Kelp Ark QUARTERLY REPORT 5

Seed Quality Improvement Project, Q5 2026

Title: Population genetics and gametophyte seed banking of Alaska kelps

Date Submitted: 7/28/2026

Report Narrative:

For this quarter 248 sporophytes were collected from the field by our collaborating farmers. 188 from Juneau,Southeast, to finalize our collection in the region. Then another 60 were collected from the Prince William Sound region, which also completes this region's field collection. Then, 67 and 65 Saccharina latissima samples were collected from the Kenai Peninsula, and Kodiak Regions, respectively.

Which now leaves only Bull Kelp From the Kenai Peninsula region as our missing field site for this project, which is being scheduled for the month of July.

Our team also worked closely on reviewing cultures being held in the lab, to ensure that they are properly isolated, and accounted for.

Biomass growth for isolated gametophytes has been slower than expected, the team is considering alternatives to speed this process to meet our timeframes.

During this quarter, our award has been amended to include three additional tasks, which we have started to take actions on. We coordinated with folks from ADF&G, and Korean collaborators to meet during the Phycological Society of America meeting in Juneau (June 14- 17, 2026), our meetings there had the following outcomes.

First, we brought up the topic of triploid and sterile kelp farming to Kathryn Gruenthal from ADF&G's Gene lab. The main takeaway from this meeting was that there is a way to get triploids or sterile kelps out in farm trials. But we also wanted to understand how to enhance farming by selective breeding and came to the conclusion that we need to first have certain trait selection happen in crosses before we implement sterile kelp farming, as those obviously will not have a chance to breed into anything else down the line. Second, meetings with our Korean colleague, Hwan Su Yoon, were very productive. We took him, and his student out to a local kelp farm, SeaQuester, to observe their operations and kelps. We also discussed our plans for a Korean-Alaskan Kelp Breeding workshop we are organizing, and they seemed enthusiastic about participating and engaging with folks in the seaweed sector in AK.

Task summary:

Task 1: Establish a collection of commercially relevant Alaska kelp

1.1(Q1) Kelp Ark will work with a group of Alaska farmers to gather sugar, bull, and ribbon kelp sori. Sori will be collected from each Alaska kelp-growing region (Prince William Sound, Kenai Peninsula, Southeast, and Kodiak)

We have completed collections during this quarter in the following regions for the following species.

67 and 65 Saccharina latissima samples were collected from the Kenai Peninsula, and Kodiak Regions, respectively.

188 field samples were collected from Juneau,Southeast, to finalize our collection in the region for all three species. Then another 60 Bull kelp individual sporophytes were collected from the Prince William Sound region, which also completes this region's field collection.

This now leaves only Bull Kelp From the Kenai Peninsula region as our missing field site for this project. Which is now being coordinated to be collected in July.

Percentage completion for collections of gametophytes from 4 project regions, and 3 species.

Field Collected	Alaria marginata	Saccharina latissima	Nereocystis luetkeana
Prince William Sound	100%	100%	100%
Kenai Peninsula	100%	100%	0%
Southeast	100%	100%	100%
Kodiak	100%	100%	100%

1.2 (Q1-2) 100% Kelp Ark will communicate with the Gene Conservation Lab at the Alaska Department of Fish and Game before sori collection in order to communicate their sampling plan and ask for feedback. Kelp Ark will consider adapting protocols, when possible, to increase the project's ability to inform the Alaska kelp farm permitting process.

Communications with the ADF&G Gene lab has resulted in working with us by funding part of our genomics work that we will be doing as part of our Task #2. The ADF&G team gave us a template for us to describe our scope of work and budget, so we may form an agreement between institutions.

1.3 (Q1-4) UAF will culture at least 50 individual kelp gametophyte strains per species per region. In total, this will be at least 600 strains, with cultures for sugar, bull, and ribbon kelp from each of the 4 regions. This collection will be housed in Juneau, AK at the UAF's Lena Point facility.

- Gametophytes transferred from well plate to culture tube: 42 females, 45 males of *Alaria marginata* from Kodiak.
- Gametophytes Isolated (in 24-well plates): 44 female, 43 males of *Nereocystis luetkeana* from Kodiak
- Samples Released & Cultured: 145 samples released from sorus tissue, 130 retained and cultured from Kodiak, and Kenai Peninsula Regions.

Our team at the UAF Laboratory has continued isolating gametophytes, for this quarter. In brief, 145 spore samples were released, from the Kodiak and Kenai Peninsula regions. These will be grown for several weeks before they are able to be isolated into culture tubes.

In terms of isolations for this quarter: 42 female and 45 male Ribbon kelp gametophytes were isolated from Kodiak; and 44 female and 43 male Bull kelp gametophytes were isolated from the Kodiak Region.

55 Sugar kelp gametophytes were isolated early in June by the UAF team; and an additional 55 Bull kelp gametophytes were isolated during the Kelp Ark personnel visit to the UAF Lab after being in Juneau for the PSA meetings.

Percentage completion for collections of gametophytes from 4 project regions, and 3 species.

Gametophytes isolated	Alaria marginata	Saccharina latissima	Nereocystis luetkeana
Prince William Sound	100%	100%	0%
Kenai Peninsula	99%	0%	0%
Southeast	77%	53%	14%

Kodiak	100%	0%	20%

1.4 (Q4) Kelp Ark will replicate the Alaska kelp seedbank in California.

Task 2: Assemble and annotate genomic and transcriptomic biodiversity resources

2.1 (Q3-4) Kelp Ark will use available genomes from S. latissima, N. luetkeana, and Undaria pinnatifida to align resequenced genomes of Alaskan kelps.

Biomass is now growing for all isolated gametophytes to be used for sequencing.

2.2 (Q3-4) Kelp Ark will use Illumina sequencing technology, utilizing a minimum of 5x coverage per genotype and a median read length of approximately 200 bp. Data will be filtered for sequencing adapters and quality via Illumina prior to starting the snp calling. They will filter out potential bacterial contamination using PathoScope 2.0.

2.3 (Q4-5) Kelp Ark will use principal component analysis to understand the geographical boundaries of population clusters to delineate population structure.

2.4 (Q4-5) Kelp Ark will communicate with the Gene Conservation Lab at ADF&G to share findings and maximize the utility of their research to ADF&G as they work to better understand population structure, local adaptation, and regulatory strategies for Alaska kelps.

Kelp Ark has submitted required paperwork for creating a subcontract between ADF&G and Kelp Ark to add additional samples for sequencing, as well as personnel time for data analysis.

Task 3: Communication with stakeholders and AMC

- *Kelp Ark will engage with other AMC Kelp Seed Quality Improvement projects as appropriate, as well as the broader AMC coalition and scientific community, to share findings and participate in related efforts.*

Our team has established communications with all other SQI projects and have had good interactions to send material to our seedbank collection. We will be looking for outside funding sources to allow us to accommodate this desire, as our current project does not allow our team to carry on this task.

- *Kelp Ark will lead accounting and invoicing.*

Invoices have been submitted for the months of June, July, August, September, October, November, December, January, February, March, April, May, and June.

Task 4: Quarterly progress reports, final report, and project presentation

- Quarterly progress reports detailing updates will be submitted to AMC during the project period.
    - Updates on our quarter reports have been submitted to SEC.
- Copy of all data generated during the project, in clean and usable formats.
    - Data has been continuously updated on our working sheet, and will be updated onto the Kelp Ark database by next quarter.
- Final report outlining key findings, successful techniques, and recommendations for future commercial production.
- Presentation at a virtual venue sponsored by SEC to share results of AMC projects. Presentation to include Power Point or similar slides.
    - Michael Marty-Rivera gave a talk titled “Kelp gametophyte seedbanking for the future of mariculture and biodiversity of Pacific Ocean kelps” at the Phycological Society of America, in Juneau during the month of June.

Budget Overview

- Budget allocated: $199,396
- Amended Budget allocated: $273,437
- Amount spent this quarter: $49,937
- Remaining balance: $135,857

Task 5: Coordinate and facilitate a Korea–Alaska kelp industry knowledge exchange

• Kelp Ark will engage Korean collaborators and Alaska stakeholders, develop an agenda responsive to participant needs, and coordinate site visit and meeting logistics. SEC must review and approve the agenda prior to the meeting.

Plans are being made to host this knowledge exchange, as expressed in the report narrative.

Task 6: Support Sterile Kelp Breeding and Triploid Farming Regulatory Framework

• Kelp Ark will collaborate with SEC partners and relevant stakeholders, including ADF&G, to provide input supporting the development of a framework for sterile kelp breeding and triploid farming in Alaska.

• Develop a study plan outlining next steps for triploid kelp breeding activities.

Our team has met with ADF&G personnel to discuss how this framework could look like in Alaska.

Task 7: Develop and culture gametophytes to support triploid kelp production

• Isolate, culture, and maintain Saccharina latissima gametophytes and derived sporophytes under controlled laboratory conditions; induce and propagate doubled haploid lines; conduct complementary crosses to generate triploid sporophytes; and prepare resulting materials for sex determination and ploidy analysis.

Our team has hired a new lab technician who will be working through this portion of the project, and has had some preliminary results which have shown sporophyte development as seen in Figure 1 below.

Figure 1. Juvenile sporophyte development in a male gametophyte sample

Next Steps

The Kelp Ark team will plan another visit next quarter to check in on all gametophytes and ensure they have enough biomass for DNA extractions.

Finalize isolation of gametophytes from all collected materials. The gametophytes require time to develop into either male or female before we can isolate them with certainty. We expect this to be completed by August 2026.

Challenges

- Import permit acquisition in California has been delaying the transfer of strains for optimized growth.