 perform the basic monitoring and maintenance activities in Grow-out.

Basic kelp monitoring activities:

Although more detailed growth measurements and biofouling monitoring were done for the purposes of this project, it is envisaged that kelp farmers will do more basic monitoring and measurements on a monthly basis and eventually on a weekly basis when nearing harvesting time in order to determine the best time to harvest depending on the product and the market it will be sold into.

1. In preparation of the monitoring at hand, pack a record keeping sheet, clipboard, pencil, ruler (for when the kelps are still small) and measuring reel (for when the kelps are growing bigger than 30cm), paper towelling, cooler box and various sizes of plastic bags and PPE.
2. For length measurements and biomass estimations:
 - On a vertical dropper; measure 6 plants at 3m depth of at least 3 droppers on a few randomly selected long-lines.
If the kelps are growing horizontally on the long-line, choose at least 3 spots on a few randomly selected long-lines and measure 6 plants at each spot.
 - Measure the total length of the entire plant (from above the holdfast to the tip of the plant).
 - Record the measurements to determine market readiness.



Biomass estimation:

- Randomly select a few droppers and remove the kelps within a 25cm stretch anywhere on the dropper, place it all together in a plastic bag in order to get the total wet weight and use the reading to extrapolate to a metre to estimate the biomass.
- Depending on the size of the kelp, use the desired size scale to determine the wet weight.
- Record the measurements to determine market readiness.
- Record the absence/presence of the problematic kelp grazing species which also feed on the epiphytes on the kelps, namely *Paridotea reticulata* commonly known as reticulate kelp louse.

(Photo credit Ms Waqeebah Moosa)



3. Biofouling estimation:

- The surface of the kelp blades provide habitat for other species which is collectively referred to as biofouling. Biofouling unfortunately degrades the quality of the blades. In the case of, for example, bio-stimulants, this may not be such a big issue however if the blades will be used for human food and/or animal feeds, it may be.
- Design a desired scale for estimations, for example:

Biofouling estimation scale:				
Biofouling score	1	2	3	4
Biofouling description	From the tip of the blade: within the 1 st quarter of the total length of the blade	From the tip of the blade: between a quarter and half of the blade	From the tip of the blade: between half and ¾ of the blade	From the tip of the blade: between ¾ of the blade and the entire blade

- From the plants that were removed for the biomass determination, estimate the degree of biofouling on the blades and record the score (i.e. 2) on the record keeping sheet so that the progress of the biofouling can be tracked especially when nearing harvesting in September.

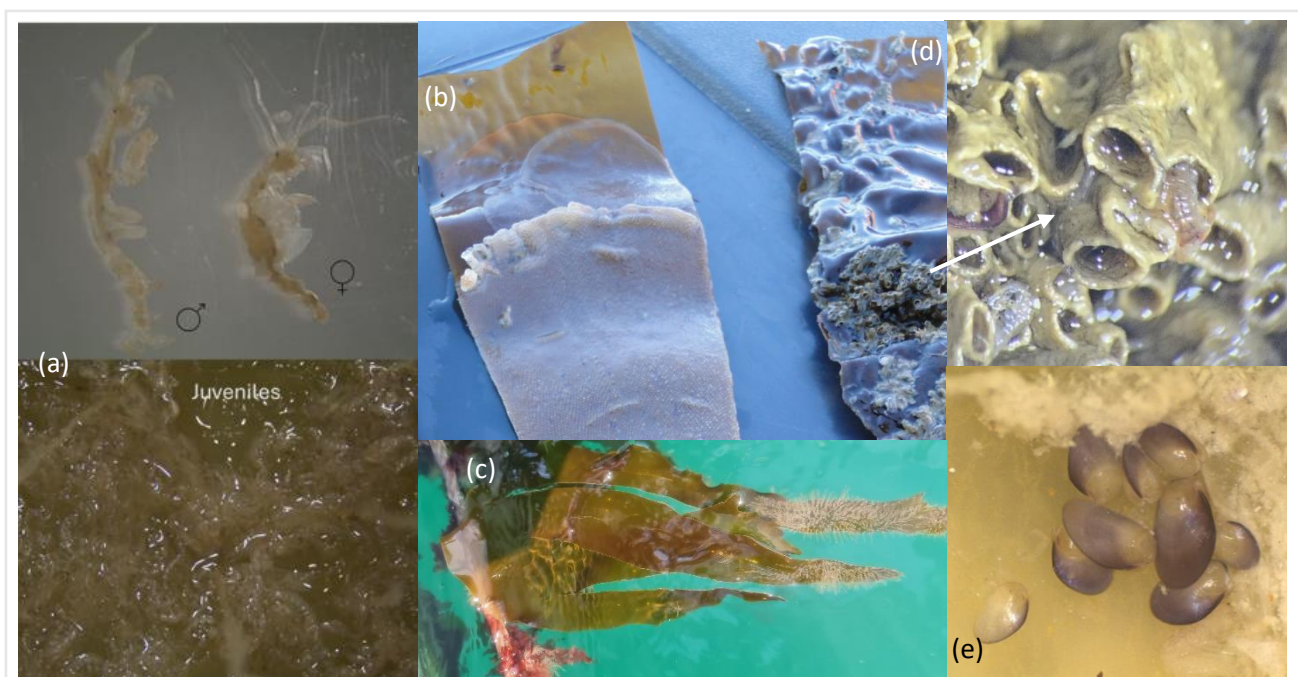


Figure 1: The most common biofouling species on kelp blades included (a) skeleton shrimps (b) colonial bryozoans (c) hydroids (d) tube dwelling amphipods and (e) mussel spat. (Photo credit: Ms Waqeebah Moosa)

Basic maintenance of grow-out structures:

1. General maintenance every two to three weeks:
 - In preparation of the general maintenance and cleaning that need to be done every 2 weeks, pack scrapers, a shackle, a knife, extra floats and extra pieces of tie-up rope.
 - Use the scrapers to clean the weights, buoys and floats and a shackle to clean the main line where possible.
 - If any of the floats need fastening, use the knife and the extra pieces of rope to tie it up.
 - Check if any of the floats need replacing. Remove the damaged ones and replace them.

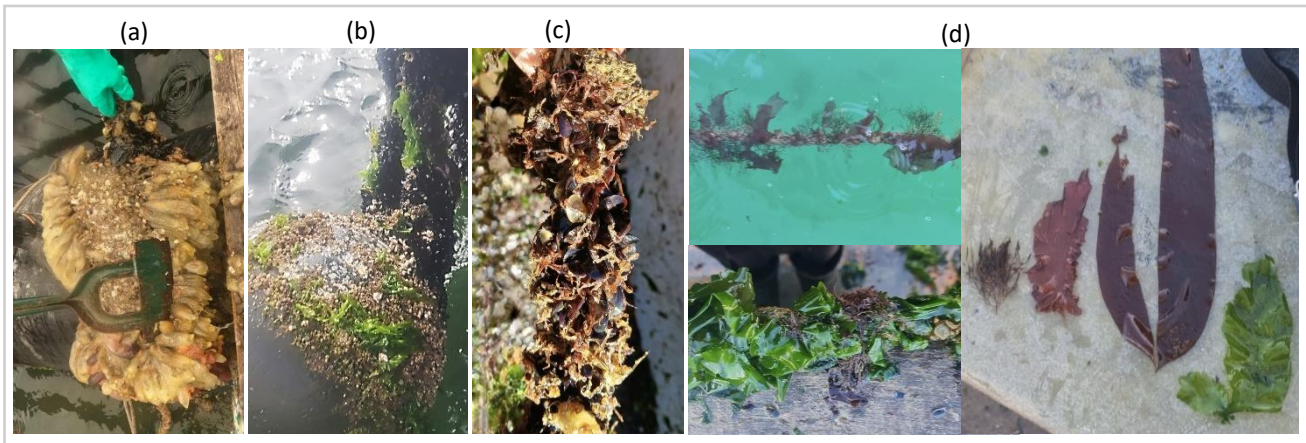


Figure 2: The most common biofouling on the main long-line and farm structures included (a) tunicates on weights, (b) encrusting barnacles and mussels on buoys and anchor lines (c) skeleton shrimps and mussels on ropes (d) various macro-algae on ropes.

2. Mooring line maintenance every 6 months

The mooring lines connecting the main long-lines to the anchors, get extremely fouled and these need to be cleaned every six months (or at least once a year) by contracting divers in to clean these to prevent it from dragging down the entire long-line.

3. Maintenance after storms

It is advisable that after each storm, a visit is paid to the farm site to untangle any rope structures and fix any damage that may have been caused by storms to ensure no losses are experienced in terms of structures and/or product.

Basic environmental monitoring:

Detailed water quality profiles (see figure3) for the site at BOM were determined using HOBO loggers that already provides a good idea of the seasonality of parameters in Small Bay of Saldanha Bay such as temperature, pH, dissolved oxygen and nutrients (Nitrite, Nitrate, Ammonium, Phosphate, Silicate), however farmers might want to get a rough indication of their own site by using these very elementary but useful monitoring kits and equipment.

1. A hand-held multi-meter can be used to measure pH, temperature, dissolved oxygen etc.
2. Sigma-Aldrich marine aquarium test strips can be used to get an instant indication of Nitrate, Nitrite, Ammonium and Phosphate at 3m depth.
3. A Niskin bottle can be used to collect a water sample at 3m depth as per [this video](#). It is not recommended that a sea surface sample be used as the water at growth depth will provide a much better indication of nutrient availability to the kelp.



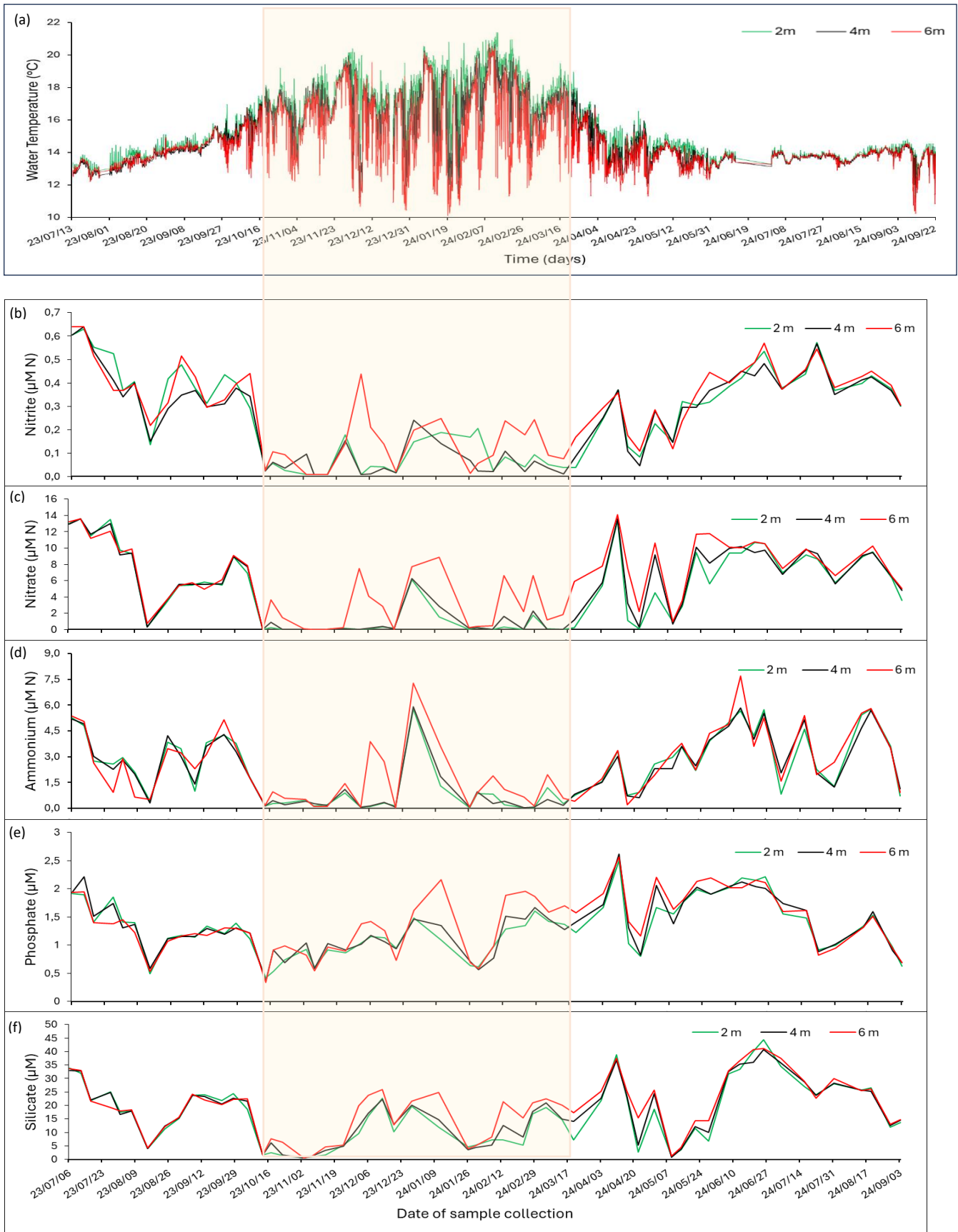


Figure 3 (a) Temporal variations in the water temperature at three depths (2m, 4m, and 6m) in Small Bay of Saldanha Bay from Jul'23 to Sept'24 (b-f) Temporal variations in nutrient concentrations at three depths (2m, 4m, and 6m) in Small Bay of Saldanha Bay from Jul'23 to early Sept'24. The yellow shaded area shows the period when nutrient concentrations are low and pose a challenge to the kelps. (Graph credit: Ms N Xulu).

Acknowledgements:

Nutrient analyses of all water samples were done by the staff of the **Marine Biogeochemistry Laboratory in the Department of Oceanography at the University of Cape Town** and the data for the above graph, quality controlled by Dr Sarah Fawcett.