

Crossbreeding and Selection for Resistance to Ocean Acidification in Pacific Oysters

WA Sea Grant Program - reporting period (Feb 1, 2018 – Jan 31, 2019)

Overview of Project:

Screening genetic lines of Pacific oysters for resistance to ocean acidification

The WASG project is based on the development of broodstocks resilient to carbonate chemistry variables associated with ocean acidification. This was accomplished by measuring resilience factors (rate of growth and survivorship) to reduced pH during two early life history larval stages in Pacific oysters, 1. embryogenesis to the veliger stage and 2. during the transition from pediveliger to early spat. The OA screening process for generating data on genetically determined resilience to OA stress called for placing embryos and larvae from different genetic lines into replicate chambers submerged in seawater under pre-determined high and low pCO₂ conditions and comparing short-term growth, survivorship and other larval stress responses.

In late August 2015 a successful full set of crosses was created (15x4), constituting 42 intraspecific hybrid and 7 inbred (G₂) lines (Figure 1).

	13x5.024x.042	13x5.019	12x3.062	12x3.028	08x3.027	08x2.034	08x2.015
13x5.024x.042	X	X	X	X	X	X	X
13x5.019	X	X	X	X	X	X	X
12x3.062	X	X	X	X	X	X	X
12x3.028	X	X	X	X	X	X	X
08x3.027	X	X	X	X	X	X	X
08x2.034	X	X	X	X	X	X	X
08x2.015	X	X	X	X	X	X	X

Figure 1. Full diallel crosses made between individual male and female oysters from seven inbred lines. Forty-two hybrid (including male by female and female by male) were made plus 7 G₂ inbred lines were established.

Oyster embryos were subsequently raised at the TSF hatchery and nursery facility to the seed stage and transferred to for testing and maintenance at Thorndyke Bay (Hood Canal). Numbers of surviving replicate cages holding oysters are indicated in Figure 2.

	13x5.024x.042	13x5.019	12x3.062	12x3.028	08x3.027	08x2.034	08x2.015
13x5.024x.042	0	5	0	4	5	5	2
13x5.019	0	5	0	1	1	0	0
12x3.062	2	5	0	0	3	2	1
12x3.028	3	5	0	0	0	4	1
08x3.027	3	4	0	3	0	3	2
08x2.034	3	2	0	1	0	0	2
08x2.015	3	1	0	0	2	2	0

Figure 2. Surviving lines (number of replicates indicated) to the seed stage assessed for general and specific combining ability.

Results of the line screening have been previously described and detailed in the 2017 and 2018 progress report to WA Sea Grant. Unfortunately, Mr. Gillon completed his MS at UW SAFS and matriculated without completing this project. During the current reporting period (February 1, 2019 - January 31, 2019), samples of larval and post larval oysters were received by PI J. Davis for further analysis. This analysis is ongoing currently, however it was deemed necessary to reinitiate the work that was only partially completed by Mr. Gillon. As a result, progress on project completion was significantly hampered. Assessment to date of samples suggest significant differences between genetic lines exist relative to survivorship to the straight hinge developmental phase in oyster larvae.

On the breeding side of the project, and with assistance from Dr. Dennis Hedgecock (University of Southern California, now Pacific Hybreed, Inc.), an analysis based on a Bayes Diallel statistical approach was accomplished and identified high general combining

ability in lines involving cohort 15x4 parents 62 and 24 with high specific combining ability observed in a number of other crosses. These lines are currently in use to produce high performing double hybrid crosses for the production of commercial oyster seed. Results of a second line assessment conducted by Pacific Hybreed in April 2018 indicated that surviving lines continue to grow and otherwise thrive at Thorndyke Bay, Hood Canal.

Plans for the remaining six months of the project (ending August 31, 2019) include 1. correlating line performance relative to OA resistance based on samples taken in 2016 and 2. replicating lines for dissemination to the shellfish industry for use as broodstock. 3. spawn individuals from high performing lines (based on growth and survivorship) to create new broodstock seed lines for future industry use.