

AKCRRAB Project Progress Report

April 1–June 30, 2008

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Project Introduction

Stock enhancement has the potential to be an effective tool for rehabilitation of depleted stocks and for fishery management and is currently in progress for crab and lobster species in the US and worldwide. However, before implementation, research is needed to assess the feasibility, effectiveness, and possible consequences of a stock enhancement program. The Alaska King Crab Research and Rehabilitation and Biology (AKCRRAB) Program was created in 2006 as a partnership between the University of Alaska Fairbanks, Alaska Sea Grant, the Alutiiq Pride Shellfish Hatchery (APSH), NOAA Fisheries, and several community-based groups to begin the necessary research to assess the feasibility of stock enhancement for king crabs in Alaska. Commercial harvest of Alaskan king crab was for decades active and lucrative. However, many stocks declined drastically over 20 years ago and have not rebounded, even in the absence of fishing. Work is being done to study the early life history of red and blue king crab species to develop methods and determine feasibility of hatchery rearing. This project addresses methods for culture of larvae and juveniles in the Alutiiq Pride Shellfish Hatchery in Seward, Alaska.

Project Outline

The AKCRRAB project currently has 2 primary phases. The first phase focuses on hatchery scale cultivation of red and blue king crab larvae and evaluates effects of stocking density, diet, and other water parameters on growth and survival. The second phase focuses on hatchery scale cultivation of juvenile red and blue king crab and evaluates effects of stocking density, diet, substrate type and other culturing parameters. Juvenile experiments also aim to investigate tagging techniques in order to track hatchery crabs in the wild and perform simulated releases in large tanks.

The long term vision on the AKCRRAB project hopes to conduct field studies to address questions regarding habitat preference, predator/prey interaction and tagging. There are hopes to do genetic work will determine a genetic base line of wild stocks and assess any potential genetic risks of releasing hatchery crabs. There are also long term plans to look at disease history of wild stocks and the pathology of individuals to be out planted.

Work Completed during 4-1-08 to 6-30-08

April

- Broodstock Care.
- Artemia culture
- Algae culture
- Large scale red and blue king crab larval rearing experiments
- Small scale red king crab larval rearing experiments
- Hatchery maintenance
- Data recording
- Data analysis

May

- Broodstock Care.
- Artemia culture
- Algae culture
- Large scale red and blue king crab larval rearing experiments
- Small scale red king crab larval rearing experiments
- Hatchery maintenance
- Data recording
- Data analysis
- Large scale juvenile king crab nursery experiments
- Oversight of AKCRRAB summer intern
- Broodstock pathology sampling
- Broodstock permitting
- Broodstock acquisition
- 2009 study plan writing

June

- Broodstock Care.
- Broodstock pathology sampling
- Artemia culture
- Large scale blue king crab larval rearing experiments
- Small scale red king crab larval rearing experiments
- Large scale juvenile king crab nursery experiments
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- Data recording
- Data analysis

2008 Red and Blue King Crab Experiments

Red king crab hatchery-scale culture in 2008 proved successful. Production scale experiments in nine 1200 liter tanks investigated effects of diet and stocking density and yielded overall survival of approximately 31% from Z1 to glaucothoe (Fig 1). Highest mortality occurred during the Z4 stage (Table 1). Diets consisted of enriched San Francisco Bay (SFB) artemia. Some tanks were also fed *Chaetoceros* sp. algae. Highest survival in a single production scale tank to glaucothoe was 68% which yielded 40,800 glaucothoe. The tank was stocked at 50 larvae per liter, fed enriched

SFB artemia and Chaetoceros sp. algae at 50,000 cells per ml, and treated with EDTA once daily. Because the tank was not replicated, definitive conclusions about specific variables are difficult to make. Production tanks yielded over 120,000 healthy glaucothoe. From these, approximately 35,000 first stage juveniles were produced, which are currently stocked in juvenile rearing experiments.

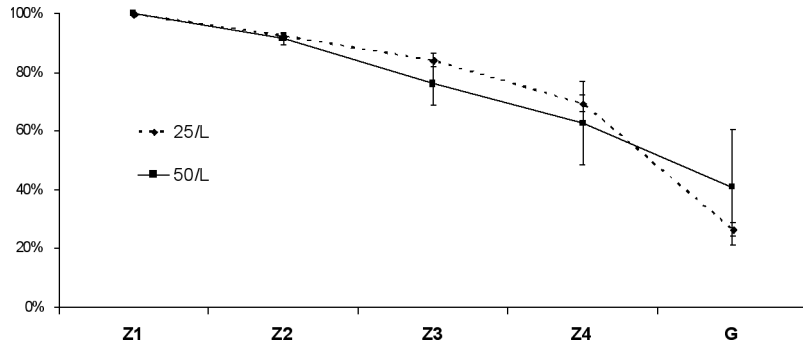


Figure 1. Percent survival of red king crab reared at two stocking densities in production scale tanks.

Table 1. Survival from one larval stage to the next.

	Z1 to Z2	Z2 to Z3	Z3 to Z4	Z4 to G
25/L	93%	91%	83%	38%
50/L	91%	83%	80%	55%

Experiments in sixteen 190 liter tanks investigated effects of stocking densities. All tanks were fed unenriched SFB artemia in addition to Isochrysis sp. algae and yielded overall survival of approximately 15% to glaucothoe (Fig 2). Highest mortality occurred during the Z4 stage (Table 2). When compared to production scale tanks, lower glaucothoe survival in experimental tanks may be due to a suboptimal diet. Enriched San Francisco Bay (SFB) artemia appears to be superior to unenriched. Overall lipid size decreases from Z2 to Z4 stages when fed unenriched SFB artemia (Fig 3).

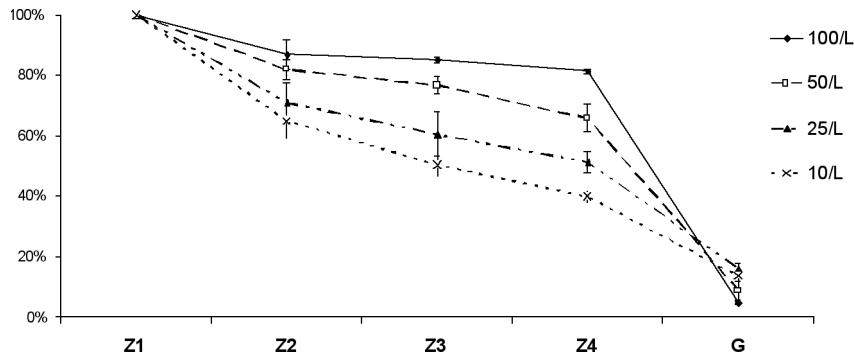


Figure 2. Percent survival of red king crab reared at four stocking densities.

Table 2. Survival from one larval stage to the next.

	Z1 to Z2	Z2 to Z3	Z3 to Z4	Z4 to G
10/L	65%	80%	78%	34%
25/L	71%	85%	87%	32%
50/L	82%	94%	85%	13%
100/L	87%	99%	94%	6%

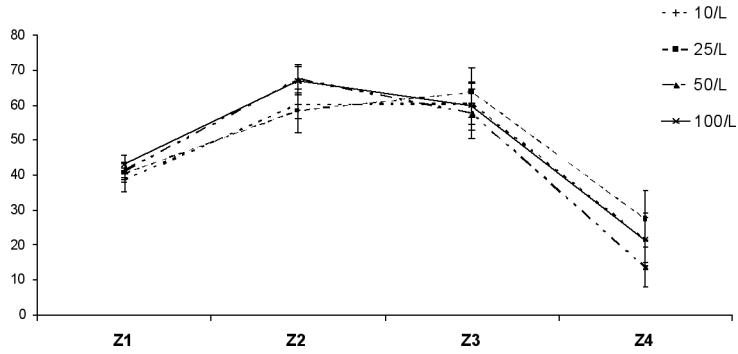


Figure 3. Maximum diameter of lipids seen in larval red king crab reared at four stocking densities.

Higher stocking densities appear to yield high survival to Z4 (Fig 2). However, filamentous bacteria become problematic in mid Z3 stage in densities as high as 100 larvae per liter (Fig 4) and may contribute to mass mortality events. In lower densities such as 25 and 50 larvae per liter, bacteria appear to be more manageable, however may still contribute to larval mortality. Observations in 2008 strongly suggest that 50 larvae/liter is an ideal stocking density, although 75 larvae/liter is thought to be reasonable (A Epelbaum, pers comm.).

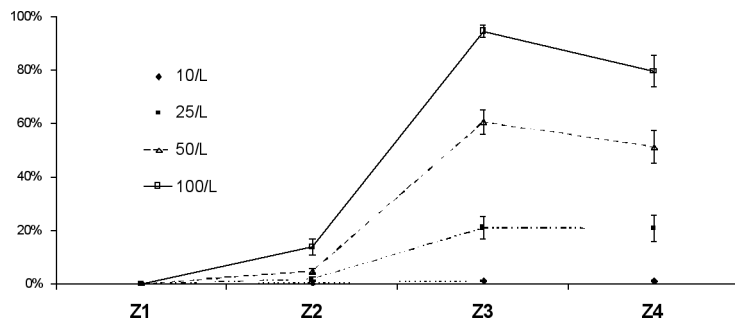


Figure 4. Bacteria load seen in larval red king crab reared at four stocking densities.

A combination of factors including improved diets, water quality, rearing temperatures, hatchery infrastructure improvements, and the knowledge gained by biologists contributed to the increased survival from 2007 to 2008. These improvements in hatchery rearing technology have led to superior husbandry techniques for king crab rearing.

Larval blue king crab experiments are currently underway at Alutiiq Pride Shellfish Hatchery. Effects of water temperature on intermolt duration, bacteria load, and survival is being examined. Three broodstock released ~50,000 larvae each providing inadequate numbers for production scale experiments. More broodstock are needed for future production scale experimentation.

Work Forecast

In 2008 we plan to finish current blue king crab larval rearing experiments. Juveniles produced will be used for nursery experiments to investigate growth, intermolt duration, effects of diet, density, and substrate, as well as get a basic understanding of juvenile husbandry techniques. Juvenile red king crab will also be used in nursery grow out experiments to continue to monitor effects of diet, density, and substrate on survival and growth. Juvenile king crab will be sent to Dr. Allen Stoner in Newport, Oregon and Dr. Ginny Eckert in Juneau, Alaska for various growth and survival experiments. We also plan submit appropriate permits for broodstock acquisition for 2009 experiments. Currently 10 Little Diomedea broodstock are being held at Seward Marine Center. Experiments will be conducted to monitor effects of temperature on embryo development.

The following is work planned to be done broken down by report period for 2008.

7-1-08 to 9-31-08

Duties will include:

- Broodstock Care.
- Broodstock pathology sampling
- Artemia culture (if needed)
- Large scale king crab juvenile rearing experiments
- Intern supervision
- Hatchery maintenance
- Broodstock permitting
- Data recording
- Data analysis
- Potential field work in Kodiak
- Manuscript preparation and submission

10-1-08 to 12-31-08

Duties will include:

- Broodstock Care
- Broodstock pathology sampling (if needed)
- Hatchery maintenance, improvement
- Broodstock permitting
- Data recording

- Data analysis
- Juvenile production experiments
- Report writing
- Broodstock permitting
- Potential field work in Kodiak
- Manuscript preparation and submission