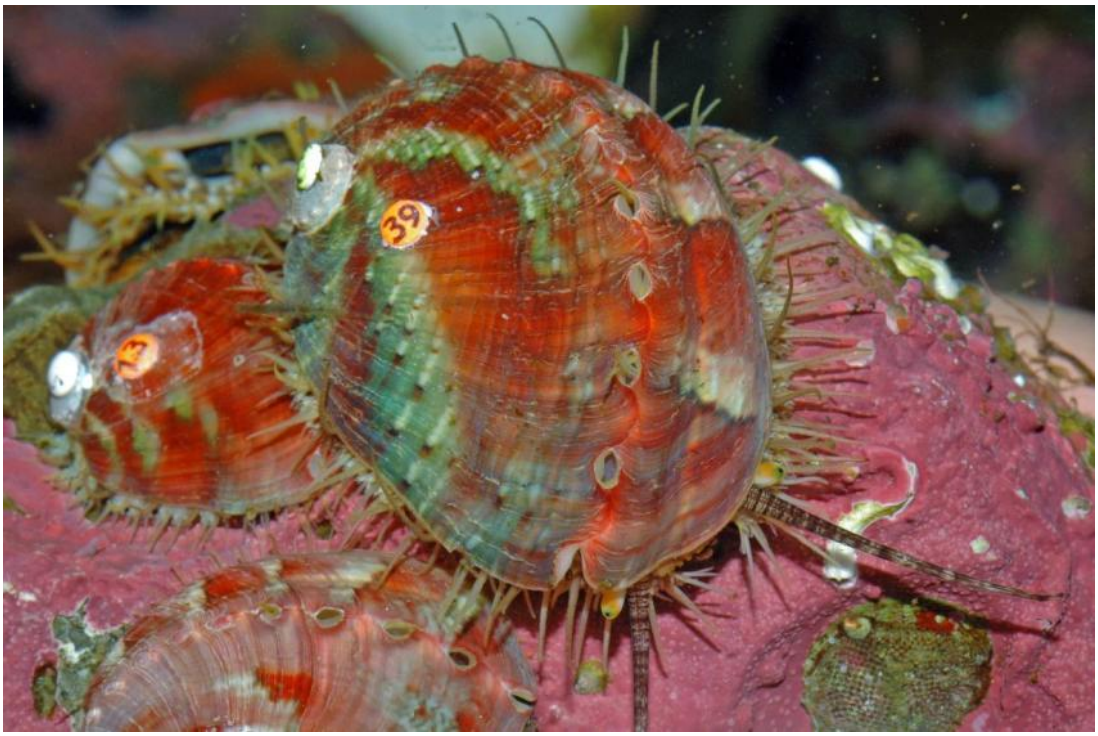
QUALITY ASSURANCE PROJECT PLAN:

Pinto Abalone Restoration and Monitoring



PUGET SOUND
RESTORATION FUND

Skagit MRC

QUALITY ASSURANCE PROJECT PLAN:

Pinto Abalone Restoration and Monitoring

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Cover Photo: Juvenile pinto abalone raised at the conservation aquaculture hatchery, tagged and ready for outplanting to restoration sites in the San Juan Archipelago. Photo by Josh Bouma.

Quality Assurance Project Plan
Pinto Abalone Restoration and Monitoring

June 2020

By Josh Bouma and Paul Dinnel

Approved by

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1.0 Table of Contents

Acronyms

EPA – Environmental Protection Agency

MLLW—Mean Lower Low Water

MRC – Marine Resources Committee

NOAA – National Oceanic and Atmospheric Administration

NWSC – Northwest Straits Commission

PSRF – Puget Sound Restoration Fund

QAPP – Quality Assurance Project Plan

SJA - San Juan Archipelago

SL—Maximum Shell Length

SPMC - Shannon Point Marine Center

WDFW – Washington Department of Fish and Wildlife

2.0 Abstract

The pinto abalone (*Haliotis kamtschatkana*), a charismatic and ecologically important marine gastropod, is in severe decline in Washington State waters. Index stations managed by the Washington Department of Fish & Wildlife for monitoring population trends within the San Juan Archipelago have revealed a decline in pinto abalone abundance greater than 97% at those sites between 1992 and 2017. Washington State proceeded with a state endangered species listing for pinto abalone in 2019. Recovery in Washington State without human intervention appears unlikely. Puget Sound Restoration Fund leads a strong collaborative team of organizations, government agencies, universities and tribes pursuing recovery strategies for pinto abalone. Since 2003, this restoration group has been investigating tools including conservation aquaculture and captive breeding, juvenile and larval outplanting, aggregation and other strategies. Hatchery methods for production of genetically diverse pinto abalone have been established and juvenile seeding onto restoration sites followed by annual dive surveys to monitor growth and survival has become a primary recovery tool since the first introduction of hatchery raised pinto abalone to rocky reef habitat in the San Juan Archipelago in 2009.

3.0 Background

3.1 Introduction and Problem Statement

The pinto (northern) abalone, *Haliotis kamtschatkana*, is the primary abalone species indigenous to Washington waters. This large gastropod plays a vital ecological role as an herbivorous grazer that maintains rocky reef habitat for settlement of other invertebrates and canopy kelp. Populations are severely depleted throughout their range in this state and considered functionally extinct. The current number and distribution of reproductive wild pinto abalone is too low and too widely distributed to maintain a sustainable population. The precipitous decline of pinto abalone in Washington is largely due to anthropogenic factors, including overharvesting during the legal recreational fishery and poaching during the 1980-90s (Bouma 2007, Carson and Ulrich 2019).

Between 1992 and 2017, the density of pinto abalone declined by 97% at 10 index sites in the San Juan Archipelago (SJA) monitored by the Washington Department of Fish and Wildlife (WDFW) even after the closure of the recreational fishery in 1994. Insignificant numbers of juvenile recruits have been observed and the average size of pinto abalone continues to increase (Rothaus et al. 2008, Bouma et al. 2012, Carson and Ulrich 2019). Both of these measures indicate likely recruitment failure of pinto abalone in areas of historical presence. They are now listed as a Washington State Endangered Species as of May 2019, and are also listed as a U.S. Federal Species of Concern and a Canadian Endangered Species (PSRF 2014).

Recruitment failure and lack of recovery for this species is largely due to the Allee effect (Allee et al. 1949) which can occur when existing animals, particularly broadcast spawning invertebrates like abalone, are not able to find each other and reproduce successfully. Babcock and Kessing (1999) estimated that the minimum density is 0.15 abalone/m^2 in order for successful reproduction to occur. Extensive sampling has shown that the remaining SJA pinto abalone population is well below this threshold, unable to facilitate necessary reproduction for natural population recovery.

Steps are being taken in an effort to help restore the pinto abalone population in northern Puget Sound waters. Puget Sound Restoration Fund (PSRF), with oversight from WDFW, has developed a conservation aquaculture program designed to supplement depleted wild stocks. The hatchery, wet laboratory and nursery facilities, named the Kenneth K. Chew Center for Shellfish Research and Restoration (Chew Center), are located at the NOAA Marine Fisheries Research Station in Manchester, WA. Juvenile outplanting and monitoring have been underway since 2009. The recovery project is a long-term collaboration between government agencies, NGOs, universities, tribes and more. This group includes researchers, managers, students and facilities support from WDFW, PSRF, Western Washington University's Shannon Point Marine Center (WWU SPMC), the NOAA Manchester Research Station, the Port Townsend Marine Science Center (PTMSC), the University of Washington, School of Aquatic & Fishery Sciences (UW) and others. Annual funding to PSRF from the Skagit County Marine Resources Committee (Skagit MRC) combined with funding from WDFW and others, supports pinto abalone conservation aquaculture and restoration activities in Skagit County.

3.2 Study Area

While pinto abalone recovery efforts are ongoing throughout the SJA, Skagit MRC funding supports restoration sites and monitoring in Skagit County. This currently includes two sites at each of the four locations: Cypress Island, Fidalgo Head, Burrows Island and Allan Island. Restoration sites may be added to this network as directed by WDFW. If sites change, a QAPP addendum will be submitted to include site changes.

3.2.1 History of study area

More than 11,400 healthy, genetically diverse hatchery produced juvenile pinto abalone have been outplanted to the eight rocky reef sites in Skagit County waters since 2009 (two of these sites were new in 2019). An additional 10,200 pinto abalone have also been outplanted at ten sites in San Juan County, creating a recovery network across a significant portion of their geographical range in Washington State. Sites have been chosen based on historical presence of adult pinto abalone along with a suite of other factors. Sites have undergone annual surveys by PSRF and WDFW divers for survival, growth and movement since 2009.

3.2.2 Summary of previous studies and existing data

Non-invasive (e.g., rocks are not overturned) surveys of these outplant sites are conducted each year to monitor survival, growth and movement providing estimates of survival and growth of pinto abalone released into the wild (Carson et al. 2019). Methods and results of surveys can also be found in annual WDFW, PSRF and Skagit MRC summary reports (Bouma and Dinnel 2017, Bouma and Dinnel 2018, Bouma and Dinnel 2019) as well as project reports by Shannon Point Marine Center (SPMC) students (Bergman 2009, Pratt and Dinnel 2010, Hester et al. 2011, Benolkin et al. 2012, Walker et al. 2013).

3.2.3 Parameters of interest

Parameters of interest for this project include:

- Number of restoration sites and number of pinto abalone released to these sites annually
- Survival, growth and movement of pinto abalone observed during annual monitoring
    - Number of abalone surveyed in comparison to number outplanted
    - Shell length measurements

- Position of abalone within survey lanes in each plot
- Number of abalone emigrated into survey perimeter outside outplant plots
- Presence/absence of colored bead of glue on shell of abalone marking age cohort for sites that are outplanted with various age groups

3.2.4 Regulatory criteria or standards

Restoration and monitoring standards fall within the guidelines of the WDFW Abalone Recovery Plan (draft plan in development at WDFW, spring 2020) for a state endangered species.

3.3 Water Quality Impairment Studies

Not applicable

3.4 Effectiveness Monitoring Studies

Not applicable

4.0 Project Description

4.1 Project Goals

The primary goal of the pinto abalone restoration program is to rebuild and recover pinto abalone stocks by introducing hatchery-reared juveniles, thus creating sustainable spawning populations at restoration sites throughout the range of the species in Washington State, resulting in natural recruitment over time. The scope of this QAPP covers efforts in Skagit County only, work that is supported by the Skagit MRC.

4.2 Project Objectives

The objectives of this project are to:

- Outplant (introduce hatchery-reared juvenile abalone to) and overseed (introduce new genetically distinct cohorts of hatchery-reared juvenile abalone in subsequent years) restoration sites in Skagit County with hatchery-reared juvenile pinto abalone that are healthy and genetically diverse.

- Monitor the success of outplant sites with annual dive surveys that collect data on survival, growth and movement of seeded pinto abalone.

- Evaluate survival of different age cohorts at the restoration sites to optimize hatchery production and subsequent outplanting of younger, smaller cohorts of juvenile pinto abalone.

4.3 Information Needed and Sources

Pinto abalone restoration outplants and subsequent annual monitoring have been ongoing since 2009. These outplants and surveys are designed to establish continuity with existing WDFW abalone recovery data in an effort to define trends and develop an understanding of the successes at restoration sites over time. To achieve this, all outplants and surveys have used established standards and methodologies developed and made available by WDFW. As the recovery program continues over succeeding years, it will generate data that can be used to better understand outplant site population trends, document changes, and identify new restoration opportunities.

4.4 Project Tasks

Project tasks include:

- Production of healthy, genetically diverse juvenile pinto abalone at the Chew Center.
- Annual dive surveys to monitor survival, growth and movement at existing Skagit County restoration sites.
- Outplanting and overseeding at Skagit County restoration sites, including establishment of new sites when possible.
- Quarterly and annual progress reports sent to Skagit MRC.

4.5 Systematic Planning Process

Not applicable.

5.0 Organization and Schedule

5.1 Key Individuals and Their Responsibilities

The PSRF abalone program director is responsible for planning, coordinating and implementing outplants to, and dive surveys of, the Skagit County pinto abalone restoration sites. All work is planned in partnership with the WDFW subtidal shellfish dive team, managed by research scientist Dr. Henry Carson and lead abalone biologist Katie Sowul. Oversight is also provided by Skagit MRC liaison Dr. Paul Dinnel.

Table 1: Organization of Project Staff

Role	Person Responsible	As of 06/01/2020
Manages project planning and implementation, coordinates with MRC liaison, creates reports and manages data.	PSRF abalone program director	Josh Bouma (PSRF)
Technical assistance when needed.	WDFW research scientist	Henry Carson (WDFW)
Technical assistance when needed.	WDFW lead abalone biologist	Katie Sowul (WDFW)
Manages field surveys/outplants	Field lead	Josh Bouma (PSRF)
Project oversight for MRC.	Skagit MRC liaison	Paul Dinnel (Skagit MRC)

5.2 Special Training and Certifications

Any PSRF diver involved in these pinto abalone surveys will be a certified American Academy of Underwater Sciences (AAUS) diver with all training and certifications current and in good standing with the Diving Safety Officer at Western Washington University, Nathan Schwarck. Core dive personnel from both WDFW and PSRF have conducted these pinto abalone surveys since the project was initiated in 2009. New divers to this project undergo ample training and observation dives prior to conducting surveys. Boat operators are either certified captains from Shannon Point Marine Center or experienced captains from the WDFW subtidal shellfish team.

5.3 Organization Chart

Not applicable.

5.4 Project Schedule

Table 2: Project Schedule

Date	**Event**
Ongoing	Chew Center juvenile pinto abalone production
October 2020, Feb-March 2021	Outplant site surveys
October 2020, Feb-March 2021	New site scouting and establishment, when possible
April-May 2021	Juvenile outplants, overseeding at restoration sites
Quarterly	Progress reports to Skagit MRC
September 2020, 2021	Annual report to Skagit MRC

5.5 Budget and Funding

Pinto abalone outplants and dive surveys at Skagit County restoration sites are partially funded by the Skagit MRC. Other funding, personnel support and in-kind contributions are provided by WDFW, PSRF, NOAA and others. This includes project management, staff time for husbandry efforts at the Chew Center, dive personnel, equipment and vessel costs, all associated field travel costs and scientific diving program (AAUS) fees. 2020-2021 funding comes from the Washington State General Fund ($15,000 annually) and EPA NEP program ($6,000 annually) through the Northwest Straits Commission to Skagit County MRC. The estimated budget for PSRF pinto abalone restoration efforts funded by Skagit MRC is provided in Table 3.

Table 3: Estimated Project Budget for 2020 and 2021.

Project Component	**Estimated Cost**
PSRF abalone project management	$2,100 annually
PSRF staff support	$10,500 annually
Travel expenses	$5,250 annually
Equipment, vessel fees, etc.	$2,150 annually

Scientific diving (AAUS) program fees	$1,000 annually
TOTAL	$21,000 annually

6.0 Quality Objectives

6.1 Data Quality Objectives

The overall quality objective for this project is to provide high quality data on the success of juvenile pinto abalone outplant efforts to recover and rebuild populations in the SJA. This QAPP describes how data is collected during dive surveys and how consistent protocols are followed for outplanting and monitoring at pinto abalone restoration sites.

6.2 Measurement Quality Objectives

To achieve comparability over time, outplants and surveys will be conducted following standard protocols designed and approved by WDFW as described in Sections 7.2 and 8.2 of this QAPP. Because this program follows protocols tested and established by WDFW's Subtidal Shellfish Management division, quality objectives are consistent across restoration sites and years.

6.2.1-6.2.2 Targets for precision, bias, and sensitivity; Targets for comparability, representativeness, and completeness

Precision: Maximum shell length (SL) will be measured with calipers to the nearest mm. When SL cannot be taken to this level of accuracy (e.g. abalone hidden in crevice, caliper cannot be positioned precisely), SL will be estimated to nearest 5 mm, measurement will be noted as an estimate and data point will not be used in overall site SL averages.

Bias & Sensitivity: Outplant sites are surveyed using non-invasive methods (see section 7.2) and because substrate is not significantly manipulated to detect abalone (only boulders of head-size or smaller are gently lifted), survey effectiveness may be decreased and observation rates may be underestimated by more than a third. All divers have been trained to use consistent techniques in how the substrate is examined and these methods are consistent between sites and over survey years. WDFW abalone index stations for monitoring population trends in the SJA are considered to be control sites as they are independent of outplant sites and surveyed every 3-4 years (outside the scope of Skagit MRC funding and this QAPP) to detect natural recruitment and presence of juvenile abalone.

Comparability: While abalone restoration and enhancement attempts have occurred with other species in a number of places around the world, outplant strategies and monitoring methodologies vary widely (Chick et al. 2013, Hart et al. 2013, Lebata-Ramos et al. 2013, Read et al. 2013, Searcy-Bernal et al. 2013). The Pinto abalone program in Washington has developed unique techniques to bring efficiency and consistency to these efforts. Outplant site establishment and survey methodologies have been based on WDFW abalone Index Station set-up and survey protocols (Rothaus et al. 2008, WDFW unpublished data) with minor modifications to increase success rate observing presence of smaller abalone and their movements (e.g. carefully moving small boulders to identify cryptic animals, using lights and mirrors to increase visibility within complex substrate, establishing survey perimeters around each plot to quantify emigration).

Representativeness: Site selection is driven by a set of criteria that aim to create outplant locations representative of typical and ideal abalone habitat. This includes suitable tidal-current swept complex rocky reef substrate (layered large cobble or boulders/rugose solid rock with crevices) in subtidal depths between 10-40' Mean Lower Low Water (MLLW) and presence of canopy kelp. Presence of conspecifics, whether from historic WDFW transect surveys or current broodstock scouting transects also informs site selection.

Completeness: The target number of abalone outplanted to Skagit County sites may vary each year and is dependent on hatchery success in producing healthy juveniles from multiple genetically distinct families. The total number of outplant site surveys conducted will be prioritized as completing surveys of all eight existing Skagit County sites in one survey year is difficult at the current funding and staff resource level. Sites that were outplanted or overseeded the previous year take first priority followed by sites that were newly established within the preceding two years. Remaining sites will be surveyed as time and resources allow.

6.3 Acceptance Criteria for Quality of Existing Data
Not applicable.

6.4 Model Quality Objectives
Not applicable.

7.0 Study Design

7.1 Study Boundaries
The current boundaries for pinto abalone recovery efforts include sites throughout the SJA (San Juan and Skagit counties). However, this QAPP only includes sites in Skagit County covered by Skagit MRC funding. New sites are selected based on historical or existing presence of conspecifics, suitable tidal current swept complex rocky reef substrate in subtidal depths between 10-40' MLLW and presence of canopy kelp. This currently includes two sites at each of the four following locations: Cypress Island, Fidalgo Head, Burrows Island and Allan Island. Description of specific site locations and GPS positions are not included in table format here for site security and safety. Position data can be acquired via direct communication with Katie Sowul, lead abalone biologist at WDFW (Katie.Sowul@dfw.wa.gov).

7.2 Field Data Collection
PSRF divers will participate in annual dive surveys investigating survival, growth and emergence of hatchery reared pinto abalone introduced to established restoration sites surrounding Fidalgo Head, Burrows, Allan and Cypress Islands in Skagit County. Surveys will be conducted in late winter (Feb-Mar) or fall (October) to avoid peak seasons of understory macroalgae growth which hampers survey efficiency and accuracy. Surveys are planned during low tidal current exchange days to increase efficiency and diver safety. While long-term plans include extensive surveys of surrounding habitat for juvenile recruitment, these upstream and downstream surveys have yet to occur.

All restoration sites will be surveyed annually prior to overseeding, when hatchery production allows for additional outplants to occur. Each site will require approximately 4 hours of dive time and sufficient

surface intervals between dives. Each site is located using precise GPS coordinates to drop a weighted buoy next to the outplant plot. Survey set-up includes locating the four plot corners which are marked by permanent pitons and submerged floating poly line, using detailed site maps that include corrected corner depths (relative to MLLW), distances and compass headings between corners along with described visual landmarks. A survey tape measure is extended around the plot to establish a perimeter, and weighted lead lines are installed temporarily for the duration of the dive survey to distinguish 2-meter survey lanes across the plot. Survey lanes extend from the deep to the shallow perimeter of the plot and each plot typically has five or six lanes. Divers will meticulously conduct non-invasive surveys of each lane. Boulders that are head-sized or smaller may be carefully lifted to observe underneath assuming little disturbance will occur, otherwise substrate is not moved or manipulated. Dive lights are used to investigate cracks, crevices and overhangs. Shell length and presence/absence of a colored bead of glue on the shell designating age cohort are recorded on dive slates for all pinto abalone observed.

Each pinto abalone is classified by how easily the observation was made; exposed, semi-exposed or cryptic. An exposed pinto abalone is emergent on top of boulders or solid rock, a semi-exposed pinto abalone is observable with some effort in shallow cracks or between boulders and cryptic pinto abalone are only observable by using lights and mirrors to look deep in cracks or under boulders. Each observation is also classified by location within the lane with the lane divided into thirds; deep, mid or shallow.

Two pilot studies conducted in 2007-2008 of outplanted juvenile pinto abalone indicated this survey method will detect a third of the pinto abalone present on the plot. These pilot studies compared results from non-invasive surveys followed by invasive surveys (boulders moved or flipped to observe more habitat). WDFW shellfish biologists have analyzed all outplant data including mark/recapture data from the subset of released pinto abalone that were tagged from 2009 to 2018 to improve our detectability estimates. When derived from a closed capture-recapture model based on the tag data from outplant sites, average detection is estimated at 0.19 (Carson et al. 2019).

7.3 Modeling and Analysis Design
Not applicable

7.4 Assumptions of Study Design
Study design assumes survey methods occur under similar conditions and circumstances each year with a consistent dive crew experienced in juvenile pinto abalone survey techniques. Assumptions are made that abalone observations during non-invasive survey methods will be much lower than the actual number surviving out of site within the substrate with estimated detection rates as low as 0.19 (see section 7.2).

7.5 Possible Challenges and Contingencies
Monitoring surveys and pinto abalone outplants at each restoration site may be constrained by factors such as weather, tidal current exchanges, visibility, boat availability and mechanics, hatchery production issues at the Chew Center and more. Field schedules are planned with these challenges in mind and excess field days are incorporated into the schedule, back-up vessels are arranged and alternate divers available to ensure all work is completed efficiently during the proposed work window. Potential disruptions related to the COVID-19 pandemic could impact upcoming hatchery production and

subsequent outplant efforts as field activities were reduced in spring 2020 and fewer broodstock abalone were collected to supplement the hatchery spawning population.

8.0 Field Procedures

8.1 Invasive Species Evaluation

Not applicable.

8.2 Juvenile Abalone Outplant Protocols

A complete disease screening of the hatchery population is completed every year prior to conducting annual pinto abalone outplant work. Sixty live juvenile pinto abalone representing multiple families designated for outplanting are sampled from the Chew Center and dissected for pathology, with a presumed 95% confidence of 5% pathogen detection level. An additional 60 live animals are sampled for Polymerase Chain Reaction (PCR) analysis for the causative agent of Withering Syndrome. Histology slides and PCR results are screened by a pathologist, Dr. Ralph Elston at Aquatechnics Inc. Results to date have indicated no presence of pathogens or infectious disease at the restoration hatchery. Spawning efforts at the hatchery aim to produce a minimum of 15 genetically distinct new families each season and this goal is based on available broodstock and rearing space. After confirmation that hatchery stocks are free of known infectious pathogens and genetic diversity goals have been met, an annual shellfish transfer permit is obtained from Brady Blake, WDFW, for moving pinto abalone from the Chew Center into the field.

All equipment and materials listed here are supplied by PSRF and are constructed/stored at the Chew Center. Outplant modules are constructed from PVC pipe (6") cut into approximately 18" long sections. Tubes recovered from previous outplants are also reused. Each outplant tube is conditioned in flow-through tanks at the Chew Center for several weeks prior to being loaded with animals. One day prior to seeding, pinto abalone are transferred from their holding tanks into the PVC outplant tubes. Fiberglass window screen (2 mm mesh size) is secured with rubber bands to close the outplant modules. Approximately 50-100 pinto abalone are loaded into each tube based on animal size and the total density for a particular site. Once loaded with pinto abalone, all tubes are housed overnight in flow through tanks in the Chew Center nursery building.

The outplant tubes are transported from the Chew Center directly to either Anacortes or Port Townsend in a large fish tote filled with seawater in a U-Haul trailer. To aerate the tote during transport, a 12V battery with a DC to AC inverter is used to power an aquarium pump with two large air stones placed in the tote. Fish totes are drained at the marina and loaded onto the research vessel, then refilled with seawater once the vessel has left the marina before being transported out to the restoration locations. Once on site, tubes are carried to depth in bundles of three or four by divers and placed within the delineated outplant plots in areas with suitable substrate and cryptic habitat onto which juvenile pinto abalone will exit. Tubes are wedged amongst cobble and boulders to secure them against current and surge. After the tubes are delivered to the rocky reef habitat and secured, divers remove the mesh from the tubes and the pinto abalone are free to move from the modules out onto the surrounding substrate. PVC outplant modules are removed from the sites approximately one month after the introduction.

8.3 Containers, Preservation Methods, Holding Times
Not applicable.

8.4 Equipment Decontamination
Not applicable.

8.5 Sample ID
Not applicable.

8.6 Chain of Custody
An appropriate chain of custody for survey data collected will be maintained and documented throughout this process. All juvenile pinto abalone outplant data collected since this project was initiated in 2009 has been co-managed by WDFW and PSRF. Abalone project biologists from WDFW have developed a database managed by WDFW that provides relational evaluation of the data.

8.7 Field Log Requirements
Field logs associated with each survey effort will include data sheets (Appendix A) and dive logs that document date, conditions, site, objective, personnel involved, data collected etc.

8.8 Other Activities
Not applicable.

9.0 Laboratory Procedures
Not applicable.

10.0 Quality Control Procedures
The following procedures will be used to maintain quality of the data in this program.

1. Adhere to the standard procedures for outplanting and dive surveys as described in the previous sections of this QAPP for both existing and new restoration sites.

2. Only divers who have been properly instructed in juvenile abalone survey techniques may participate in restoration site monitoring. Less experienced surveyors will always be teamed with a PSRF or WDFW diver with extensive survey experience on existing outplant sites.

3. Project Manager or a single individual with history leading pinto abalone restoration efforts will serve as Field Lead, and be responsible for the integrity of the surveys.

4. Prior to leaving each site, the Field Lead will review field logs and other field notes to identify any unusual or anomalous results. If any are found, they will be resolved (e.g., discrepancies between dive slates, data sheets or tablet forms) before leaving the field.

5. Datasheets and dive logs will be managed by WDFW subtidal shellfish biologists for oversight/error checking to ensure accuracy.

10.1 Table of Field and Laboratory Quality Control
Not applicable.

10.2 Corrective Action Processes
The experienced monitoring team is composed of three divers from PSRF and six divers from WDFW. This often provides multiple sets of eyes and experience that can identify a potential issue with field survey techniques or data collection. If there are concerns about survey accuracy due to weather, tidal currents, visibility or other conditions, survey operations will be postponed until a time when conditions are appropriate for accurate and thorough data collection.

11.0 Data Management Procedures
The PSRF abalone project manager ensures that all outplant and monitoring data are compiled and organized on field data sheets or in the field tablet. These data are ultimately entered, stored and managed electronically by WDFW shellfish biologists on the WDFW agency server.

12.0 Audits and Reports
12.1 Audits
Audits are not anticipated for this project. Progress reports will be submitted quarterly to the Skagit MRC.

12.2 Responsible Personnel
PSRF abalone program personnel are responsible for reporting quarterly to the Skagit MRC on pinto abalone outplanting and surveying activity.

12.3 Frequency and Distribution of Reports
A copy of protocols and QAPP will be developed and reviewed annually.

A summary report on outplanting and survey activities will be submitted annually. The report will include:

- A narrative of the field research.
- A summary of Chew Center juvenile pinto abalone production for Skagit County sites.
- An overview of restoration sites to which pinto abalone are outplanted and overseeded, including a description of any new sites established.
- A summary of dive surveys and monitoring results (survival, growth, movement, density etc. of juvenile pinto abalone) on Skagit County restoration sites.
- A summary of any other insights gained during pinto abalone field work in Skagit County.

12.4 Responsibility for Reports
PSRF abalone program personnel are responsible for progress and annual report submissions to the Skagit MRC.

13.0 Data Verification

13.1 Field Data Verification, Requirements, and Responsibilities

For field data verification, the PSRF project lead will review dive slates, field logs and tablet data forms to identify any unusual or anomalous results prior to leaving each restoration site. If any are found, they will be resolved before leaving the field.

13.2 Laboratory Data Verification

Not applicable.

13.3 Validation Requirements, if Necessary

Not applicable.

13.4 Model Quality Assessment

Not applicable.

14.0 Data Quality (Usability) Assessment

14.1 Process for Determining Project Objectives Were Met

The outplanting and monitoring objectives were met if and when Skagit County restoration sites included in the annual project plan were surveyed and then outplanted or overseeded with juvenile pinto abalone, assuming hatchery production at the Chew Center allows.

14.2 Treatment of Non-detects

Not applicable.

14.3 Data Analysis and Presentation Methods

Not applicable.

14.4 Sampling Design Evaluation

Survey design is established by WDFW and used across years and all restoration sites.

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Appendix A: Juvenile Abalone Outplant Site Survey Data Sheet

ABALONE OUTPLANT SURVEY DATA FORM

Date: _____ **D1 Start Time:**_____ **D2 Start Time:**_____ **D3 Start Time:**_____

Location: _____ **D1 End Time:** _____ **D2 End Time:** _____ **D3 End Time:** _____

Dive Team(s): _____ **Page** _____ **of** _____

	Sector #	Depth	Tag?	T Cert	SL	SL Cert	C/S/E	Comments
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