SAINT PAUL HATCHERY BASIC MANAGEMENT PLAN

1.0 INTRODUCTION

The Saint Paul Hatchery (SPH) is in a self-contained room located inside the lower level (ground floor) of the Trident processing plant in Saint Paul. The hatchery collects gravid female king crab from Bristol Bay, rears larvae through the early juvenile life stage, and releases juveniles into appropriate crab habitat. When the released animals mature, they will enhance the wild population of king crab in the Bering Sea and help provide for the successful continuation of the crab industry for the benefit of harvesters, processors, and communities.

Research and development stages of the crab enhancement program began in 2006 by Alaska King Crab Research, Rehabilitation and Biology (AKCRRAB). Federal funding was sought to provide proof-of-concept for a king crab hatchery with higher production levels. With the federal funding, the facility was designed in 2025 and built during November 2025–March 2026.

1.1 Permitted Capacity

Up to 45 gravid female red king crab, donor stock Bristol Bay in the Bering Sea, may be collected, with progeny reared through the early juvenile stage and strategically released. Because this is an integrated program and to limit the potential effect of broodstock removals on the Bristol Bay Red King Crab (BBRKC) population, the number of female brood collected cannot be > 1% of the lower bound of the estimated abundance of mature female BBRKC.

1.2 Goals

The goals of the SPH program are to increase the number of mature BBRKC and enhance common property fisheries without reducing BBRKC genetic diversity.

1.3 Objectives

The objective is to annually collect up to 45 adult female brood and strategically release progeny at a juvenile life stage. This production could result in 16,000 crab recruitment to the common property fishery, assuming the sex ratio is 50:50 and that there is 5% survival over 8–9 years after release.

2.0 HATCHERY OPERATIONAL CONSIDERATIONS

2.1 Facility Design

Two residential water heaters are used to maintain seawater at the desired temperature for hatchery operations. 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. Figures 1 and 2 at the end of this document show the facility layout and saltwater schematic.

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The hatchery uses a previously existing seawater intake system that has multiple filtration systems. Filtered seawater (FSW) is sent directly to a header tank through a float valve so that as flow demand picks up to the collective of tanks, the float valve keeps the header tank full and FSW is available on-call. Technicians measure and set seawater flow rates at each delivery point in the hatchery (brood, larvae, and live feed tanks).

All effluent is directed using existing drain water systems within the Trident Seafoods processing plant, including floor wash downs and water from the handwashing sink. Hatchery effluent is directed through a treatment drain designed to remove suspended solids prior to discharge. Effluent from hatchery tanks first passes through two 20 µm sock filters and then is routed through a plate heat exchanger, where residual thermal energy is recovered and transferred to the incoming filtered seawater supply. The treated effluent is subsequently conveyed to the hatchery drainage system.

Systems and tanks within the hatchery can be isolated, allowing co-occurring research on other RKC stocks or other crab species, without concern of co-mingling.

2.2 Crab Culture Considerations

The SPH follows methods and techniques in the AKCRRAB's Red King Crab Hatchery Manual (MANRKC, unpublished).

Adult female brood are egg bearing when they are imported to the hatchery. No fertilization is overseen nor eggs handled/incubated. The egg bearing females release free-swimming larvae in hatch bins, which are transferred to larval rearing tanks (LRTs). The production cycle, from newly hatched larvae to ready-to-release juvenile crab, lasts less than a year. All juveniles will be transported from hatchery to the field within several months of brood collection. No crab will be kept past C4 juvenile stage.

Broodstock transport
Broodstock can be transported in live wells filled with cold, oxygenated seawater or by waterless shipping in coolers. In live wells, egg-bearing females are held at about 4°C, in near full-strength salinity, and can be separated by placing them in burlap bags closed with a zip tie. For waterless transport, crabs are placed on their backs between damp seawater-soaked burlap layers in a cooled insulated container, with ice packs separated from the crabs by burlap to maintain about 4° C. Using this method, shipments of six ~1.5 kg females in a 100-quart cooler with eight ice packs have repeatedly survived eight-hour transport. Similar techniques have kept crabs alive for up to four days, though the survival of attached eggs after four-day waterless shipping is uncertain.

Hatch
The hatching tank consists of a 3000 L rectangular tank (11' long x 5' wide x 2' deep) that houses ten cylindrical hatching bins creating 30 individual containment silos. If additional holding space is needed, broodstock may be held within tanks underneath the network of silos. Each hatching bin is 23" diameter and 23" deep and has a 250 micrometer Nitex® mesh screen at its base. The mesh screen at the base of the hatching bin allows larvae to be retained and for seawater to down-well through the screen, providing for water exchange. Each hatching bin is partially immersed to a depth of 10", providing a ~70 L operating volume. Hatching bins are provided with continuous

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1.5 Lpm flow-through seawater for good water quality and for maintaining stable temperature in the hatching tank. At a hatchery room temperature of 12° C, this flow rate and tank volume maintains 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 will remain between 30–35 ‰ and vary less than 1 ‰ daily.

Most hatching occurs at night and larger females tend to produce more larvae. Though variation exists, typical female RKC (~130 mm carapace width and 1.5 kg) with a full clutch of eggs produces about 180,000 larvae over a 3–4 week hatch period. During the first several days of hatch, several hundred to several thousand larvae are hatched per day, which increases to 10,000–20,000 daily by about day 7, then hatch rate declines starting around day 21, and on the last few days of hatch, larvae releases are down to several thousand to hundred per day. After hatching is complete, a brown, spongy mass of egg casings remain attached to the underside of the female until she molts several days to several weeks later. See MANRKC, p. 26–27.

Larval rearing

Newly hatched larvae are collected in the morning, their abundance is estimated, and the larvae are transferred to larval rearing tanks (LRTs). Before larval enumerations, the broodstock are temporarily moved to a tub containing seawater from the tank. Then, waste from broodstock is siphoned out from the hatching bin and water in the bin is stirred so weak larvae and unhatched eggs settle and can be discarded. Healthy larvae swimming off the bottom are rinsed into a 100-L aerated counting container kept at the same temperature and salinity. Transfers are performed carefully to avoid shock.

The LRTs are routinely cleaned daily to maintain water quality. Each morning, uneaten Artemia and waste that has settled in the bottom of the 500 µm seawater exchange sieve are siphoned out using a PVC-vinyl tubing siphon and discarded. Any accumulation of waste or dead larvae on the LRT bottom are siphoned out of the tank several times a day. Removal of dead larvae is necessary because any dead larvae left in the tank will decompose, fragment into smaller pieces, and become a substrate for growth of bacteria such as Vibrio. Live larvae may consume tissue fragments causing pathogens to spread quickly and high larval mortality.

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

Feeding

Crab larvae are fed enriched Artemia twice daily. Artemia are hatched and then enriched for 24 hours with DC DHA Selco® in a series of three 340 L cone bottom tanks. To ensure continuous feeding, enriched Artemia levels in the LRT should not drop below 0.5 per mL prior to the next feeding. Feed consumption rates should be monitored daily and adjusted as necessary to avoid under- or overfeeding. See MANRKC Table 8-2, p. 35 for an Artemia concentrations guide by larval stage.

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Disease monitoring
To assess health, a random sample of at least ten larvae from the well aerated, evenly mixed LRT are scooped up with a beaker and 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 onto a microscope slide in drops of seawater. The health of each crab larva is observed using a compound microscope under 40X and 100X magnification and evaluated for gut fullness, gut lipid droplet number and maximum diameter, deformities, attached debris, filamentous bacteria, and other general indicators of health. Observations are recorded in the Larval Health Assessment Log. For details on the log an each larval health assessment category, see MANRKC, beginning on page 43.

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

Enumerations
Population estimates use volumetric methods and 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 (when >90% have molted into the glaucothoe stage).

Typical survivorship in a run stocked at 50 larvae per liter is about 90% at mid-Z2, 80% at mid-Z3, 60% at mid-Z4, and 50% at early glaucothoe. Our production goal is ≥50% survival from larvae to glaucothoe, or ≥25 glaucothoe per liter.

2.3 Stock Separation and Release Plans

Released crab are expected to integrate with the naturally occurring population in Bristol Bay and Bering Sea. Juvenile hatchery produced crabs will be released in the same expansive larval drift zone as the broodstock.

Specific Bristol Bay release locations will be based on our depth and monitoring capabilities that will be determined by diver surveys and gear tests, in cooperation with ADF&G staff. Post-release research on optimum rearing conditions, the most appropriate habitat, growth and survival through rearing stages and post release will be performed by AKCRRAB and BSFRF.

3.0 BROODSTOCK CONSIDERATIONS

There is no broodstock development schedule because this is an integrated program with wild broodstock to be used in each year of activity.

Broodstock will be collected in South/Central Bristol Bay. The broodstock will be harvested by king crab pot gear operated on a commercial crab vessel. The pots are set in known RKC grounds and left to soak for 24 hours. The pots are retrieved and contents examined and sorted. The permitted number of adult female crab carrying fertilized eggs are retained, and other crab are returned immediately to the ocean alive. Retained broodstock are kept in circulating sea water on the vessel until delivery to the hatchery in Saint Paul. At the end of their service, broodstock are

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sacrificed and genetic samples are taken according to procedures provided by ADF&G Gene Conservation Lab.

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.

4.0 FISHERY MANAGEMENT CONSIDERATIONS

There are no anticipated changes to commercial fishery management from hatchery production.

No changes to commercial fishery management are requested for hatchery purposes.

BBRKC are jointly managed by ADF&G and NOAA Fisheries under a Fishery Management Plan developed by the North Pacific Fishery Management Council. Primary management objectives for BBRKC include maintaining a population level that ensures reproductive viability and long-term sustained harvests. To meet these objectives, ADF&G annually establishes a harvest limit for the commercial fishery coupled with size-sex-season restrictions. Only male crab equal or greater than 6.5 in carapace length may be retained during the fishery. Seasons are structured to avoid directed fishing during sensitive molting and mating periods.

5.0 MARKING AND RECOVERY REQUIREMENTS

5.1 Performance Data

Information about hatchery-produced crab that recruit to the fishery is not needed for hatchery purposes (i.e., no broodstock or cost recovery needs) or to manage the BBRKC fishery.

For evaluation of program success, genetic techniques provide the most promising venue and is an ongoing research topic. Genetic samples will be collected from broodstock and larvae for possible development and application of future tagging and monitoring efforts.

BSFRF will support, as feasible, department programs necessary to ensure proper management of BBRKC stocks.

6.0 APPROVAL

The Basic Management Plan for Saint Paul Hatchery is hereby approved.

Doug Vincent Lang — Date

Commissioner
Alaska Department of Fish and Game

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Figure 1. Facility layout.

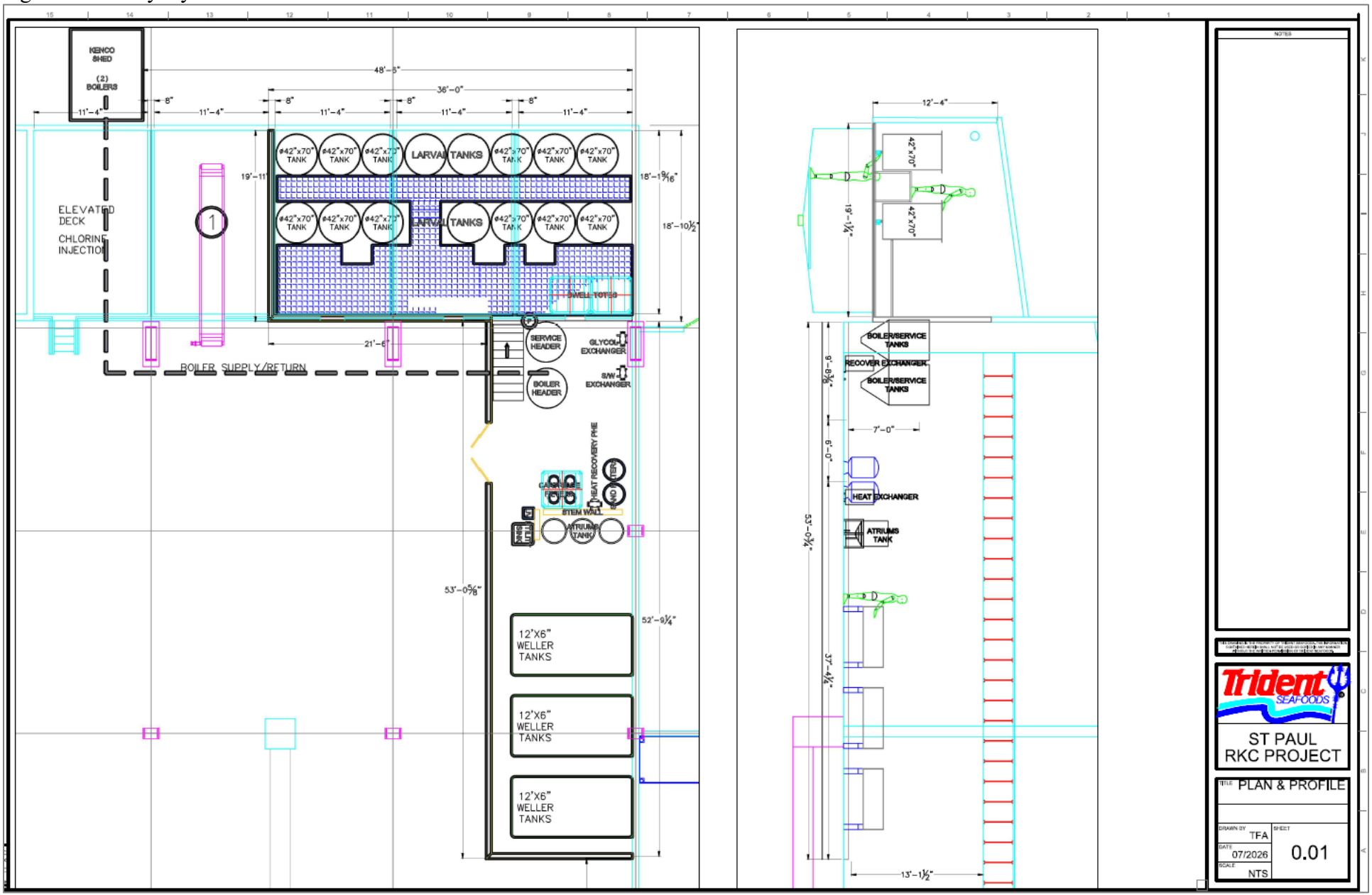


Figure 2. Saltwater schematic.

