

Joint Innovation Project - 2024/25

From Hatchery to Harvest: Examining the effects of different hatchery environment throughout the bull kelp lifecycle

Lead Entity: Dr. Michael Stekoll

Category: Innovations in Seaweed Farming

Project Location: Juneau and Kodiak

Project Start Date: August 1, 2024

Expected End Date: October 31, 2025

Award Amount: \$100,000

PROJECT OVERVIEW

Please provide an updated description of your project here using the following guidelines:

The problem to be solved (1-2 sentences)

The initial goal of this project was to optimize bull kelp hatchery production and farm harvest by understanding the lifelong effects of abiotic conditions in the hatchery. While we had decent results in the hatchery portion of this project, we experienced a number of challenges on the farm, leading us to add an additional goal of understanding how certain environmental factors may have resulted in seed loss.

Your proposed solution (1-3 sentences)

We proposed to achieve this goal by focusing on three objectives:

1. Assess how varying temperature and light levels influence microscopic bull kelp growth and development at the hatchery stage.
2. Monitor how different abiotic conditions within the hatchery affect costs and energy uses.
3. Determine how the growth and harvest of adult bull kelp is affected by different hatchery conditions.

What you have accomplished/learned to date including challenges, successes, and any changes to your original proposal (4-5 sentences)

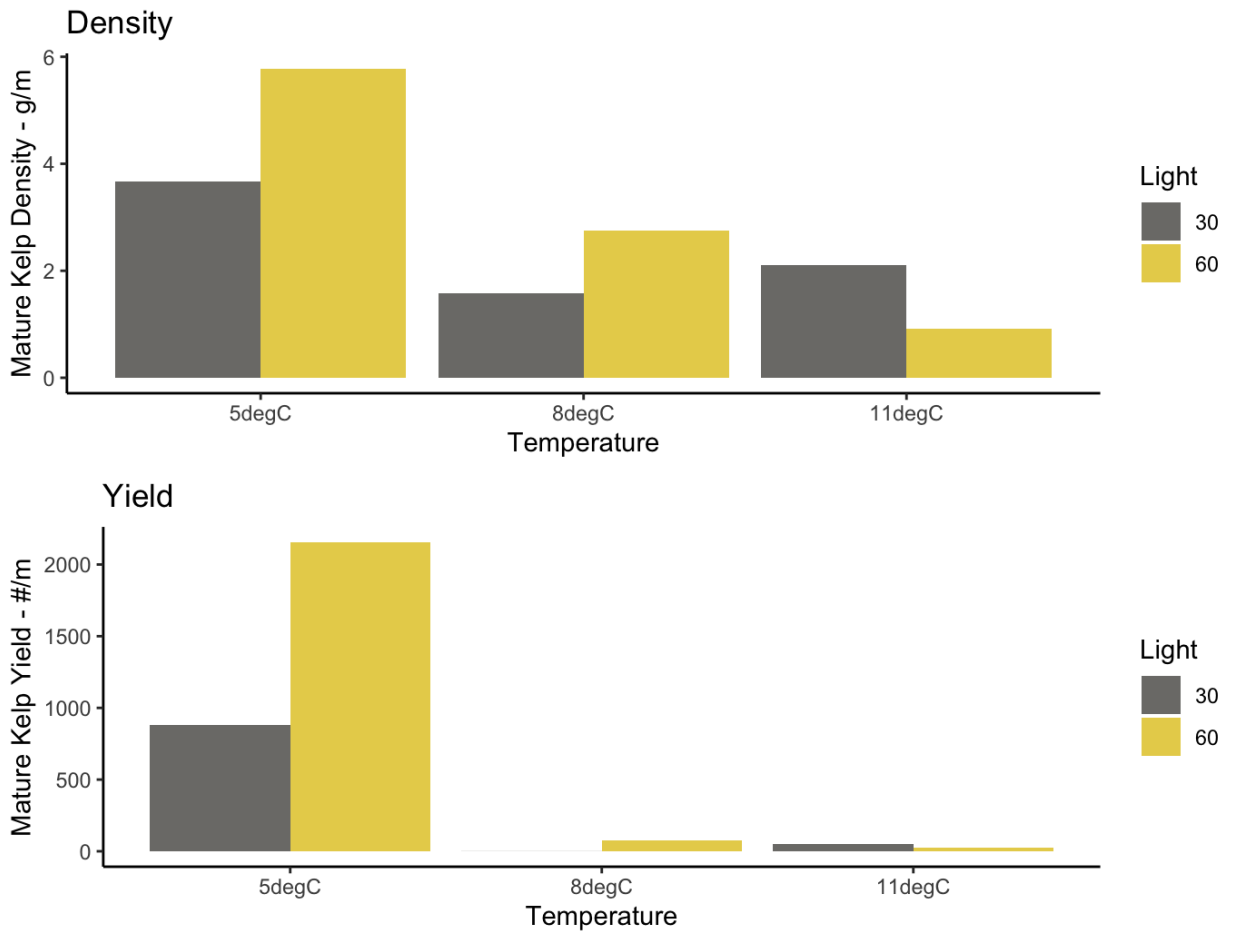
So far, we have learned that temperature and light regime in the hatchery can have significant impacts on the growth and development of bull kelp. High temperatures led to the fastest growth of bull kelp microstages, but also grew almost too fast, as many juvenile sporophytes fell off the seed string by the time we outplanted. Low temperature, on the other hand, had slower, but more steady growth, with an added benefit of lower contamination risk. Higher light regimes also seemed to have a positive effect on bull kelp microstages, but we are still analyzing whether this effect was significant or not. Within a month of outplanting, however, almost all the bull kelp seed was washed off the seedline, thus preventing us from analyzing how these hatchery effects impacted harvest.

Next/final steps (1-3 sentences)

Currently, we are analyzing the data from the hatchery portion of our experiment as well as exploring two hypotheses for the loss of kelp in the field portion of our experiment. One hypothesis is that this winter was an odd one in both Juneau and Kodiak – temperatures were warmer than usual, there was a lot of rain and little snow, and skies were constantly overcast. To explore this hypothesis, we will use NOAA weather data and abiotic sensor data from the MarReCon experimental arrays in Kodiak to compare environmental conditions between the winter of 2024 and 2025. Our second hypothesis is that certain hatchery conditions (i.e. low water motion and frequent GeO_2 additions) may have prevented strong adhesion of young kelp to the seed string, thus causing them to be washed away once placed in a natural marine environment. We are currently running a follow up experiment in Kodiak that replicates the conditions we used in our initial hatchery design, but instead of manipulating temperature and light, are exposing seed string to three different water velocities and three different GeO_2 addition regimes. This experiment will conclude at the end of July, after which only data analysis will remain.

ADDITIONAL INFORMATION

- Do you anticipate any challenges in completing your current scope of work by your planned end date? All field and lab operations will indeed be finished by the end of October, but due to the additional hypotheses and questions posed by the loss of kelp stock on the farm, data analysis may not be completed by then.
- Do you anticipate spending all of your awarded funds?
Currently, we have about \$25,000 remaining in the budget. If we can get a no-cost extension as indicated below we expect to spend about \$20,00 for salaries and farmer's contract. This would require a rearrangement of the budget.
- Do you have anything *additional* that you would like to share?
While we did learn a lot from these initial trials, we believe that retrialing our experiment this coming fall may lead to better outplanting outcomes and more information about how hatchery conditions affect bull kelp growth on farms. For example, initial analysis of the data we were able to gather from Kodiak's harvest seems to indicate that growing bull kelp under lower temperatures (5C) in the hatchery results in drastically higher yield and density when outplanted (see graphs). However, due to the aforementioned loss of seed coverage on our lines this winter, it is difficult to say whether this was an effect of the hatchery treatments themselves, or just a serendipitous effect of just not as much seed being washed off the seedlines grown at 5C. An additional season of replication would help us to better determine the possible cause of this interesting result. As such, we would like to extend the timeline of our grant to end in June of 2026, thus giving us time to replicate our hatchery conditions and re-outplant our kelp to see if there are any significant effects of hatchery on harvest.



PHOTOS



Figure 1. Bull kelp gametophytes on outplant string.



Figure 2. Outplanted bull kelp in Kodiak.