

South African Kelp Farming Project (SA KFP)

(a) Kelp Farming Production Cycle Outline

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Kelp production cycle	1. Collecting kelp to stock up hatchery spools 2. Kelp spool care & maintenance			3. Out-planting of hatchery spools (Temps preferably ≤15 °C)	4. Monitoring-kelp growth &-biofouling 5. Inspections & infrastructure maintenance (especially after storms)				6. Harvesting	7. Removal & cleaning of infrastructure/structures 8. Pre-processing & Processing activities		
Environmental influences	Decreasing temperatures with ad hoc upwelling events			Cooler water temperatures						Increasing water temperatures with ad hoc upwelling events		
	Low N-based nutrients conc's			High nutrient conc's						Extremely low N-based nutrient conc's		
	Phytoplankton blooms											
	Biofouling season											

Diagram 1. General timeline of the kelp production cycle together with environmental parameters in Small Bay of Saldanha Bay (Diagram credit: Dr Lizeth Botes)

Generally, in **land-based aquaculture farm facilities**, the production cycle is well known to include the following production stages i.e. Hatchery (where parent stock are maintained indoors to produce offspring), Nursery (where offspring are reared indoors until big enough to be introduced to a semi-outdoors area), Weaning (where offspring are being transitioned to better equip them to being grown outdoors), and Grow-out (where offspring are maintained outdoors until market size is reached).

In the SA KFP, we initially took the approach to move kelp sporophytes which are barely visible by eye, from the hatchery directly to grow-out and exposing them to the outside environmental elements without intermediary stages. While this approach may work well elsewhere, we have found that having all the stages as explained above is more successful in Saldanha Bay. The inclusion of the intermediary stages i.e. nursery (where sporophytes were grown to ~1cm even though we eventually end up having to accept some degree of micro-algal contamination) and weaning (where spools were hung in the sea for ~2-3 weeks before being unwound) have allowed the kelps from the nursery to have a better chance to compete with initial siltation and biofouling when out-planted in Saldanha Bay. The weaning stage has repeatedly proven to be successful providing the kelp sporophytes approximately 2-3 weeks to acclimatize especially if the travel distance between the hatchery site and the grow-out site is far. However, the other school of thought to outplant the hatchery spools as soon as possible before hatchery contamination sets in and when the sporophytes are less than 1cm in average length, is equally valid thus each potential kelp hatchery facility and/or potential kelp farmer will have to assess the two options and see which will work the best depending on the distance between the hatchery and grow-out as well the conditions at the grow-out site.

Hatchery/Nursery component (~2 months)

Although diagram 1 provides a general timeline that will be useful to a future kelp farmer in terms of planning, one should be mindful that differences between hatchery set-ups may exist, for example, at Paternoster Oyster

Company (POC) all 3 kelp species grew to ~1cm within 7 weeks, whereas at the DFFE Research Aquarium *Ecklonia* and *Laminaria* grew to 0.5cm in 12 weeks and *Macrocystis* grew to almost 1cm in 12 weeks.

Transporting from the Hatchery/Nursery facility to the Weaning/Grow-out facility

When transporting the kelp sporophytes to the grow-out site, temperatures during transit must be kept stable and preferably between 12-15°C. Therefore, when planning to transport kelp sporophytes from the hatchery to the grow-out site (and depending on the distance to be travelled) it is important to choose a cool overcast day especially without having access to an air-conditioned vehicle. Care should be taken to maintain the temperature in the transporting canisters and cooler containers, and to note the sea water temperatures where the kelps will be out-planted to as far as possible prevent the kelps from getting a temperature shock either from heating up in the vehicle and then out-planted in cold water or from putting it into canisters and coolers where it is cold and then being out-planted in water that is much warmer.

Out-planting

When considering a day to out-plant, it is important to select a day (www.windguru.cz) that is cool with little to no wind for ease of working on the boat. If the boat has a cabin, put the coolers with canisters containing the spools with sporophytes in the cabin until you reach the out-planting rope structures. It would be advantageous to look at the days prior to the out-plant day and consider which winds are blowing and what the prevailing sea surface temperatures are (and even to obtain a vague idea of which winds may have resulted in a nutrient influx). If possible, overcast days during early April with water temperatures below 15°C would be ideal. When the coolers with canisters (containing the hatchery spools) arrive, it is worth recording the air temperature inside the cooler, as well as the water temperature inside the canister for record keeping purposes. If possible, all should be between 12-15°C and as closely matched to the sea surface temperature where the unwinding of spools onto the grow-out rope structures will take place in order to avoid giving the sporophytes a temperature shock.

Weaning/Grow-out component (~6 months)

We have repeatedly had success with the method of hanging spools at the Blue Ocean Mussels (BOM) site at a preferred depth (i.e. 3m) for 2-3 weeks (depending on the size of the sporophytes when out-planted) without unwinding the spools, serving as a weaning stage. As soon as the sporophytes reached 2-3cm, the spools were removed and unwound on the desired out-planting rope structures, serving as the grow-out stage. It should be noted though that it is recommended to unwind the spools before the sporophytes reach 3cm and not to wait until they are 4cm or bigger, as at that point the holdfasts of the sporophytes extend over the hatchery twine and when being unwound there is a risk of damaging the holdfasts. Once in grow-out, kelps should be monitored on a monthly basis. This would be especially important during the month in which the kelps will be harvested in order to get the best quality blades with as little as possible fouling.



(b) Kelp Standard Operating Procedures (SOP) Outline

Hatchery & Nursery

SOP1: General set-up & preparations

SOP2: Kelp collection

SOP3: Processing of kelp blades

SOP4: Sporulation

SOP5: Settling spores onto spools

SOP6: Transferring spools to jars/tanks

SOP7: Water changes & maintenance

SOP8: Transporting spools from nursery to weaning

Weaning & Grow-out

SOP9: General set-up & preparations

SOP10: Receiving spools in weaning

SOP11: Transferring spools to grow-out

SOP12: Monitoring & maintenance

Please view the SOP accompanying short videos on the [SA KFP YouTube channel](#), and the Final Output report on the [SA KFP webpage](#)