Development of large-scale hatchery production technology for red king crab
(Paralithodes camtschaticus)

James Swingle*, Benjamin Daly†, Ginny Eckert‡, Jeff Hetrick§

*Alutiiq Pride Shellfish Hatchery, 101 Railway Avenue, Seward, Alaska 99664, USA
†School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 201 Railway Avenue, Seward, Alaska 99664, USA
‡Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 17101 Point Lena Loop Road, Juneau, Alaska 99801, USA
§Corresponding Author. Tel.: +1 907 321 3084
E-mail address: jimswingle@hotmail.com (J. Swingle).

Introduction
In 2008, we conducted red king crab (Paralithodes camtschaticus) large scale hatchery production trials to test a variety of protocols for mass rearing larvae at the Alutiiq Pride Shellfish Hatchery as part of the Alaska King Crab Rehabilitation, Research, and Biology (AKCRRAB) Project. These experiments comprised part of our second year of research at the hatchery as we work toward developing large-scale production technology for potential future stock enhancement of red and blue king crab.

Methods
Larvae were reared in nine 1200 L cylindroconical tanks with continuous flow-through seawater exchange from stage Z1 to glaucothoe. Mean larval rearing temperature was 8°C and salinity was 31-32 ppt. Larvae were fed Artemia twice daily to satiation with concentrations ranging from 2-4 ml^-1 day^-1 increasing with larval stage. The tanks that received microalgae were fed 50,000 cells ml^-1 once daily. Population estimates and percent survival were quantified at each larval stage. Intermolt duration was also determined for each larval stage. A combination of stocking densities, diets, and an additive were tested.

Stocking Densities: 25 and 50 larvae L^-1

Diets: 1. Unenriched San Francisco Bay Artemia
2. DC DHA Selco enriched Artemia
3. DC DHA Selco enriched Artemia and Chaetoceros muelleri microalgae

Additive: EDTA (ethylenediaminetetraacetate), a synthetic chelator commonly used in the culture of marine shrimp larvae and microalgae

Results

Stocking Density Effects

Diet and Additive Effects

Fig 1. Effects of stocking density on survival for larval rearing tanks stocked at 25 and 50 larvae L^-1.

Fig 2. Effects of diet and EDTA additive on larval survival when fed unenriched Artemia, enriched Artemia, enriched Artemia and Chaetoceros muelleri microalgae, and enriched Artemia and Chaetoceros muelleri microalgae with EDTA additive.

Stocking Density: Mean survival from Z1 to glaucothoe in four tanks stocked at 25 and 50 larvae L^-1 and fed an identical diet of enriched Artemia was similar, averaging 28 and 27% respectively.

Diet: Survival to the glaucothoe stage in the absence of EDTA was similar for all three diet combinations tested, averaging 27, 28, and 23% for diets 1, 2, and 3, respectively.

Additive: The single tank receiving the combination diet of enriched Artemia, microalgae, and a once daily addition of EDTA exhibited the highest survival from Z1 to glaucothoe (68%).

Intermolt Duration: Intermolt duration averaged 7, 7, 7, and 11 days for larval stages Z1-Z4, respectively.

Discussion
The objective of this study was to test the effectiveness of a variety of larval rearing protocols for hatchery rearing of red king crab on a large scale. A stocking density of 50 larvae L^-1 with a diet of enriched Artemia and Chaetoceros muelleri microalgae and a once daily addition of 10 ppm EDTA yielded the highest survival from Z1 to glaucothoe of 68%. We produced 40,800 glaucothoe from this single 1200L tank, equivalent to a harvest yield of 34 glaucothoe L^-1. The larval period from hatching to first molting into the glaucothoe stage was 32 days and 23 days from glaucothoe to first juveniles (C1). Overall, we produced approximately 40,000 C1's, which were subsequently used in nursery rearing experiments and ecological studies conducted in Seward and Juneau, Alaska, and Newport, Oregon to further evaluate the potential for a successful stock enhancement program.