APPLICATION
PRIVATE NONPROFIT SHELLFISH HATCHERY PERMIT

State of Alaska
Department of Fish and Game
Division of Commercial Fisheries
P.O. Box 115526
Juneau, AK 99811-5526

GENERAL INSTRUCTIONS

1. Fill in the blanks provided on the form.

2. Where necessary to fully answer a particular question, attach additional pages marked with the corresponding appendix number in the application.

3. Applications **must be typed**.

4. Applications must be signed by a legally authorized representative of the applicant.

5. The application should be sent to the following address:

Alaska Department of Fish and Game
Division of Commercial Fisheries
P.O. Box 115526
Juneau, AK 99811-5526

ATTENTION: PNP COORDINATOR

6. Requests for assistance in preparation of the application or related activities should be directed to the PNP Coordinator. Such requests will be honored to the extent available staff time and funds permit.

7. This application must be accompanied by a management feasibility analysis (MFA) prepared by the department in accordance with 5 AAC 40.130.

8. The application is accompanied by a $0 nonrefundable application fee, in accordance with AS 16.12.10.

Shellfish means a species of crustacean, mollusk, or other invertebrate, in any stage of its life cycle, that is indigenous to state water or that is authorized to be imported into the sate under a permit issued by the commissioner (AS 16.12.199(3), which refers to AS 16.40.199).

Last modified June 2025.

I IDENTIFICATION OF APPLICANT

A. Private Nonprofit Corporation

Bering Sea Fisheries Research Foundation	425-232-5986
Name	Phone number

23929 22nd Dr SE		
Address		
Bothell	WA	98021
City	State	Zip

Attach a copy of Articles of Incorporation for the above nonprofit corporation organized in accordance with Alaska Statute 10.20.

B. Individual completing this form

Scott Goodman	Executive Director
Name	Relation to Above Nonprofit Corporation
4039 21st Ave West Suite 404	425-232-5986
Address	Phone Number

Seattle	WA	98199
City	State	Zip

II BASIC PROJECT INFORMATION

A. General area in Alaska of activity (Southeast, Southcentral, Kodiak, Alaska Peninsula…)

St. Paul Island

B. Species requested (list all)

Paralithodes camtschaticus, Red King Crab (RKC)

III OPERATIONAL GOALS AND OBJECTIVES

A. Detailed statements of operational goals and objectives

These should explain why you have decided to apply for a shellfish enhancement permit and what you generally expect to accomplish by operation.

Federal funding was sought for this project to provide proof-of-concept for a king crab hatchery production at higher production levels than was attempted in the research and development stages of the crab enhancement program undertaken by AKCRRAB starting in 2016. At higher production levels, a hatchery permit is required, using for the first time the regulations developed by ADFG following the passage of an Alaska Statute allowing the establishment and operation of shellfish hatcheries in the State.

The goal is to produce juvenile king crab and release them into appropriate crab habitat so they can grow into mature animals that will both enhance the wild population of king crab in the Bering Sea and provide for the successful continuation of the crab industry for the benefit of harvesters, processors and the communities that support them.

B. Production goal in maximum capacities by species

Provide the production goals, in numbers of organisms, in the earliest quantifiable life stage (e.g., eggs or larvae) at start up (first year of operation) and at the fullest requested capacity.

	Number of organisms required for the hatchery	
Species	**At start up**	**At capacity**
Paralithodes sp.	45 adult females	45
		2,000,000 larvae (zoea 1)
		1,200,000 glaucathoe (G1)
		640,000 juvenile crab (C1)
		-

IV OPERATIONAL PLAN

A. Proposed construction timetable

Prepare a timetable for the construction periods consisting of critical milestones for the development of the facility.

Spring 2025: Design led by The Salty Farmer and Trident Seafoods
Summer 2025: Procurement begins
Fall 2025: Materials shipped to St Paul
November 2025: Construction begins for the hatchery “room”

January 2026: Life support systems installed
February 2026: Plumbing begins. Electrical installation.
March 2026: Hatchery complete.
April 2026: Seawater drawn through hatchery for production season 2026

B. Location of facility

Describe the location of hatchery operation. Attach a location map labeled "*Figure 1. Facility location map*."

The hatchery is located inside the lower level or ground floor of the Trident processing plant in Saint Paul, Alaska. The facility was constructed completely inside the Trident building, and is entirely separated from the floor where crab processing is carried out. The hatchery is self-contained.

Figure 1 contains the USGS topographical and NOAA marine chart for Part C, below.

C. Facility and culture system plans

Attach a written description of the proposed facility and plans in an appendix labeled, *"Appendix 1. Facility and culture system plan"*. This appendix should include the hatchery's overall use of space, including types of culture systems and support culture, such as algae production for shellfish. This description should represent a solid concept of the proposed hatchery design. The plan should include, at minimum:

1. Incubation and rearing site plan
2. Hatchery floor plan
3. Water supply system
4. Incubation/operation building
5. Facility layout

The plans should include a scale drawing of the facility at 1:100 or larger, a USGS 1:63360 scale topographical map showing water flow and facility locations, and a NOAA marine chart of the largest scale available showing all tidewater-based facilities and local data.

D. Method of power generation (e.g., local utility, generator, etc.)

Two residential water heaters are used to maintain desired seawater temperature for hatchery procedures. A 500-gallon double-walled diesel tank fuels the water heaters and is filled approximately weekly at peak production.
The remainder of the project is powered by St. Paul city power. Secondary power is directly wired to a large generator which acts as secondary power in the event of a power failure.

E. Current land and water use and ownership status

Use permits (land and water). List the additional state and federal permits needed to build and operate the proposed facility. Examples may include U.S. Army Corps of Engineers Permit; Department of Natural Resources Water Use, Land Use, and Tidelands Lease Permits; and U.S. Forest Service Land Use Permit.

Permit	Issuing agency	Status	Date acquired

N/a at this time, because the building has been existing and all systems nested within.

Comments, if useful for understanding current land and water use and ownership status.

Tanadgusix Corporation (TDX) is the land owner and Trident Seafoods, the lessee.

F. Water supply

1. The hatchery must have a secured water source and delivery system that is adequate for the proposed levels of incubation of rearing. In addition to listing any appropriate water use permits (above), please describe the following items to the best of your knowledge to helps reviewers understand the water supply system. If your operations are to be saltwater based; not all questions below are applicable. If attaching a plot, provide title of attachment.

    a. Water delivery system type (e.g., recirculating, flow-through, both)

The Trident Seafoods processing plant which we're operating within has an existing seawater intake system. The RKC hatchery has installed a dedicated line delivered from their pump room which provides constant seawater on flow through, 24/7.

    b. Water source (e.g., water is drawn from hatchery location, x meters below mean tide and x meters offshore)

Seawater is drawn from a network of three large-diameter steel pipes @ 8-10". These pipes penetrate the waters surface just off of the plant's dock, 40' from shore, and extend 10' below the dock's surface. The intake lines are submerged during low tide events and allow 24/7 draw. The 8" intake pipe is reduced to a 3" line for delivery to the hatchery. Excess water is pumped back into the harbor without ever entering the plant.

    c. Intake (e.g., multiple valves are used to reduce flow within lab)

Multiple large centrifugal pumps contribute to a single header manifold within the Trident pump room. The hatchery then draws seawater from this 24" manifold through a 3"

schedule80 PVC line which runs 120’ to the hatchery.
Once in the hatchery, the water can bypass the hatchery (be sent back out to the bay after being filtered down to 100 micrometers (microns / um)), or be manipulated for use in the hatchery.

This seawater, intended for distribution to tanks, is filtered through parallel media filters (filled with antimicrobial glass media bed) and subsequent cartridge filters. This arrangement of filtration allows flow rates to attain 50 gallons per minute (gpm) while filtering water down to a minimum of 20um, and as far as 1um. This now filtered seawater (FSW) is sent directly to a 500 gallon header tank through a float valve. As flow demand picks up, to the collective of tanks, the float valve keeps the header tank full with FSW on-call. See next section (d. Flow control).

d. Flow control

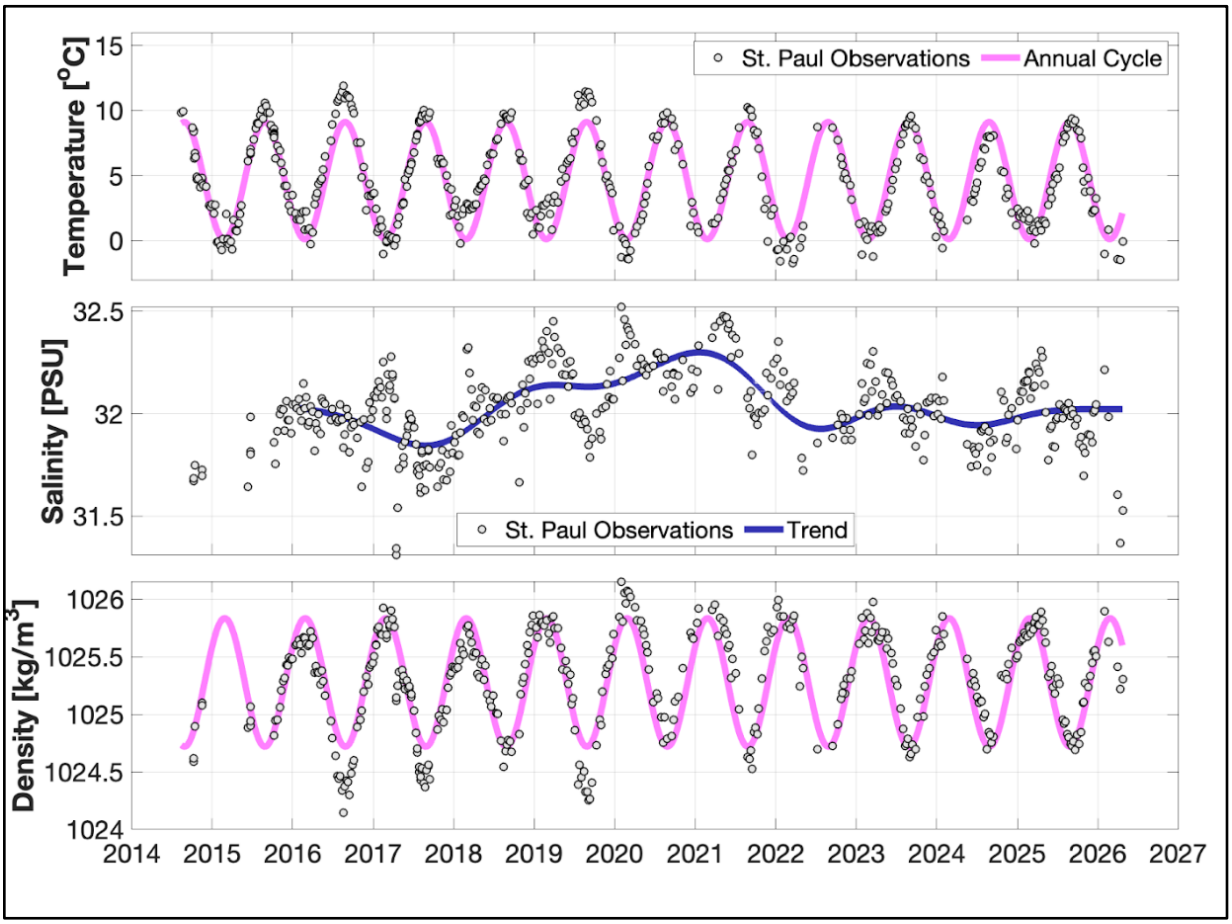
Seawater is delivered to each tank by way of various sized schedule 80 pvc, depending on tank size, placement, and anticipated flow rate. Each tank has an isolation valve which also controls flow of seawater. No tanks are equipped with flow meters. Instead, technicians are responsible for measuring and setting flow rates with a high-end Asahi ball valve.

e. Annual temperature range (e.g., x–x °C):

The annual seawater temperature range for St Paul, AK fluctuates from 0-10’C on an annual basis. The table below shows the fluctuation of these ambient seawater temps as “St. Paul SW avg.” from seatemperature.info. Below this are the target temperatures of each of the life stages: “brood target, Egg hatching, Larval rearing, Glaucothoe > C1, Juvenile”.

	St. Paul @ Pribilof Islands				('C)				"-" = ambient			
	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct
St. Paul SW avg	5	3	2	1	1	1	2	5	7	9	9	7
Brood target	5	6	6	6	6	6	6	5	-	-	-	-
Egg Hatching	"	"	"	"	"	"		*Shirley et al 1990? (3,6,9,12?)				
Larval rearing	-	-	-	-	6	8	-	-	-	-	-	-
Glaucothoe > C1	-	-	-	-	-	8	8	8	-	-	-	-
Juvenile	*Suggested at ambient, to slow growth/metabolism/cannabilism while waiting for plant out*											

f. Annual water salinity range (e.g., x–x ppm)



This table has been provided by The Aleut Tribe of St Paul Island through a monitoring system directly adjacent to the AKCRRAB hatchery, within St Paul Harbor.

The AKCRRAB hatchery is collecting daily salinities starting from 5/7/26 through present. Specific gravity has stayed steady, in the range of 1.022 - 1.024 specific gravity / 32ppt which verifies the data above.

g. Influent water depuration devices

The AKCRRAB hatchery seawater system is designed to provide up to 50 gallons per minute (gpm) of filtered seawater for hatchery operations. Seawater is drawn through a multi-stage treatment system located within the hatchery. Two media filters plumbed in parallel and filled with activated filter media (AFM® meta-silicate media) remove suspended solids and larger particulate matter from the incoming seawater. Following media filtration, the seawater passes through cartridge filtration capable of reducing particulate matter to 1 micrometer (µm).

After filtration, the filtered seawater (FSW) is routed through a 150-watt ultraviolet (UV) disinfection unit. The UV system provides an additional treatment barrier by inactivating microorganisms, including potential pathogens, before the seawater is distributed to hatchery tanks. The combined filtration and

UV disinfection process provides high-quality seawater suitable for broodstock holding, incubation, and larval rearing operations.

To maintain treatment efficiency, media filters are routinely backwashed to remove accumulated solids and restore flow capacity. Sock filters and cartridge filters are monitored and replaced or cleaned as needed based on observed loading and system performance.

Reusable filter components are rinsed to remove debris, disinfected using a chlorine solution, and subsequently treated with sodium thiosulfate to neutralize residual chlorine prior to reuse. Following cleaning and disinfection, filter components are air dried and stored for future use.
Filtration system maintenance and cleaning activities are conducted by trained hatchery personnel in accordance with established operating procedures.

h. Effluent water depuration devices and plans

Hatchery effluent is directed through a treatment train designed to remove suspended solids prior to discharge. Effluent from hatchery tanks first passes through dual sock filters that two sock filters rated at 20 µm. The filtered effluent is then routed through a plate heat exchanger, where residual thermal energy is recovered and transferred to the incoming filtered seawater supply to improve overall system efficiency. The treated effluent is subsequently conveyed to the hatchery drainage system.

Following treatment, hatchery effluent commingles with other facility wastewater streams and is discharged through the existing Trident Seafoods wastewater collection and discharge system in accordance with the conditions of Alaska Department of Environmental Conservation (ADEC) Wastewater Discharge Authorization Program Permit No. AK0053490. Hatchery operations are designed to minimize the discharge of suspended solids through filtration and routine maintenance of the influent and effluent treatment systems.

i. Water treatment(s)

n/a

j. Chemical analyses of the water source

n/a

k. Provisions for water recycling

n/a

2. Method for disinfection of equipment

a. Rearing containers

Rearing containers and associated hatchery equipment are routinely cleaned and disinfected to maintain biosecurity and reduce the potential for disease transmission. Disinfection is performed using approved chemicals and procedures established by the AKCRRAB hatchery.

The primary disinfection method utilizes a 100 mg/L (ppm) free chlorine solution with a minimum contact time of 20 minutes. Following disinfection, residual chlorine is neutralized using sodium thiosulfate and verified through testing prior to disposal. Acid-based cleaning agents may be used as necessary for scale removal and equipment sanitation. Any cleaning solutions are neutralized or otherwise managed in accordance with hatchery procedures before being discharged through the facility's approved wastewater management system.

b. Other equipment

n/a

3. Wastewater treatment system. Describe water treatments for preventing disease-causing organisms to leave the hatchery.

The AKCRRAB hatchery uses existing drain water systems within the Trident Seafoods processing plant to direct all effluent. This includes floor wash downs, and water from the handwashing sink.

V INCUBATION AND REARING PLANS

Use the following spaces to describe the incubation and rearing plans for one species. If additional species are requested, please complete the PNP Shellfish Enhancement Permit Application Additional Species form, one form per species (repeats V–VII).

A. Broodstock

1. Source: Identify the donor stock (i.e., broodstock collection location) for adults to be used as broodstock. Include geographic coordinates and water body name.

Future RKC harvest - South/Central Bristol Bay

2026 collection coordinates - The approximate collection location was 56° 30.1’ N latitude, 162° 09.9’ W longitude, (inside SE corner of the red king crab savings area [RKCSA] in Bristol Bay)

2. Describe in detail the capture techniques you will use to harvest adults and take gametes (e.g., natural set, pot) for broodstock purposes.

The broodstock will be harvested by king crab pot gear operated on a commercial crab vessel. The pots are set in known red king crab grounds and left to soak for 24 hours. The pots are retrieved and contents examined and sorted. Adult female crab carrying fertilized eggs are retained, up to the number authorized by the permit, and other crab are returned immediately to the ocean alive.

Broodstock retained are kept in circulating sea water on the vessel until delivery to the hatchery in Saint Paul.

3. Describe the facilities to be used to hold broodstock. Include or refer to attached schematics and describe their exact location. Refer to the holding facility location on a map (if indicated on a map, refer to the map).

Three large upwelling tanks are used to house adult broodstock crab. Each of these three tanks house 10x 22" diameter silos each, allowing for a total of 30x individual containment silos. If additional space is needed, broodstock may be housed underneath the network of silos, within the tank.

4. List the loading rate [kg organism/ (L/min)] and density (kg organism/mg^3) for broodstock at the holding facilities.

(from Appendix 2: MANRKC, p.24-25)
Three 6x12' flat bottom, rectangular tanks are used to hold conditioned broodstock. Each tank is an estimated 3,215 Liters. The hatching tank consists of a 3000 L rectangular tank (11' long x 5' wide x 2' deep) into which 10 cylindrical hatching bins are partially immersed (Figures 15 & 16). Each 23" diameter, 23" deep hatching bin has a 100 µm Nitex® mesh screen attached to its base. The 100 µm mesh screen retains larvae as they hatch and allows good water exchange as seawater down-wells from above through the screen at the base of the bin. Each hatching bin is partially immersed to a depth of 10" in the hatching tank, providing an operating volume of approximately 70 L of seawater in each bin. Continuous flow-through of seawater is delivered to each bin through a perforated 1⁄2" diameter, 10' long PVC spray bar positioned across the top of the bins. The spray bar delivers continuous seawater flow of 1.5 Lpm to each bin (15 lpm to the entire hatching tank). This flow rate provides good water quality and maintains stable temperature in the hatching tank. At a hatchery room temperature of 12'C, this flow rate and tank volume maintained the target seawater hatching tank temperature at near the ambient incoming seawater temperature of 5-6'C with daily fluctuations of less than 1'C. Salinity should remain between 30-35 ‰ and vary less than 1 ‰ daily.

Figure 15. 3000 L 10-bin hatching tank.

James S. Swingle

Figure 16. Broodstock in individual hatching bin.

James S. Swingle

5. Describe broodstock acquisition needs (i.e., abundance), stock separation plans, and genetic management plans (see Gruenthal et al. 2024[1]).

Ovigerous red king crab have high fecundity (~200,000+ embryos per clutch), thus 30-50 is adequate for hatchery production needs. A minimum of 30 RKC will be requested for each larval production run. Broodstock collection numbers will also be informed by the ADFG gene conservation group. Smaller numbers of BKC may be requested for research only, and collections would be guided by input from the ADFG gene conservation lab.

[1] Gruenthal, K., C. Habicht, and S. Gilk-Baumer. 2024. Genetic Guidelines for Mariculture of Invertebrates in Alaska. Alaska Department of Fish and Game, Regional Information Report No. 5J24-06, Anchorage. https://www.adfg.alaska.gov/FedAidPDFs/RIR.5J.2024.06.pdf

B. Broodstock transportation. Discuss method planned for transporting broodstock.

(from Appendix 2: MANRKC, p.7-8)
Broodstock can be transported in seawater filled tanks (live wells) or coolers utilizing a waterless shipping technique. Live wells are typically used to keep the crab alive on board the fishing boat. The live well is a holding tank through which seawater is continuously pumped to maintain good water quality. Egg bearing females with desirable characteristics (described in the previous section) are removed from the crab pots and placed in a live well. The live well should be well oxygenated (dissolved oxygen >6 ppm), close to full strength salinity (30-35 ‰), and kept at a steady temperature of about 4'C. Individual egg bearing females can be kept separate in the live well by placing them in a burlap bag closed with a zip tie before immersing them in the tank for transport. Once off-loaded from the capture vessel, the second method of live transport can be used to deliver broodstock to the hatchery. This method entails waterless shipping (shipping without seawater), in which broodstock are placed on their backs in a cooler between layers of damp seawater soaked burlap bags. The temperature in the cooler is maintained at about 4'C during transport by placing 1-lb ice packs lying flat in the bottom of the cooler. The ice packs are covered with two layers of damp burlap to prevent direct contact with the shell of the crabs being shipped. One pound of ice should be used for about every 12 quarts of cooler capacity. We have repeatedly used 100 quart plastic coolers containing eight one-pound ice packs to successfully ship (100% survival) six RKC broodstock (mean weight ~1.5 kg) per cooler. Shipping time was eight hours from when the broodstock were packed until being received and placed in their holding tanks at the hatchery. The broodstock are packed on their backs two to three layers deep with damp seawater-soaked burlap above and below each layer of crab. It may be possible to successfully use this method for longer transport times, as Donaldson and Byersdorfer (2005) state that crab transported in a similar manner can survive up to four days, though it is unclear whether their attached eggs could survive that long out of water.

Donaldson, W.E. and Byersdorfer, S.C. 2005. Biological field techniques for Lithodid crabs. Alaska Sea Grant College Program. University of Alaska. AK-SG-05-03. 82 pp.

C. Conditioning and propagation method. Describe the methods by which you plan to handle the eggs from the spawning process through planting them in incubators. Include descriptions of disinfection procedures and the procedure for estimating percent fertilization.

No eggs are handled in the production process, nor any fertilization overseen. Adult broodstock RKC are egg-bearing when they are imported to hatchery. These egg bearing females release free-swimming larvae. The text below describes the hatching and collection of these newly hatched larvae, originally from Appendix 2: MANRKC, p. 26-27.

Hatch Pattern
Though variation exists, a typical RKC broodstock (~130 mm CW and 1.5 kg) with a full clutch of eggs will produce about 180,000 larvae over a three to four week period of hatch. The typical hatch pattern is as follows. During the first several days of hatch, only several hundred to several thousand larvae are hatched per day. Then daily hatch tends to gradually increase and by about day 7, a productive female will be hatching between 10,000 and 20,000 larvae per day. Daily hatch rate typically remains at about this level until about day 21 when the number of larvae hatched per day tends to begin declining, with several thousand to several hundred larvae per day released the last few days of hatch. Though some eggs hatch during the day, the majority of hatching tends to occur at

night. The total number of larvae hatched per female is largely dependent on size, with larger females typically hatching more larvae than smaller ones. At the completion of hatch, a brown, spongy looking material composed of remnants of egg casings remains attached to the underside of the female in her brood pouch. This material remains attached until she molts out of her old shell, which usually occurs several days to several weeks after hatching is complete.

Collecting Larvae from the Hatching Bins
Newly hatched larvae are collected from the hatching bins every morning and their numbers estimated before stocking the larval rearing tanks. Larvae are typically collected from the hatching bins each morning in the following way. First, the broodstock crab is removed from the bin and placed temporarily in a tub containing seawater from the hatching tank, to ensure the broodstock and eggs experience no temperature or salinity shock. Broodstock waste (feces) in the hatching bin is then siphoned out. The seawater containing the larvae within the bin is then stirred vigorously in a circular motion. After about three minutes, the swirling motion of seawater within the bin stops, and any weak or dead larvae along with any unhatched eggs that had sloughed off of the female's egg mass settle in the bottom center of the bin where it is easily siphoned out and discarded. The bin cleaning siphon is composed of an 18" long piece of 1⁄2" PVC pipe with a 10' long piece of clear vinyl tubing snugly inserted into one end. Healthy larvae will be actively swimming off the bottom and along the wall of the bin. The hatching bin, now containing only actively swimming larvae, is then gently lifted out of the hatching tank. The healthy larvae are then gently rinsed from the hatching bin into a 100 L aerated counting container that contains a 6" cushion of seawater the same temperature and salinity as the hatching tank. We utilize a 33 gallon heavy duty gray plastic food grade Rubbermaid trash bin as the larval counting container. Each time larvae or broodstock are transferred from one tank to another, care is taken to avoid temperature or salinity shocks, which can potentially stress or kill the crab. The counting container is then topped off to a volume of 100 L. Larvae can be held temporarily at high density in a well aerated counting container while volumetric sample counts are made to estimate the total number of larvae. As a rule of thumb, the concentration of larvae in the counting container should not exceed 1000 per liter and larvae should remain in the counting container at high density no longer than 30 minutes.

D. Incubation, setting, and rearing methods and units. Indicate the species and number of organisms in each incubator or rearing unit. Please refer to names/terms consistent with those used in the Facility and culture system plan.

15x 1,500 liter flat-bottom cylindrical tanks are used as larvae rearing tanks (LRT). Tank stocking vary at each life stage:

Life Stage	Stocking Density	Max stocking per 1,500L LRT	Total RKC capacity (15x LRTs)
Z1 larvae	50 per L	75,000	1,125,000
Glaucothoe	30 per L	45,000	675,000

1. Separation plans and genetic management (*e.g.*, tanks will be isolated by stock and have lids for biosecurity. Separate tools will be used per species and stock or disinfected between uses.)

Maximize amount of contributing broodstock per larval tank*
Keeping RKC + BKC separate. Isolation by tank and equipment. Lids?
Genetic contamination is not a concern because of the nature of this project - mass release at juvenile stage.

2. Disease control. Describe plans for preventing or controlling disease during rearing. Describe bacterial monitoring (e.g., the most common contaminants we have encountered are … Treatment will be administered by …).

(from Appendix 2: MANRKC, p.37)
The LRTs are routinely cleaned on a daily basis to help maintain good water quality and tank hygiene, essential for the successful hatchery rearing of healthy larvae. Each morning, any uneaten Artemia or waste that has settled in the bottom of the 500 µm seawater exchange sieve is siphoned out and discarded. This is accomplished by inserting the PVC end of the exchange sieve siphon into the exchange sieve and siphoning out the waste while the sieve is still installed in the LRT. The exchange sieve siphon consists of an 18" long piece of 1⁄2" PVC pipe with a ten foot long piece of clear vinyl tubing inserted snugly into one end. In addition to routinely cleaning the exchange sieves, any waste or dead larvae observed accumulating on the LRT bottom should be siphoned out of the tank several times a day as needed. A 15' long piece of 1/2" clear vinyl tubing attached with three plastic zip ties to a 6' long piece of 1" diameter PVC pipe which serves as a handle works well as a tank cleaning siphon (Figure 23) . It is especially important to remove dead larvae from the LRT as these can become a substrate for bacterial growth and proliferation. If dead larvae are left in the LRT, they eventually decompose and fragment into smaller pieces. These bacteria-filled fragments can then be consumed by other larvae in the tank causing bacterial pathogens such as Vibrio to quickly spread and result in high mortality in the LRT.

The solids obtained through routine cleaning are caught on an external 500um seive and thrown in the trash. Any biomass that does not retain 500um catch screen is sent through the effluent system and collect in our effluent filter socks, which then become discarded into the trash daily.

Figure 23. Tank cleaning siphon.

James S. Swingle

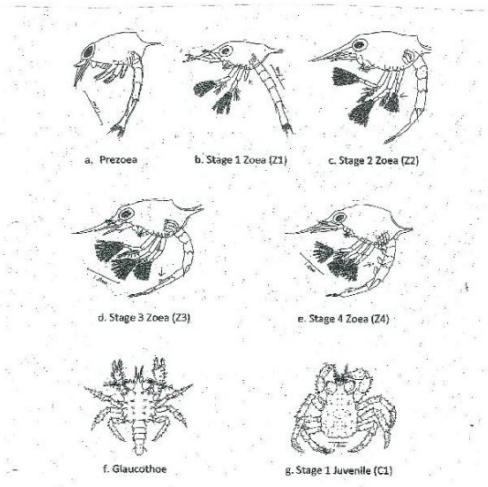
E. Timeline for spawning and rearing. Describe the duration of time that organisms will spend at each life stage (e.g., gamete, larva), or if at one life stage for longer than a year, describe the annual change in size (g) and density.

(from Appendix 2: MANRKC, p.40-43)

Table 8-4. Intermolt period of each larval stage at 8 and 11 °C.

Larval Stage	Intermolt Period at 8 °C (Days)	Intermolt Period at 11 °C (Days)
Z1	6	4
Z2	7	5
Z3	7	5
Z4	10	7
Z1 to G	30	21

Figure 26. Red king crab larval, glaucothoe, and first juvenile crab stage (Sato, 1958).



All animals are expected to be transplanted from hatchery to field after each year's production cycle. No animals are anticipated to be kept past C2 juvenile stage.

F. Feeding. Food production and feeding system.

(from Appendix 2: MANRKC, p.33-35)

The primary food source for the crab larvae is enriched Artemia, which is fed twice daily. After hatching, Artemia is enriched for 24 hours with DC DHA Selco® before being fed to the crab larvae. Artemia are hatched, and enriched (in two separate processes) in a series of three 340-liter cone bottom tanks.

Table 8-2. Larval feeding guide.
Concentrations of enriched *Artemia* to be fed daily at each larval stage in an LRT stocked with 50 RKC larvae per liter.

Larval Stage	8:00 AM (# Art/ml)	4:00 PM (# Art/ml)	Daily Total Art/ml
Z1	1	1	2
Z2	1	2	3
Z3	1.5	2	3.5
Z4	2	2	4

A good rule of thumb is to manage feed in the larval rearing tank such that concentration of enriched Artemia in the LRT never drops below 0.5 per ml prior to the next feeding. Following this strategy ensures larvae can feed continuously to satiation and also keeps time larvae spend capturing Artemia to a minimum.

Monitoring and Adjusting Feed Amounts (Residual Feed Counts)
Though Table 8-2 serves as a guide for the concentrations of enriched Artemia to be fed during each larval stage of the hatchery production run, feed consumption rates should none the less be monitored daily and adjusted as necessary to avoid underfeeding or overfeeding of the larvae.

G. Disease monitoring

Frequent health assessments in accordance to Appendix 2: MANRKC

Health assessments are made using the following protocol. A beaker is used to scoop a random sample of at least 10 larvae from the well aerated, evenly mixed LRT. The larvae are then poured through a 500 µm sample sieve on a cushion of seawater by keeping the sieve partially immersed in a Petri dish. A random sample of ten larvae is then pipetted out of the sample sieve and transferred in drops of seawater to a microscope slide. Each crab larva is then observed under 40X and 100X magnification and evaluated for gut fullness, gut lipid droplet number and maximum diameter, deformities, attached debris, and filamentous bacteria. Observations are recorded in the Larval Health Assessment Log (see Appendix 6 in Appendix 2 MANRKC). A brief discussion of each larval health assessment category is outlined in Appendix 2: MANRKC, beginning on p.43. These include: Gut Fullness, Lipid Droplet Number and Maximum Diameter, Deformities, Attached Debris, Filamentous Bacteria, and Other General Indicators of Larval Health.

H. Mortality disposal plans

Mortality is expected at all stages of life within the hatchery.
Imported broodstock are sacrificed at the end of their service. At that time, genetic samples are taken in step with procures provided by ADFG Gene Conservation Lab (version 3/12/2026). Remaining shell + tissue are frozen and discarded in general garbage.

Mortality from early life stages (egg-juvenile) are collected in our effluent filter socks and discarded into the trash daily.

All tools and equipment used to handle dead animals is disinfected in a common bleach bin. This bleach bin is checked weekly for Chlorine concentration and should remain @ 50+ppm.

I. Enumerations. Describe the method(s) to be used to estimate the number of organisms at each life stage.

(from Appendix 2: MANRKC, p. 27-28)

Volumetric Larval Counts and Population Estimates

Larval counts and population estimates are made using a volumetric method. First the counting container with 100 L of seawater and the larvae to be counted is vigorously aerated to evenly mix and ensure a homogenous suspension of the larvae. Five 100 ml samples of seawater containing suspended larvae are then scooped from the vigorously aerated container. The number of larvae in each 100 ml sample is then counted by pouring the sample through a sample sieve which is partially immersed in a Petri dish. The sample sieve is a 2" diameter, 1" deep section of PVC pipe with a 500 µm mesh screen attached to its base.

During the counting process, the sample sieve is partially immersed in a seawater filled Petri dish to provide a cushion of seawater for the counted larvae. By providing a cushion of seawater in the Petri dish, the larvae are shielded from direct or overly forceful contact with the sample sieve screen and are not harmed during the counting process. The sample sieve has a grid drawn on its bottom screen dividing it into four equal parts to facilitate counting. The sample is poured about 20 larvae at a time into the sample sieve until all the larvae in the 100 ml sample are counted.

The sample sieve containing larvae to be counted can be lifted from the Petri dish and held inverted toward an overhead light source. The temporarily immobilized larvae adhere to the damp screen of the sample sieve and can be easily counted in this way. After each count is made, the sample sieve containing the counted larvae is immersed back into the counting container to return the unharmed larvae. Once larvae in all five 100 ml samples have been counted, the five sample counts are averaged and then divided by 100 to estimate the number of larvae per ml in the counting container. The total number of larvae in the counting container is then estimated by multiplying by 100,000 (the total volume in ml of the 100 L counting container). To obtain a reasonably accurate population estimate, it is important that each sample count contains at least 30 larvae. The goal is to count enough larvae to obtain a statistically valid estimate while not counting so many larvae that the counts become overly burdensome. To achieve this goal, the sample volume can be adjusted so that the number of larvae collected in each sample is in the 30-50 range. If the counting container is sufficiently aerated to keep the larvae evenly suspended during the sampling process, individual counts will generally not vary by more than 20%.

Once all sample counts are made, the following equation can be used to estimate the number of larvae in the counting container:

Estimated Total Number of Larvae in the Counting Container = (Average Number of Larvae in the Sample Counts / Average Sample Volume (ml)) x Counting Container Volume (ml)

Once counts are complete and population estimates are calculated, the larvae can be stocked into the larval rearing tank (LRT). The larvae are transferred using a 5L beaker with handle to scoop and pour the volume of seawater containing the desired number of suspended larvae from the vigorously aerated and well mixed counting container into the LRT.

(from Appendix 2: MANRKC, p. 43)

Larval Population Estimates

During the larval rearing run, population estimates are made at stocking of newly hatched Z1s and during each subsequent larval stage, typically mid Z2, mid Z3, mid Z4, and at the beginning of the glaucothoe stage (once >90% have molted into the glaucothoe stage). These estimates can be made

directly from the LRT using the volumetric method. First, the incoming flow-through seawater is turned off and the exchange sieve is removed and replaced with a plug (consisting of a 1" long piece of 1" diameter PVC pipe with a cap). Then a weighted air stone with its air tubing attached to a portable compressor is lowered to the bottom center of the 1200 L LRT to provide vigorous aeration (~20 lpm) to evenly suspend all the larvae in the tank. Then, five 1 L samples are scooped from the evenly mixed tank. The larvae from each 1 L sample are then poured through a 500 μm sample sieve partially immersed in a petri dish to keep the larvae in a cushion of seawater. The larvae from each 1 L volumetric sample are then counted in the sample sieves and the average of the five counts yields the average number of larvae per liter in the tank.
This value is then multiplied by the total volume of the 1200 L tank to yield the population estimate of total number of larvae in the tank. In a successful larval rearing run initially stocked at 50 larvae per liter, average survivals we typically observe are approximately 90%, 80%, 60%, and 50% at mid Z2, mid Z3, mid Z4, and early glaucothoe, respectively. When stocking the LRTs at 50 larvae per liter, consistent survival from Z1 to glaucothoe at or above 50% is our production goal. This is equivalent to a target production yield of at least 25 healthy glaucothoe per liter of LRT volume.

J. Production and survival goals for one cohort of organisms (e.g., number of organisms acquired per year and expected survival in the hatchery before release).

Life stage	Number alive	Cumulative survival (%)
Z1	2,000,000	100%
G1	1,200,000	60%
C1	640,000	32%
-	-	-

Comments, if useful for understanding production and survival goals for one cohort of organisms.

The St Paul AKCRRAB hatchery is setup to host one pulse/cohort of crab at a time. If we can configure it, we would like to host up to two pulses/cohorts per year to increase our production potential.

VI RELEASE PLAN

A. Give the exact location and description of proposed release site(s), including latitude longitude for each release site. A map attachment showing proposed release site(s) is preferred.

For the BBRKC, the proposed release sites are located in eastern Bristol Bay, near the community of Port Moller. The sites are chosen based on the availability of appropriate habitat to most effectively shelter juvenile king crab, through a rigorous observation and selection process carried out by the Alaska Department of Fish and Game (ADFG). The release sites may differ slightly from one site to another, based on results of studies and observations carried out on the juvenile crab by ADFG researchers.

B. List the proposed number, age, and size of releases at each site.

Animals to be released during the C1 life stage at an estimated at 2mm carapace width. The number of C1s released will depend on rearing success in each cycle, but will remain within the maximum number of juveniles stated in the permit.

C. Describe the methods used for transporting the organisms before release.

(from Appendix 2: MANRKC, p.58-60)

During the first seven years of AKCRRAB research, the Seward based hatchery has transported nearly 100,000 hatchery produced juveniles to other researchers. The vast majority of juveniles shipped have been C1s, though we have shipped lesser numbers of later stage juveniles, some as late as stage C6. The technique we use for shipping juveniles has proven adequate for our needs to date. However, we need to conduct more research in order to determine the most efficient, cost effective methods for safely shipping larger numbers of juveniles (likely the C1 stage) in order to support future out-planting for stock enhancement

The transport method we use is outlined below. All materials used in shipping need to be cleaned, disinfected in 200 ppm hypochlorite, and thoroughly rinsed prior to and after each use. It is especially important that the gillnet used is thoroughly rinsed and has no residual chlorine on it before use. On the day before packing, juveniles to be shipped are not fed to allow them to clear their digestive tracts, ensuring better water quality in the shipping containers. On the morning before packing, the juveniles to be shipped are transferred into a smooth, flat bottomed holding tank without substrate so they can be easily captured using an aquarium net, weighed, and then placed into the shipping containers.

Method for packing juvenile RKC for transport

1. Place 50 g clean gillnet into a clean 1-gallon jug.
2. Add 2 L seawater to the jug. We typically use seawater in the 5-8 °C temperature range for transporting juveniles. Seawater in the transport jugs should be no more than 2 °C colder than the tank from which the juveniles are being collected.
3. Capture juveniles from holding tank with aquarium net
4. Allow excess seawater to drain off the net and juveniles and then blot off excess moisture from the bottom of the net with paper towels.
5. Weigh out 9 g juveniles into plastic 1 L beaker on electronic balance. This would be equivalent to 1800 C1s (average weight 5 mg).
6. Add seawater to beaker containing 9 g C1s and pour into the jug containing seawater and gillnet
7. Reach into the jug to grasp the top edge of the gill net and gently spread it so that it is loosely fills the jug from top to bottom and side to side. While being shipped, most of the juveniles in the shipping jug will slowly disperse on and cling to the gillnet
8. Top off the jug with seawater.
9. Screw on jug cap tightly and then tape down pour spout with electrical tape and wrap electrical tape around the seam between the cap and jug.
10. Place each sealed jug into a plastic garbage bag and seal top of bag shut with a cable tie. This is a safeguard to capture any seawater in case there is any leakage from the jug during transport.
11. Place bagged jugs in cooler and add 5 1.5 lb frozen ice packs to the cooler. We use a 100

Quart cooler which will hold 6 1-gallon jugs. The cooler packed in this manner weighs approximately 90 pounds (Figure 33).
12. Seal the seam of the cooler shut with a couple of wraps of duct tape. Then further seal the lid of the cooler shut by adding a couple of wraps of duct tape around the cooler near each end.
13. Tape on the address label and shipping permit (if required) and ship to destination by express air cargo service.

Figure 33. 100-quart cooler with six 1-gallon jugs (containing juvenile crabs and gillnet) and ice packs (for keeping cooler contents at ~4 °C) during transport.

James S. Swingle

Using this packing technique, we have consistently achieved greater than 95% transport survival when total time from packing to unpacking is 24 hours or less (Figure 34).

D. Describe your understanding of natural stocks, any species, that may be affected by this release and the possible effects on those stocks.

We do not anticipate any effect on natural stocks with a release of these hatchery-reared animals

E. Describe number of years after release until one cohort recruits into fisheries and anticipated post-release ocean survival (%).

Released hatchery crabs will take approximately 5-7 years until they reach the legal size for the fishery. Survival of hatchery RKC from release to recruitment to fishery is unknown, and likely variable. However, it is believed that most mortality will occur immediately after release, and that hatchery-reared juvenile RKC survive as well as their wild counterparts (Long et al., 2018).

Long, W.C., Cummiskey , P.A., Munk, E.J., 2018. How does stocking density affect enhancement success for hatchery-reared red king crab? CJFAS; 75; 1940-1948.

F. Describe any plans for program evaluation (e.g., marking plans and rates, methods for recovering marked organisms).

There are no immediate plans for marking hatchery-rearing RKC at this time. The development of a genetic mass mark likely is the most promising avenue for future development, but is not available at this time. Unexpected increases in juvenile recruitment depicted in the annual NOAA bottom trawl survey and stock assessment may suggest impacts of hatchery release. However, RKC are not captured in the trawl survey gear until they reach approximately 20-30 mm carapace width, likely 2+ years after release.

VII BROODSTOCK RETURNING TO HATCHERY, if applicable

Applicable? **No**

If not applicable, move to VIII.

VIII STAFFING

Provide a brief statement on staffing. This may include technical advisors for the nonprofit corporation, persons or corporations responsible for final design and construction of proposed facility, administrative personnel who will support this facility when operational, and operating personnel assigned to this facility.

See Appendix 3: AKCRRAB hatchery roles

X FINANCIAL PLAN

An estimate of hatchery construction and operating costs should be detailed here. These estimates would provide an indication of the cost recovery requirements of the proposed facility on an annual basis. Acceptance of this application by the Department of Fish and Game in no way implies agreement by the Department of Commerce, Community, and Economic Development to commit state loan funds for this project.

The hatchery construction and operating costs for the first cycle were part of the $4 million federally-funded grant approved by Congress and administered by NOAA through the Alaska Fisheries Development Foundation. The final cost of the hatchery construction and the cost of operating the hatchery for the first cycle is under development and will be provided at the end of the summer when the rearing cycle is completed and juvenile crab are transferred to Port Moller.

The project funding will cover through the second production cycle beginning in late winter of 2027. Additional funding has been requested of Congress to continue the project through the third production cycle.

X BASIC MANAGEMENT PLAN

The preparation of a draft Basic Management Plan will be completed after the department has reviewed this application and prior to the public hearing. The applicant will be expected to work closely with ADF&G staff in developing the Basic Management Plan (see 5 AAC 40.185).

XI DECLARATION AND SIGNATURE

I declare that the information given in this application is, to my knowledge, true, correct, and complete.

Scott Goodman, BSFRF Executive Director

_____ August 6, 2026

Name of Applicant Date Signed

_____

Signature of Applicant