Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion for the Issuance of an ESA Section 10(a)(1)(A) Scientific Research and Enhancement Permit associated with the Rescue and Rearing Management Plan for Petaluma River Steelhead

NMFS Consultation Number: WCRO-2022-00382
Action Agency: NOAA's National Marine Fisheries Service

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

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Date: April 15, 2022

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1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at California Coastal NMFS office.

1.2 Consultation History

NMFS received a Section 10(a)(1)(A) Scientific Research and Enhancement Permit application from the United Anglers of Casa Grande (UACG, applicant) on January 21, 2021. NMFS conducted extensive literature reviews, consulted with fish culturists and with members of the Technical Advisory Committee (TAC), and analyzed stocking data and devised a suite of recommendations for the UACG to consider implementing to improve the program. The application was updated on August 1, 2021 to incorporate emergency rearing actions and modified again in September, 2021 to remove Chinook from the list of covered species. UACG has requested a permit to rescue, transport, rear, and release wild Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) in the Petaluma River watershed. The permit application was supplemented by the Rescue and Rearing Management Plan (RRMP) which details current and proposed operations and monitoring. NMFS reviewed the RRMP in coordination with the California Department of Fish and Wildlife (CDFW) and Trout Unlimited (TAC members) and deemed it sufficient on October 1, 2021. On February, 16, 2022, NMFS provided notice of our receipt of the Section 10(a)(1)(A) permit application and RRMP in the Federal Register, which also initiated a 30-day public comment period which closed on March 18, 2022. Tribal Engagement letters were sent to five local tribes on January 19, 2021. As the federal action agency for the issuance of the section 10(a)(1)(A) permit, NMFS initiated internal section 7 consultation for the operation of the Program on February 16, 2022?

1.3 Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02 The action is NMFS' issuance of an ESA 10(a)(1)(A) scientific research and enhancement permit to the UACG for a RRMP that is intended to:

1) Increase adult CCC steelhead abundance in the Petaluma River watershed towards levels identified by NMFS in the recovery plan for this population.

2) Provide emergency incubation and rearing facilities for other hatchery programs where conditions within these facilities are expected to become unsuitable for the culture of ESA-listed steelhead or coho salmon (*O. kisutch*).

3) Conduct monitoring and research to document program performance and status of CCC steelhead in the Petaluma River watershed.

4) Through the rescue and rearing of fish, monitoring of fish and watershed conditions, and eventual recovery of the Petaluma River steelhead population and restoration of the watershed, provide for the education and involvement of Casa Grande High School students and the surrounding community.

Fish rearing will occur at the UACG Hatchery and will be run by Casa Grande High School located in Petaluma, California in cooperation with UACG, CDFW, and NMFS. A TAC, consisting of representatives of the operating organizations, will provide scientific oversight for the program.

The RRMP anticipates a permit term of five years (2022-2027), at which time the TAC will reevaluate the need and scope of the program and consider permit renewal.

Fish will be defined as belonging to one of four groups:

Group 1 - Collected as fry and reared at the hatchery (Hatchery Program).
Group 2 - Collected as fry and released back to the stream at the point of capture (Natural Rearing - Fry).
Group 3 - Rescued, transported, and released to better habitat (Rescue Program – fry, fingerling, smolts).[1]
Group 4 - Rescued and released at collection location (Natural Rearing – fry, fingerling, smolts).

The effectiveness of both the rescue and rearing programs to increase steelhead abundance will be determined by using genetic analysis to estimate the contribution of program fish to natural steelhead production each year. Genetic samples (tissues) will be collected from all juvenile steelhead captured in each stream each year.[2] Parentage-based tagging (PBT) will be the method used to conduct the analysis (Hess et al. 2009, Anderson and Garza 2006).

The NMFS Recovery plan identifies the Petaluma River steelhead as an essential independent population (NMFS 2016). The high-risk thresholds identify densities at which populations are at heightened risk of a reduction in per capita growth rate (i.e., depensation). Intrinsic potential (IP) is the historical habitats expected to support spawning and juvenile salmonids and steelhead. Models predict that there is approximately 64 kilometers of IP in the Petaluma River watershed

[1] Some rescued fish may be reared in the hatchery if no suitable habitat can be found to which they can be released.
[2] Genetic samples will also be collected from any adult steelhead carcasses found during juvenile and adult M&E activities.

(Figure 1, NMFS 2016). In Spence *et al.* (2008), the high-risk extinction threshold used for biological viability criteria is a population averaging one spawner per IP-km. Therefore, the high-risk depensation threshold for the Petaluma River is 64 spawning adults.

If it is found within five years that: 1) adult steelhead abundance in the Petaluma is substantially less than the high-risk depensation level for the Petaluma River (64 adults); and/or 2) that the program is unable to collect a sufficient number of juveniles for rearing that increase adult abundance to >64 fish, the program will consider importing hatchery juvenile or adult steelhead from the Russian River and releasing them to the Petaluma River. Under this scenario, Petaluma River steelhead would no longer be reared at the hatchery, but rescue operations would continue. A separate management plan (and opinion) would be developed before importing Russian River steelhead to the system.

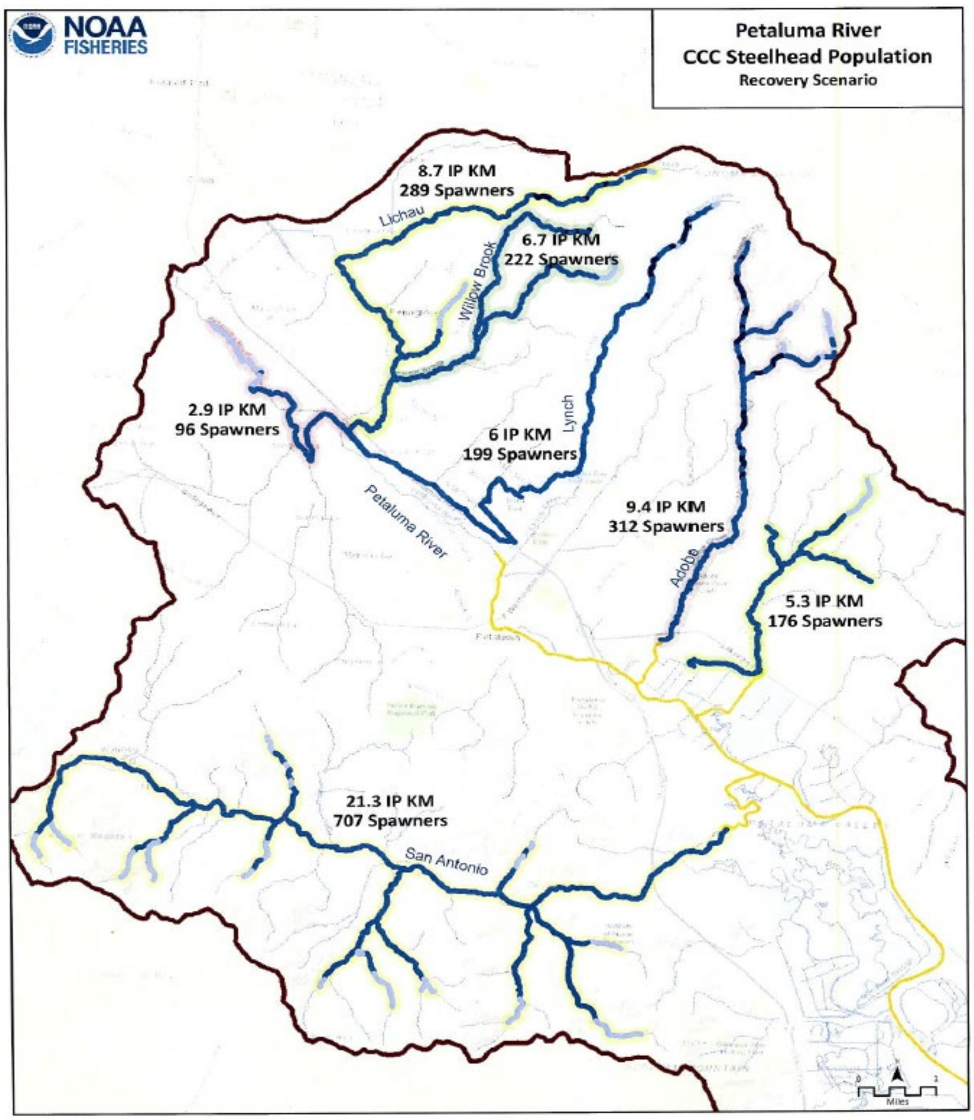

Figure 1. Map of kilometers of habitat within the Petaluma River watershed, modeled for recovery intrinsic potential (IP) and adult spawner abundance targets (NMFS 2016).

1.3.1. Description of Incubation and Rearing Facilities

Built in 1993 by UACG, the hatchery is one of the first facilities to operate using a Recirculated Aquaculture System (RAS) to conserve water and to increase the quality and reliability of source water to the hatchery. The facility is a 3,000 sq. foot building which includes: Adobe Creek interpretative area, an incubation and tagging room, and a rearing area.

The hatchery uses well water to rear juvenile steelhead. Water from the well is delivered into a large (5,655 L) underground sump tank. The well water temperature is a constant 20 degrees C before being passed through the chiller unit that reduces the temperature to 13 degrees C. The well water is mixed with water arriving from an underground bio-filter (60,570L) and is sent into the buildings' ultra-violet system. The RAS system uses a process of physical and biological filters to remove waste and recirculate treated water back to the hatchery. The water is discharged to the Petaluma City Water Sewer system or recycled through the hatchery.

The rearing area contains two fiberglass troughs (0.6m x 0.6m x 3m) and four concrete raceways (9.5m x 1.5m x 1.5m). The hatchery is also equipped with four sets of heath trays and multiple jars that allow the incubation of approximately 100,000 eggs. The program will purchase four additional 8-foot, round, tanks to provide space as needed for emergency rearing. Flow through the systems range from 3 to 5 gallons per minute. An alarm system is installed at the hatchery which calls the hatchery manager in case of a power outage, or low flows in any of troughs or raceways.

The raceways that make up the rearing area for parr and smolts are covered by a fine mesh netting, and each raceway can be separated into five sections. This allows for the ability to separate fish by stream origin. Flow rate is controlled from the plumbing manifold to each raceway, where the water flows through each raceway and is collected in the bio-filter. Each raceway is plumbed with valves to adjust water flow rate and depth. Depth can be raised or lowered to achieve rearing density criteria by life stage. The raceways are safeguarded by a low flow stop point that prevents raceway depth from dropping below a depth of 0.5m. Flow rates maintain dissolved oxygen levels greater than 7 mg/l.

The two fiberglass troughs are used for rearing fry and fingerling life stages. Each trough is plumbed with adjustable flow rate and maintains ample oxygen levels. Each trough can be divided into three sections to separate fish from different creeks.

The transportation of juvenile steelhead is conducted under direct supervision of the UACG Director with CDFW permission. UACG can transport as needed with a 568 L tank mounted to the transport truck. The tank is equipped with oxygen and fresh flow for transportation needs. Fish do not undergo long term (+30 days) acclimation prior to release. When the transport truck arrives at the release site, the driver will record the temperature of the truck water and receiving water. The tank water is tempered to within 1 degree Celsius of the receiving water prior to releasing fish. Water tempering is achieved by pumping water from the receiving water into the tank until the temperature criterion is achieved. Fish will be released directly from the truck to the stream or in 5-gallon buckets dependent on site conditions.

1.3.2. Rescue

The rescue component of the program will occur in the late spring or early summer, when stream flows in most Petaluma River tributaries decrease to levels that result in CCC steelhead being trapped in primarily pool habitat. As the summer progresses, these pools may dry up or water temperatures increase to levels unsuitable for rearing and may result in near 100 percent mortality for juvenile steelhead. To increase the survival rate of trapped steelhead, the program will collect (rescue) some of these fish (fry, fingerling, and 1+smolts) from the streams then transport and release them to areas where habitat conditions are better suited to produce juvenile steelhead (perennial flow and stream temperatures < 20 degrees C).

Only steelhead will be collected and relocated to prevent non-native or invasive species from colonizing these areas. The Aquatic Species Invasive Species Decontamination Protocol will be followed during all sampling and transfer activities.[3] Hatchery staff will immediately report any observed new locations of detrimental species per Title 14, Section 671, including New Zealand Mudsnail and dreissenid mussels to the CDFW within 24 hours of their discovery.

Each year, the program may rescue and release up to 7,815 juvenile steelhead (fry, fingerling, 1+smolts) (Table 1, Appendix A). The target streams include Adobe, Lynch, Lichau, and Willow Brook creeks. These streams were selected because past spawner surveys indicate exceptionally low steelhead abundance and existing agreements with landowners allow program staff access to a large portion of each stream. Rescue and rearing activities will not occur in Ellis Creek, the mainstem Petaluma River, and miscellaneous small tributaries. This approach is used as a risk aversion measure to ensure that possible negative effects associated with program activities do not directly affect the entire steelhead population of the Petaluma River watershed.

Each of the target streams will be surveyed by staff starting July 1st of each year or earlier if stream environmental conditions are unlikely to support juvenile rearing as determined by the TAC. Until more quantitative estimates of stream flow can be developed by the program (through the TAC), professional opinion or phone calls from landowners will be used as the primary justifications for the start date for rescues.

Surveys will start at the mouth of each target stream and progress upstream to the point where flow discharge in the stream prevents juvenile steelhead from migrating downstream. Juvenile steelhead rescue activities will start at this point and continue upstream to: 1) the end of the anadromous zone as determined by habitat inventory reports;[4] 2) where stream access is restricted by landowners; or 3) where stream flow in the channel is no longer intermittent. The decision to rescue fish from any portion of the stream will be made by the field crew leader. Electrofishing and netting will be the methods used to collect fish from each rescue site. The field crew leader will be responsible for determining the appropriate method used per site.

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[3] https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=92821&inline

[4] The ability to conduct rescue operations will also be dependent on access to the stream as determined by landowners.

Table 1. The maximum numbers of fish rescued and released, or reared and released annually, and expected adult productions by life stage and stream.

<table>
<tr><th rowspan="2">Life Stage</th><th rowspan="2">Release Locations</th><th rowspan="2">IP KM</th><th>Maximum Annual</th><th rowspan="2">Expected Adults Produced</th><th>Maximum Annual</th><th rowspan="2">Expected Adults Produced</th></tr>
<tr><th>Rescue and Release (no rearing)</th><th>Rear and Release (1+)</th></tr>
<tr><td rowspan="9">Fry-Fingerling</td><td>Adobe Creek</td><td>9.4</td><td>1,800</td><td>9</td><td>1,050</td><td>9</td></tr>
<tr><td>Lynch Creek</td><td>6.0</td><td>1,200</td><td>6</td><td>700</td><td>6</td></tr>
<tr><td>Lichau Creek</td><td>8.7</td><td>1,800</td><td>9</td><td>1,050</td><td>9</td></tr>
<tr><td>Willow Brook Creek</td><td>6.7</td><td>1,400</td><td>7</td><td>820</td><td>7</td></tr>
<tr><td>San Antonio</td><td>21.3</td><td>0</td><td>0</td><td>2,325</td><td>21</td></tr>
<tr><td>Petaluma River</td><td>2.9</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Ellis Creek</td><td>5.3</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Misc. Small Tribs</td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>64.3</td><td>6,200</td><td>31</td><td>5,945</td><td>52</td></tr>
<tr><td colspan="5"></td><td colspan="2"></td></tr>
<tr><td rowspan="9">1+ Smolts</td><td>Adobe Creek</td><td>9.4</td><td>450</td><td>9</td><td rowspan="9" colspan="2"></td></tr>
<tr><td>Lynch Creek</td><td>6.0</td><td>315</td><td>6</td></tr>
<tr><td>Lichau Creek</td><td>8.7</td><td>475</td><td>9</td></tr>
<tr><td>Willow Brook Creek</td><td>6.7</td><td>375</td><td>7</td></tr>
<tr><td>San Antonio</td><td>21.3</td><td>0</td><td>0</td></tr>
<tr><td>Petaluma River</td><td>2.9</td><td>0</td><td>0</td></tr>
<tr><td>Ellis Creek</td><td>5.3</td><td>0</td><td>0</td></tr>
<tr><td>Misc. Small Tribs</td><td>4</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>64.3</td><td>1,615</td><td>31</td></tr>
</table>

Of the fish rescued, 50 percent will be transported and released to stream habitat that supports steelhead production year-round while the other 50 percent will be released back to the stream where collected. Releasing 50 percent of the fish back to the stream allows the program to determine the effectiveness of the rescue effort, i.e., resulting adult production, by genetically sampling the fish using PBT. Tissue samples will be collected for genetic analysis from all juvenile steelhead sampled. Rescued fish will be placed into coolers and then transferred to larger tanks located on the transfer truck. The truck(s) will then transport the fish to habitat of sufficient quality to support juvenile steelhead production as determined by the TAC.

During each survey staff will use GPS and physical marking to identify each location where fish were collected and released. Stream physical conditions (flow and temperature) and fish presence at these sites will be recorded. Photos will be taken at each site to document conditions. Rescue activities will only occur at a site one time. Fish presence will be determined using snorkeling or visually from the bank in subsequent visits, if possible. The number of dead fish found will be enumerated and checked for marks.

1.3.3. Rearing

The rearing component is designed to provide a demographic boost and maintain the genetic diversity of the entire steelhead population in each stream. These goals will be accomplished by randomly collecting fry (<60 mm) from all accessible stream habitat before these areas become dewatered (early spring) or stream temperatures reach levels that are lethal to juvenile steelhead. Of the fish captured, up to 50 percent will be kept for rearing and the remainder marked (physical clip, or internal tag) and returned to the stream. A tissue sample will be retained for genetic analysis (PBT).[5] Up to 5,945 juvenile steelhead will be collected, transported to the UACG Hatchery, and reared to the smolt stage (Table 1, Appendix A). Because survival from fry to smolt is expected to be higher in the hatchery than in the natural environment, hatchery rearing is expected to result in an increase in total adult steelhead production for these streams.

Fish will be collected using a combination of electrofishing (one-pass) and netting (seines). Field crews will start capturing steelhead fry near the mouth of each stream, or the lowest point where they have stream access. Capture activities will proceed upstream until the extent of anadromous fish zone is reached. Because of a lack of access to certain portions of the stream, capture activities will not be conducted in these areas.

A total of 114 adult steelhead are expected to be produced if the juvenile numbers shown in Table 1 are achieved. However, because of substantial uncertainty associated with juvenile to adult survival rates, total juvenile production in each stream, and the size (life stage) of the fish rescued each year[6], adult steelhead production could be substantially lower or higher than 114 fish. To account for this outcome, program assumptions will be reviewed every five years (approximately one generation) and program rescue and rearing numbers adjusted accordingly. Any proposed changes in program rescue or rearing numbers will be sent to NMFS and CDFW for review and approval before being implemented.

Operations to collect fish for the rearing program will begin in April when fry are expected to emerge from the gravel. Fry emergence date is expected to vary somewhat by stream due to differences in adult spawn-timing and stream temperatures. Snorkel and visual surveys from the bank will be used to determine when emergence has occurred in each stream. After confirmation of fry emergence, field crews will return to the stream 1-2 weeks later to collect fry for the rearing component of the program. The 1–2-week delay is needed to ensure that fish are of sufficient size (>40mm) where capture activities do not result in high mortality to the fish. Capture activities will be repeated approximately every 2 weeks (through June) to ensure that the reared fish are representative of the entire spawning population. The end date of the capture activities will be adaptively managed as more as learned on fry emergence timing and growth rates.

1.3.4. Emergency Incubation

California is in severe drought and water supply reservoirs are at record and historic lows prompting regulators to curtail water diversions to preserve storage for human health, safety, and

[5] A different portion of the fish may be used for genetic analysis if directed by NMFS and CDFW.
[6] Larger fish are expected to have higher survival than smaller fish. For this analysis it is assumed that fry are <60mm in length, fingerlings 61-149 mm and 1+ smolts 149+ mm.

ESA-listed salmon and steelhead. Because many hatcheries rely on natural stream flow and cold-water present in reservoirs to rear salmon and steelhead, a decrease in either one can result in the hatcheries being unable to successfully culture fish. When this occurs, hatchery managers either need to release the fish to streams that are now exhibiting environmental conditions unsuitable for salmon or transfer these fish to another hatchery facility with a suitable rearing environment. The UACG Hatchery is such a facility as it uses a combination of groundwater, water chillers and RAS to incubate and rear fish under ideal conditions.

The UACG Hatchery may, therefore, be used to provide emergency incubation and rearing facilities for other hatchery programs where conditions within these facilities are expected to become unsuitable for the culture of ESA-listed steelhead and/or coho salmon. Eggs and fish will be transferred from these facilities to the UACG Hatchery where they will be incubated and/or reared until conditions at the source hatcheries once again become suitable for successful culture of these fish. At that time, the fish will be transported back to these facilities for eventual release to previously identified streams. The total number of fish reared will be dependent on fish size, length of time required before fish are sent back to the source hatchery and water temperature, flow and density culture criteria requirements. The number of eggs incubated will be dependent on the density limitations of the Heath trays and jars.[7] Direct and incidental take and associated effects to other ESA-listed steelhead and/or coho salmon that may occur as part of the emergency incubation and rearing component of the RRMP will be covered under existing 10(a)(1)(A) permits (and associated opinions) specific to individual hatchery management plans and will not be included in this permit or opinion.

Education Program

Additionally, as part of the education objective of the Casa Grande High School and UACG Hatchery Educational Program, up to 20,000 eggs from non-ESA listed hatchery steelhead may be transferred and reared at the UACGH from the CDFW Warm Springs Hatchery each year. These eggs will be reared to the yearling stage, then transported back to Warm Springs for release into Dry Creek. Fish may be transported back to Warm Springs earlier if more space is needed for RRMP steelhead rescues or other emergency rearing. This activity is covered under the Warm Springs Hatchery Genetic Management Plan and since these steelhead are not listed, no take is required.

1.3.5. Monitoring and Research

The program will conduct monitoring and research (currently conducted under an existing 4(d) permit) that: 1) evaluates program performance, 2) estimates the abundance, productivity, and spatial structure of CCC steelhead in the Petaluma River watershed, 3) collects habitat data that will enable a comprehensive evaluation of habitat conditions in the Petaluma River watershed, and 4) incorporates streamflow monitoring to determine start and end date of rescue operations. The following monitoring and research activities are currently conducted under an existing 4(d) permit that is renewed annually with NMFS (Appendix B):

[7] Water temperature and flow requirements for successful egg incubation will also be followed (USFWS 2002)

- Adult abundance surveys (redd, carcass, and live adult count surveys): Jan 1-Apr 30; and Dec 1- Dec 31, every 7-10 days.
- Juvenile distribution surveys:
  - Visual Inspection: April 15-Nov 15, every 7-14 days,
  - Fyke Netting: April 1 - June 15, continuous,
  - Pole seine: April 15-Nov 15, at an irregular frequency (approx. two sites per month),
  - Electrofishing: June 1-Nov 15, at an irregular frequency (approx. two sites per month).
- Habitat surveys: Jun 15- Nov 15, daily.

1.3.6. Best Management Practices and Performance Standards

Once issued, the Section 10(a)(1)(A) associated with this opinion will take the place of the 4(d) permit and annual renewal of the 4(d) will no longer be necessary. All terms and conditions from the current 4(d) permit (Appendix B) will be carried over into the new 10(a)(1)(A) permit and will continue to be followed.

Approximately 1-week prior to release (or transfer back to source hatchery), fish will be inspected by a CDFW pathologist. Only fish certified as healthy by the pathologist will be released back to their streams (hatchery) of origin. Any treatments recommended by the pathologist will be completed by the hatchery manager prior to transport from the facility. Fish health policies for CDFW hatcheries will be followed based on the direction provided in detail in the following documents:

- California Department of Fish and Wildlife Fish Health Policy for Anadromous Fish Hatcheries (CDFW 2014),
- California Fish & Game Code § 1008 (CDFW 2019),
- Aquatic Invasive Species Monitoring at CDFW Hatcheries (CDFW 2015).

Fish mortalities in the incubation systems, raceways and troughs will be enumerated each day. Each dead fish will be examined for lesions, signs of infection and parasites. If any of these symptoms are present in the fish the CDFW pathologist is contacted for possible treatment options or sent samples for evaluation. The hatchery manager will be responsible for implementing all treatments recommended by the pathologist.

Performance standards and indicators proposed in the RRMP provide measurable metrics to determine if the goals of the Program are being met (Table 2). Standards include hatchery management practices, producing high quality smolts, achieving production targets, and ensuring high survival rates for rescued fish and emergency rearing.

Table 2. Rescue and rearing performance standards for the program.

Performance Standard	Definition
Achieve Hatchery Best Management Practices	Culture practices developed by the CDFW and others to increase life-stage specific survival rates, protect the genetic resources of the cultured population, produce a high-quality rearing environment.
Produce High Quality Smolts (yearlings)	A high quality smolt is defined as having similar genetic, physical, behavioral traits and survival rates to naturally produced smolts.
Achieve Production Target(s)	Collect, culture, and release the number of fry required to achieve annual production targets.
Achieve High Survival Rates for Rescued Fish and Emergency Rearing	Capture methods used to rescue, transport, and release juvenile fish result in high survival rates.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS, and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation of critical habitat for CCC steelhead uses the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion, we use the terms "effects" and "consequences" interchangeably. We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

NMFS assesses four population viability[8] parameters to discern the status of the listed Distinct Population Segment (DPS) and to assess each species ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany *et al.* 2000). While there is insufficient data to evaluate these population viability parameters quantitatively, NMFS has used existing information to determine the general condition of the populations in the CCC steelhead DPS and the factors responsible for the current status of these listed species.

We use these population viability parameters as surrogates for "reproduction, numbers, and distribution" in the regulatory definition of "jeopardize the continued existence of" (50 CFR 402.02). For example, abundance, population growth rate, and distribution are surrogates for numbers, reproduction, and distribution, respectively. The fourth parameter, diversity, is related to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained, resulting in reduced population resilience to environmental variation at local or landscape-level scales.

This opinion analyzes the effects of the proposed action on the following federally-listed species' DPS, and designated critical habitat.

CCC steelhead DPS
Threatened (71 FR 834; January 5, 2006)
Critical habitat designation (70 FR 52488; September 2, 2005).

2.2.1 CCC Steelhead Status

CCC steelhead was listed as federally threatened in 1996. This DPS includes all naturally spawned steelhead from the Russian River in Sonoma County to Aptos Creek in Santa Cruz County as well as the drainages of San Francisco, Suisun, and San Pablo bays eastward to Chipps Island at the confluence of the Sacramento and San Joaquin rivers (NMFS 2005). Critical

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[8] NMFS defines a viable salmonid population as "an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100- year time frame" (McElhany *et al*. 2000).

habitat was designated in 2005 (NMFS 2005). Historically, approximately 70 populations[9] of steelhead existed in the CCC steelhead DPS (Spence *et al.* 2008, Spence *et al.* 2012). About 37 of these were considered independent, orpotentially independent (Bjorkstedt *et al.* 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (McElhaney *et al*. 2000, Bjorkstedt *et al*. 2005).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby *et al.* 1996). Though still below historic levels, the trend of adult returns to the Warm Springs and Coyote Valley fish facilities on the Russian River has improved since the 1980s and '90s. Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vicente, Pudding, Caspar creeks) of individual run sizes of 500 fish or less (62 FR 43937; August 18, 1997). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). In San Francisco Bay streams, reduced population sizes and fragmentation of habitat has likely also led to loss of genetic diversity in these populations.

A 2008 viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and the limited information available did not indicate that any other CCC steelhead populations were demonstrably viable (Spence *et al*. 2008). Although there were average returns (based on the last ten years) of adult CCC steelhead during 2007/08, research monitoring data from the 2008/09 and 2009/10 adult CCC steelhead returns show a decline in returning adults across their range compared to the previous ten years. The lack of adequate spawner surveys within the Russian River precludes the estimation of wild steelhead escapement within the basin; however, hatchery returns suggest the vast majority of returning fish are of hatchery origin. Information from years of the Coastal Monitoring Program in the Santa Cruz Mountains suggests that population sizes there are higher than previously thought. However, the long-term downward trend in the Scott Creek population, which has the most robust estimates of abundance, is a source of concern. Population-level estimates of adult abundance are not available for any of the seven independent populations (i.e., Novato Creek, Corte Madera Creek, Guadalupe River, Saratoga Creek, Stevens Creek, San Francisquito Creek, and San Mateo Creek) inhabiting the watersheds of the coastal strata.

The scarcity of information on CCC steelhead abundance continues to make it difficult to assess whether conditions have changed appreciably since the previous status review assessment (Williams *et al*. 2016). The most recent status update concludes that steelhead in the CCC DPS remain "likely to become endangered in the foreseeable future", as new and additional information does not appear to suggest a change in extinction risk (Howe 2016). NMFS concluded that the CCC steelhead DPS shall remain listed as threatened (81 FR 33468; May 26, 2016).

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[9] Population as defined by Bjorkstedt *et al.* 2005 and McElhaney *et al.* 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream.

2.2.2 Status of Critical Habitat

In determining what areas are critical habitat, agency regulations require that we must consider those PBFs that are essential to the conservation of a given species including space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing of offspring; and habitats that are protected from disturbance or are representative of the historical geographical and ecological distribution of a species.

PBFs for CCC steelhead critical habitat within freshwater include:

- freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

- freshwater rearing sites with:
    - water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
    - water quality and forage supporting juvenile development;
    - natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;

- freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercutbanks supporting juvenile and adult mobility and survival.

The condition of designated critical habitat for CCC steelhead, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that currently depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat[10]: logging, agriculture, mining, urbanization, stream channelization and bank stabilization, dams, wetland loss, and water withdrawals (including unscreened diversions for irrigation). Impacts of concern include: altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel andwood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Weitkamp *et al.* 1995; Busby *et al*. 1996; 64 FR 24049; 70 FR 52488). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in

[10] Other factors, such as over fishing and artificial propagation have also contributed to the current population statusof these species. All these human induced factors have exacerbated the adverse effects of natural environmental variability from such factors as drought and poor ocean productivity.

many of the streams within steelhead DPSs. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

2.2.3 Additional Threats to Listed Species and Critical Habitat

Another factor affecting the rangewide status of steelhead, and their critical habitat at large, is climate change. Impacts from global climate change are already occurring in California and listed salmonids here may have already experienced some detrimental impacts. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir *et al.* 2013). California has a history of episodic droughts. However, the state has experienced a two-decade period of persistently warm and dry conditions. The five-year period from 2012 to 2016 was the driest since record keeping began (Williams *et al.* 2016). The extreme drought conditions for most of California from January 2020 through October 2021 resulted from the lowest total precipitation and near-highest temperatures recorded since 1895 (Mankin *et al.* 2021).

The threat to salmonids from global climate change will continue to increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley *et al.* 2007; Moser *et al.* 2012). Heat waves are expected to occur more often and be comprised of higher temperatures (Hayhoe *et al.* 2004, Moser *et al.* 2012; Kadir *et al.* 2013). Total precipitation in California will likely decline and critically dry years may increase (Lindley *et al.* 2007; Schneider 2007; Moser *et al.* 2012). Although wildfires are an integral ecological feature in California, they are expected to increase in frequency and magnitude (Westerling *et al.* 2011, Moser *et al.* 2012, Goss *et al.* 2020).

For Northern California, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts. Many of these changes are likely to further degrade salmonid habitat by reducing stream flow during the summer and raising summer water temperatures. For example, in the San Francisco Bay region, warm temperatures generally occur in July and August, but as climate change takes hold, the occurrences of these events will likely begin in June and could continue to occur in September (Cayan *et al.* 2012). Climate simulation models project that the San Francisco region will maintain its Mediterranean climate regime, but will also experience a higher degree of variability of annual precipitation during the next 50 years.

Estuaries may also experience changes detrimental to salmonids. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002, Ruggiero *et al.* 2010). In marine environments, ecosystems and habitats important to juvenile and adult salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Brewer and Barry 2008; Feely *et al.* 2004; Osgood 2008; Turley 2008; Abdul-Aziz *et al.* 2011; Doney *et al.* 2012).

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this project is the area that will be directly and indirectly impacted by the proposed action and will cover the entire Petaluma River watershed in the southern portion of Sonoma County, California. Although, the streams that will be included in rescue/rearing activities are restricted to: Adobe Creek, Lynch Creek, Lichau Creek, Willow Brook Creek, and San Antonio Creek, there is the potential for the entire watershed to be affected if the program successfully expands the density and geographic range of the CCC steelhead population.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The action area in the southern portion of Sonoma County experiences a Mediterranean climate characterized by cool wet winters with typically high runoff, and dry warm summers which can result in greatly reduced instream flows. Annual average temperature ranging from approximately 70 degrees F to 45 degrees F, and annual rainfall averaging from 20 to 50 inches, depending upon location. Most of the precipitation falls as rain from October through April (the wet season) of each year.

High seasonal rainfall on bedrock and other geologic units with relatively low permeability, erodible soils, and steep slopes contribute to the flashy nature of these watersheds. These high natural runoff rates have been increased by road systems, urbanization, and channelization. Streams that previously migrated and deposited their materials across a broad fan or plain surface are now contained in linear channels. As a result, many river systems within the action area contain a relatively large sediment load, typically deposited throughout the lower gradient reaches of these systems.

2.4.1 Status of CCC Steelhead in the Action Area

Limited information exists regarding the historic abundance of steelhead in the Petaluma basin, though the low elevations, gradient, valley confinement and the presence of a large marsh with connection to the San Francisco Bay suggests the population must have been plentiful (NMFS 2016). In a 1962 report, steelhead were described as "lightly using" the Petaluma River (Skinner 1962). CDFW observations indicate that steelhead were historically found in Lichau, Adobe, and San Antonio creeks and possibly in Lynch, Willow Brook, and Thompson creeks. Of these tributaries, Adobe Creek has had the highest reported numbers of steelhead (e.g., a 1968 survey reported an estimated abundance of 150 juvenile steelhead per 30 meters (Leidy et al. 2005)). More current day information suggests available indicate that few tributaries in the watershed currently support steelhead (NMFS 2016). UACG High School has monitored Adobe Creek (and other streams less frequently) in the Petaluma River watershed since the mid-80's. Numbers of spawners observed have ranged from a high of 60 in the mid-90's to a low of zero from 2015-2017 (Figure 2). In 2007, CDFW conducted thorough habitat surveys of major tributaries and confirmed presence of juvenile steelhead in most anadromous reaches. Recent declining trends in abundance also mirror declines in fish abundance elsewhere in the San Francisco Bay Diversity Strata. While survey effort has varied over the years, recently surveys have been more consistent with survey and data protocols following those of CDFW and NMFS. This is the most comprehensive survey effort in the Petaluma system, and indicates that steelhead abundance is far below what was seen 20 years ago.

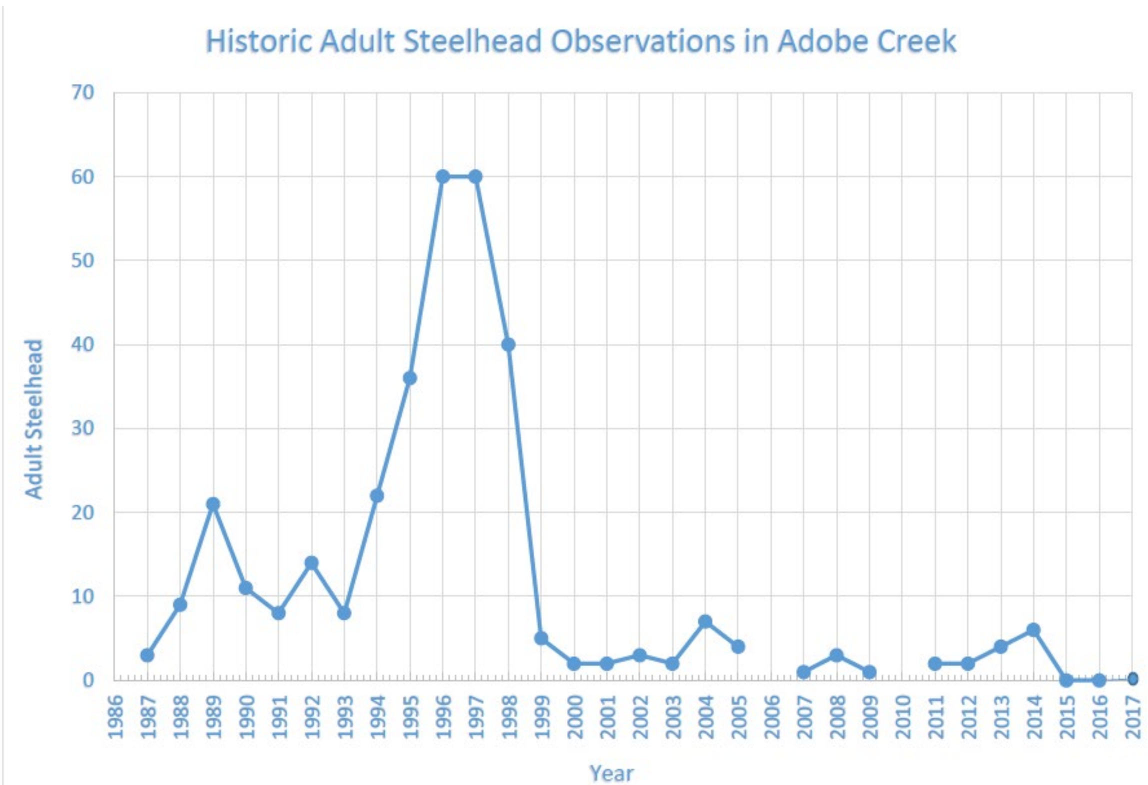

Figure 2. Adult steelhead observations in Adobe Creek from 1987 through 2017.

2.4.2 Status of Critical Habitat in the Action Area

The Petaluma River watershed occupies 146 square miles and the lower river flows through 12 miles of tidal wetlands before emptying into San Pablo Bay. Prior to European settlement in the 1800s, Miwok people lived within the Petaluma River basin for more than 2500 years. Despite its problematic sediment load, the Petaluma River has a long been used as a source of transportation for commercial goods to San Francisco. The mainstem has been straightened, widened, and dredged several times. The problems of siltation and flooding recognized over a century ago still exist today. Since the 1880's the COE has improved and maintained the Petaluma River for navigation. The first dredging project, completed in 1933, provided for a 200-foot wide, 8-foot deep channel across the mudflats in San Pablo Bay to the mouth of the Petaluma River. The channel upstream to Western Avenue in the City of Petaluma, was widened

100 feet and deepened 8 feet. Dredging is a continuing project and under present scheduling, the COE maintains the San Pablo Bay Channel on a 144-month cycle and the Upper River channel on a 48-month cycle. According to COE, an average of 60,000 cubic yards of material is deposited in the river each year (SCWA, 1986).

Historically, farming and chicken ranching boomed within the basin and the town of Petaluma became one of the wealthiest towns in California. By 1915 the area was shipping out an estimated ten million eggs a year, most of them via the Petaluma River. After the chicken industry declined, dairies began to flourish, but the dairy industry also subsequently declined, and by 1997 there were only 15 dairies in the Petaluma watershed, located mostly in the San Antonio Creek and Adobe Creek regions. Although previously considered too cool for grape growing, vineyard development has increased, and vineyards are now competing with the dairy industry throughout the watershed. The watershed has one large urban center, the City of Petaluma, and a smaller commercial and residential development area in the City of Penngrove. There are also open space lands, such as state and local parks as well as almost 5,000 acres in several marsh preserves.

Within the action area, critical habitat for CCC steelhead has been designated in the mainstem Petaluma River, Willow Brook, Lynch, Lichau, Adobe, and San Antonio Creeks. The functioning of critical habitat within the action area has been compromised largely by urban development (commercial, residential and roads), channel modification, and agriculture. Rearing habitat is marginal; primarily due to elevated stream temperatures, fine sediment loading, and the abundance of warm-water predator fish species. Overwinter and outmigration habitat conditions are also poor because many of these urban stream channels lack habitat complexity and velocity refuge and carry a high level of fine sediment (Ritter and Brown 1971, COE 1982, Beach 1996, CDFG 2001). Substrate in much of the action area lacks clean, loosely compacted, gravel in cool water with highly dissolved oxygen and an inter-gravel flow necessary for spawning.

While lower Petaluma River retains wetland habitats out to the Bay on the south side, the channel has been straightened, and the historic sloughs which provided complex winter rearing habitat are diked, or flanked by levees, with significant agricultural development on the north side. Mid-watershed, urban development and agricultural lands encroach upon the historic floodplain. Road building, culverts, and grazing activities have led to severe channel incision in the mainstem and eastern tributaries. Channel incision contributes to the retention of spawning gravels and shelter as they are mobilized during high flow events, and consequently there is high potential for redd scour. The San Antonio Creek subwatershed, on the western side of the Petaluma River, maintains a more natural channel configuration, and, therefore, it is less susceptible to this stress.

Western tributaries, mainly San Antonio Creek, retain some natural channel conditions, yet much of the riparian vegetation has been cleared for grazing and channel incision is severe. The lack of large woody debris and floodplain refugia reduces overwinter survival of juveniles throughout the watershed. Channel modification and incision has separated the active stream channel from its natural floodplain except at extreme flood flows when salmonids can be flushed out to agricultural and grazing lands, where they may become trapped on the declining limb of the hydrograph. Existing infrastructure, such as urban development and roads, limits opportunities for floodplain enhancement on the eastern side of the watershed.

Although there are no major dams in the Petaluma River Watershed, there are numerous adult migration barriers in the form of culverts, bridges and small dams and farm ponds. There is a fish ladder in disrepair on Adobe Creek that is not functioning due to erosion and sediment accumulation and blocks juvenile salmonid passage during low flows. Several potential passage barriers have been identified on Lynch Creek, starting at the mouth and all the way up to the upper crossing at Sonoma Mountain Road. The habitat in San Antonio Creek suffers from intensive cattle usage and would benefit from cattle exclusion fencing and revegetation/erosion control. Fish rescues occur often in these tributaries due to stream drying during the summer months which causes pools to be disconnected and fish to be stranded or exposed to lethal temperatures.

We rely on information from section 2.2.5 with respect to the broader climatic variables influencing the current condition of habitat in the action area. Variables such as air temperature, wind patterns, and precipitation are likely influencing localized environmental conditions, such as water temperature, stream flow, and food availability. These local environmental conditions can affect the biology of listed species and the functioning of critical habitat and its value for conservation. The combination of climate change effects and effects of past and current human activities on local environmental conditions further reduce the current condition of available habitat for listed species in the action area.

Restoration Efforts in the Watershed

The Sonoma County Water Agency (SCWA) currently conducts flood control maintenance activities including sediment management, bank stabilization, and vegetation management on approximately 54,377 linear feet of stream in various reaches within the Petaluma watershed (Figure 3). As part of this program SCWA contributes 10 percent of its annual operating cost to implementing restoration projects. SCWA's Watershed Partnerships Program, a collaborative effort, whereby SCWA provides funds to projects that are implemented with local non-profit agencies, municipalities, restoration organizations, creek groups, schools, and Resource Conservation Districts. Since implementing the SMP, the degree of canopy cover over the engineered flood control channels has increased significantly. Between 2009-2010, SCWA conducted restoration projects resulting in a total of 99,044 linear feet of channel plantings, including 7,016 trees and 2,609 shrubs. Since 2009 SCWA has implemented forty habitat restoration, erosion control, and water quality improvement projects, restoring approximately 68 acres of habitat. At the onset of the program, most of the engineered channels supported less than 25% canopy cover. As of 2013, a majority of engineered channels supported 51-75% canopy cover. Canopy cover is expected to continue increasing under program operations and as newly planted trees mature. Although these totals include stream reaches in adjacent watersheds, the majority of SCWAs actions occur in the Petaluma River basin.

From 2019 through 2022, the Sonoma Resource Conservation District led a Petaluma River Watershed Consortium effort which formed a collaborative group of stakeholders to revise and finalize the Petaluma Watershed Enhancement Plan and develop and action plan to prioritize critical projects for watershed sustainability. NMFS has actively engaged in this effort and continued collaboration is expected.

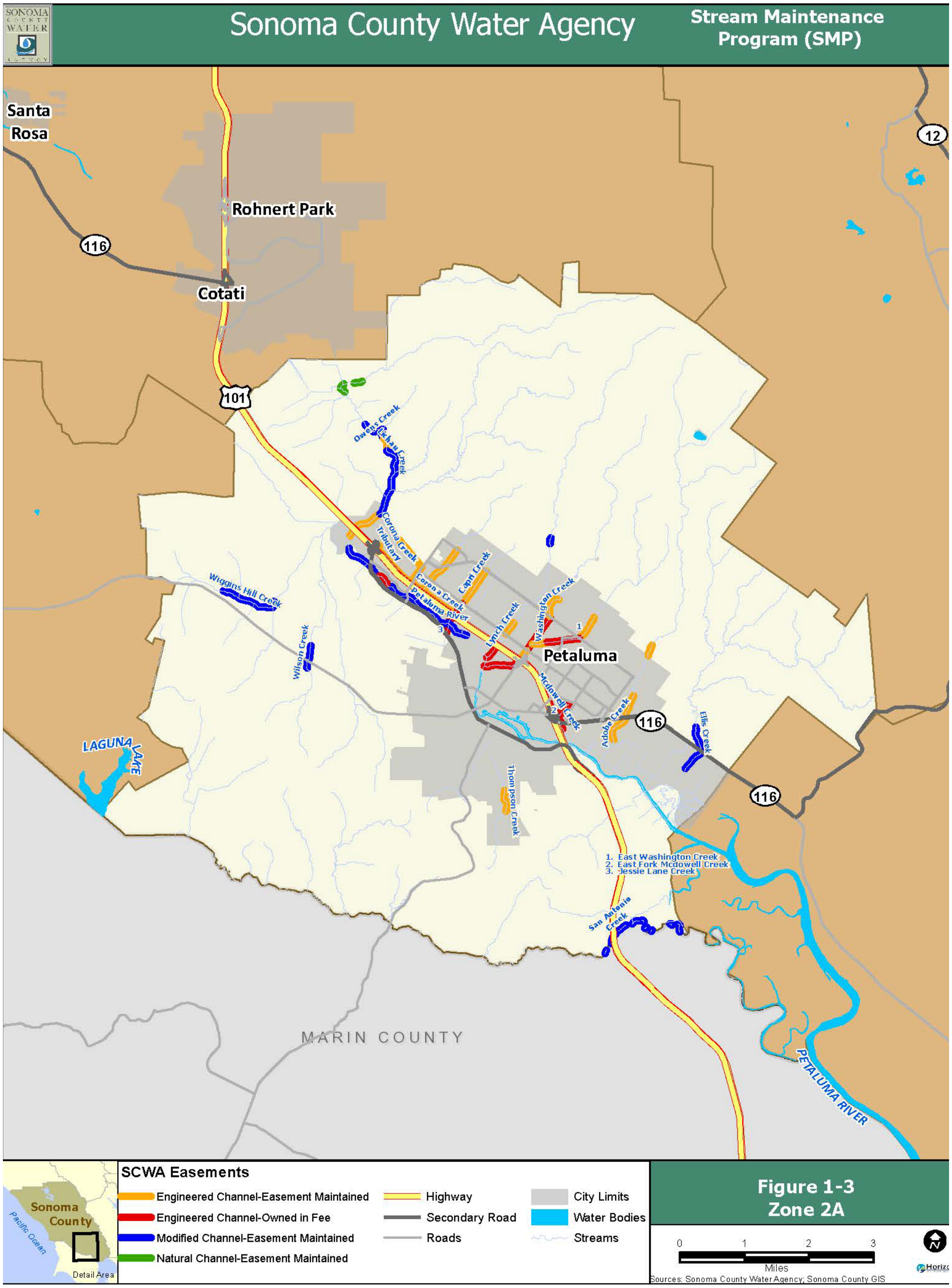

Figure 3. Stream reaches in the Petaluma River watershed maintained by the Sonoma County Water Agency as part of their Stream Maintenance Plan.

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

Each year, the UACG may rescue and release up to 7,815 juvenile steelhead, and rear and release up to 5, 945 juvenile steelhead. . However, until adult returns to the basin increase and the program gains access to more private lands for conducting activities, the number of juveniles rescued and or reared will likely be only a small percentage of these values. NMFS identified the following effects to CCC steelhead in the Petaluma River population that may result due to implementation of the RRMP. Performance indicators and metrics addressing benefits or risks of the RRMP, and associated monitoring and evaluation methods are further detailed in Table 3.

- Capture and Transport - effects on fish either rescued or collected for rearing and transported either the UACG Hatchery or translocated to perennial habitat.
- Survival Rates - effect on steelhead interactions and survival due to 1) facility design and operation, and 2) rescue and release.
- Genetic and Life History Variation - the effect of rearing in the facility on wild steelhead fitness.
- Translocation - potentially exceeding the river's carrying capacity and spreading of disease.
- Increase adult CCC steelhead abundance in the Petaluma River to levels greater than the High-Risk adult abundance depensation threshold level.

2.5.1. Capture and Transport

Fish captured as part of the RRMP will be defined as belonging to one of four groups:

Group 1 - Collected as fry and reared at the hatchery (Hatchery Program),
Group 2 - Collected as fry and released back to the stream at the point of capture (Natural Rearing - Fry),
Group 3 - Rescued, transported, and released to better habitat (Rescue Program),
Group 4 - Rescued and released at collection location (Natural Rearing - Juveniles).

Fish relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes et al. 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. In addition, rescued steelhead experience higher stress levels from increased stream temperatures and lower flows typically present during the rescue season (Grantham et al. 2012). Capture and transport may cause additional stress on fish rescued from poor habitat conditions. Stress can have a multitude of effects on fish, including immune system suppression, reduced growth rates, and behavioral changes. Electroshocking, seining, handling, chasing, and transport are forms of acute stress in fish. Acute stress causes increased metabolic rates and higher cortisol levels in the blood (Barton and Schreck 1987; Vanderkooi et al. 2001). Energy is directed away from somatic growth and immune system response and towards stress coping (Vanderkooi et al. 2001). Cortisol levels typically return to pre-stress levels within 24 hours following a single exposure to a stressor (Vanderkooi et al. 2001); however, exposure to regular stressors results in a cumulative stress response (Barton et al. 1986). The stress caused by electroshocking fish has the potential to reduce growth rates in steelhead for up to 35 days following exposure (Gatz et al. 1986; Dwyer and White 1995).

Stress inflicted on steelhead during rescue operations is unavoidable, yet if they were not rescued, their fate would be death from desiccation or predation. Thus, the net effect is ultimately a better chance of survival than would be expected if the steelhead remained in the drying streams. Measures can be taken to minimize the magnitude and duration of stress exposure such that chronic immune suppression and reduced growth rates do not occur. Steelhead handling will be limited to the minimum necessary to capture and transport them to and from the rearing facility or better-suited, wetted habitat. The amount of unintentional injury and mortality attributable to fish capture varies widely, depending on the method used, the ambient conditions, and the expertise and experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following NMFS electrofishing guidelines (NMFS 2000) and other standards for seining and relocating salmonids, direct effects to, and mortality of juvenile salmonids during capture and relocation will be minimized.

Notwithstanding the stressful conditions present during rescues, NMFS anticipates the number of fish injured or killed during rescue and relocations will be 5 percent or less. Using a 5 percent mortality rate and a likely annual maximum of 6,200 juvenile (fry, and fingerling) and 1,615 1+smolt steelhead rescued and relocated in 1 year (combined 7,815 fish), the maximum amount of steelhead likely to be killed or injured in any given year over the next 5 years would be 310 juvenile and 82, 1+smolt steelhead (see Appendix A).

The number of juveniles needed for the Hatchery program assumes a juvenile collection and transport mortality of 5 percent. A maximum of 11,890 fry may be collected as part of the hatchery rearing. 50 percent may be taken to the hatchery for rearing (Group 1) to yearling age, and the other 50 percent returned to the stream (Group 2). The maximum number of fry that can be reared at the hatchery will not exceed 5,945 fish. Using a 5 percent mortality rate, we expect 297 steelhead fry are likely to be killed or injured in any given year over the next 5 years as part of collecting and transporting fry needed for the rearing component of the RR MP.

Rescued fish whether released in the vicinity of capture (Groups 2 and 4) or to more suitable habitat (Group 3) will be transported via buckets and coolers with aeration, and remain in their stream of origin (unless no suitable conditions exist within that stream they will be released to other streams within the Petaluma basin with suitable habitat). The numbers of fish rescued annually will vary based on effort, local climatic conditions, flows and storms, landowner access, and numbers of juveniles produced from natural spawners. Numbers of fish rescued will be reported annually. Hatchery reared juvenile steelhead (Group 1) will be transported in trucks to/from the hatchery and re-released back to their stream of origin as yearlings. Water temperatures for the release location and transport tank will be measured prior to release. If water temperature in the two vessels differ by more than 2 degrees Celsius, water from the stream/hatchery will be added to the transport vessel until temperatures of both water sources match. The maximum numbers of fish which can be rescued, reared and released are summarized below by group. These numbers are dependent on space availability at the Hatchery. The TAC will stay informed and make decisions on capacity and prioritize movement of fish in and out of the facility:

Group 1 - (Hatchery Program) 5,945 fish,
Group 2 - (Natural Rearing - Fry) 5,945 fish,
Group 3 - (Rescue Program) and Group 4 - (Natural Rearing - Juveniles) TBD annually, up to 7,815 juvenile fish,
Emergency Rearing – Up to 90,000 eggs and 4,000 yearlings,
Education Program – Up to 20,000 eggs.

Eggs and fish from received from other hatcheries for emergency rearing, will be transferred from these facilities to the UACG Hatchery where they will be incubated and/or reared until conditions at the source hatcheries once again become suitable. At that time, the fish will be transported back to these facilities for eventual release to previously identified streams. The total number of fish reared will be dependent on fish size, length of time required before fish are sent back to the source hatchery and water temperature, flow and density culture criteria requirements. The number of eggs incubated will be dependent on the density limitations of the Heath trays and jars.

2.5.2. Survival Rate

Performance Indicators and Metrics addressing benefits or risks of the RRMP, and associated monitoring and evaluation methods are detailed in Table 3. Hatchery staff will determine the survival rate for all life stages cultured by enumerating and tracking the number of live and dead fish under culture each day. Survival rates will be determined by dividing the number of dead fish by total fish being reared by life stage. The number of fish alive each day will be used to set fish feeding rate.

Table 3. Performance Indicators and Metrics addressing benefits or risks of the RRMP, and associated monitoring and evaluation methods.

Indicator	Metric/Action	Benefits, Risks and Associated Monitoring and Evaluation
Survival Rate of Collected (Rescued) Fish	>95 percent for collection and transport to the hatchery >98 percent for fish collected and released back to the stream	Benefit: Collection and transport techniques that maximize life-stage survival make the most efficient use of the resource and provide the greatest conservation benefit. Risk: Low collection and transport survival rates indicate that methods need improvement. To provide a conservation benefit total survival from collection, through hatchery rearing and release must be higher than the survival rate for fish that remained in the stream Monitoring and Evaluation: Collection and transport survival rates will be calculated for all fish rescued in each stream.

Indicator	Metric/Action	Benefits, Risks and Associated Monitoring and Evaluation
In-Hatchery Life Stage Survival Rates	>95 percent for all life stages cultured	Benefit: Hatchery culture practices that maximize life-stage survival make the most efficient use of the resource and provide the greatest conservation benefit. Risk: Low egg-to-fry, fry- to-parr, and parr-to-smolt survival rates would indicate poor hatchery culture practices or physical and environmental constraints. To provide a conservation benefit in-hatchery survival rates must be higher than what would occur in nature. Monitoring and Evaluation: In-hatchery survival rates by life stage will be monitored at the hatchery. Field surveys of natal streams where fish were rescued will be undertaken during the lowest flow conditions to document the presence/absence of remaining juveniles.
Number and Severity of Disease Outbreaks is Low	Follow Best Culture Practices	Benefit: Fewer and less severe disease outbreaks reduce the risks that hatchery populations and operations pose to natural populations. This results in better natural population productivity, diversity, and spatial structure which are crucial to natural populations located close to the hatchery. Minimizing disease loss also allows for accurate evaluation of number of contributing parents and family size variation, which are important components of effective population size estimates. Risk: Frequent and severe disease outbreaks reduce population productivity and require higher numbers of natural and hatchery origin broodstock to produce a similar number of fish. The use of more natural origin fish in the hatchery reduces natural spawning escapement, which may reduce population productivity, spatial structure, and diversity. Monitoring and Evaluation: Continue to monitor the health of hatchery-produced fish and treat, as necessary. The CDFW pathologist will certify fish as healthy before release back to the stream.

Indicator	Metric/Action	Benefits, Risks and Associated Monitoring and Evaluation
Release Timing, Fish Health, Size and Condition of Released Fish Produce High Survival	Size of Hatchery Yearlings Similar to Naturally Produced Fish	Benefit: Releasing healthy fish at a size that mimics naturally produced fish is theorized to increase survival and reduce competition with naturally produced fish. Risk: Releasing fish that are too large may result in increased predation on competition with natural fish. A mismatch between release timing and environmental conditions required for good survival may reduce overall hatchery performance. This could also result in precociousness, i.e., fish that never go to the ocean, but become sexually mature. Monitoring and Evaluation: Monitoring size and condition of fish released from the hatchery. This data will be compared to the expected condition of naturally produced Steelhead in each stream where fish are released.
Acute Survival Rate of Released Fish (Rescued) Fish	>98 percent	Benefit: Release techniques that maximize life-stage survival make the most efficient use of the resource and provide the greatest conservation benefit to the species. Risk: Low release survival rates indicate that methods need improvement. To provide a conservation benefit total survival from collection, through hatchery rearing and release must be higher than the survival rate for fish that remained in the stream Monitoring and Evaluation: Acute (1-hour) survival rates will be calculated for all fish released to the stream. Stream flow and temperature will be collected at each release site. Stream temperature loggers will be used to monitor temperatures throughout the year to confirm habitat quality.
High Reproductive Success of Hatchery Reared and Rescued Juveniles	Reproductive Success of Reared and Rescued Juveniles Greater than or Equal to Naturally Produced Juveniles	Benefit: Fish released from rescue and rearing efforts with higher or equal reproductive success to naturally reared populations is an indicator that the program is producing fish that contribute demographically to the population over time; resulting in increased population abundance. Risk: Exhibiting lower reproductive success than naturally reared fish indicates that program activities are ineffective and likely decreasing population abundance. Monitoring and Evaluation: Using genetic analyses estimate the reproductive success of four groups of steelhead: Group 1- Collected as fry and reared at the hatchery (Hatchery Program). Group 2 - Collected as fry and released back to the stream at the point of capture (Natural Rearing - Fry). Group 3 – Rescued, transported, and released to better habitat (Rescue Program). Group 4 - Rescued and released at collection location (Natural Rearing - Juveniles).

Crowding has been found to lead to chronically suppressed lymphocytes circulating in the bloodstream of rainbow trout (Pickering and Pottinger 1987), meaning their immune system response is chronically suppressed, and they can become less disease resistant. Furthermore, social hierarchies established between fish of different size or age classes may lead to subordinate fish to undergo more severe stress responses (Sloman et al. 2001). The impacts of stress on mortality due to disease may vary depending on the type of infection; however, infections may progress more rapidly in fish subjected to stress (Angelidis et al. 1987; Vanderkooi et al. 2001). Stress-related immune deficiencies are a major contributing factor of survival in the facility since steelhead come into the facility with a relatively high baseline stress level from the harsh conditions they were exposed to in the streams prior to relocation. The maximum number of fry that can be reared at the hatchery for one year, then released as smolts will not exceed 5,945 fish. Assuming a 5 percent rearing mortality at the UACG Hatchery, we expect 297 steelhead will be killed or harmed during the rearing process each year. An additional 60 steelhead may be sacrificed for disease testing. (direct mortality will be covered in the 10(a)(1)(A) permit).

Goals and objectives of the emergency rearing component of the RRMP will vary dependent on the needs of the programs transferring fish into the facility. The facility can incubate 100,000 eggs and rear up to 20,000 yearling smolts (dependent on fish weight at release requirements). The Educational Program can rear up to 20,000 Dry Creek steelhead smolts from for eventual transportation back to the Warm Springs Hatchery. The RRMP yearling rearing target is ~6,000 fish, which is 30 percent of rearing capacity of the facility (20,000 yearling smolts), thus up to ~ 4,000 yearlings can be emergency reared. The number of age 2+ to 3+ captive brood the program may rear is also dependent on the weight of the fish being transferred in and target fish size at return to the source hatchery. The number of adult (2+ and 3+) captive brood salmon transferred from other facilities as part of emergency actions is not expected to exceed 4,000 fish.

The actual number of fish incubated/reared under the emergency program will be limited by the number of educational and rescue rearing program fish within the facility at the time, as well as water temperature, density, and flow criteria used by the hatchery for the culture of salmonids by life stage. The program will strive to achieve in-hatchery survival rates of > 90 percent for all life stages reared. Raceway/tank density and loading criteria will not exceed those as described in USFWS 2002. Fish from each stream (or hatchery) will be reared in separate raceways or raceways split so that fish can be tracked by stream (or hatchery). This action will allow hatchery staff to return fish to the streams/hatcheries where they were collected as juveniles. Fish feeding protocols for the emergency rearing will follows those developed by the source hatcheries. Guidelines on feeding rate, schedule and food type for the hatchery rearing program will be developed in coordination with the fish hatchery manager at Warm Springs hatchery on the Russian River. This information will be reviewed and approved by the TAC.

A CDFW pathologist is contacted when daily mortality rate of reared fish exceeds 1 percent or staff observe fish exhibiting visual signs of disease or behavior indicative of disease. Fish mortalities in the incubation systems, raceways and troughs will be enumerated each day. Each dead fish will be examined for lesions, signs of infection and parasites. If any of these symptoms are present in the fish the CDFW pathologist is contacted for possible treatment options or sent samples for evaluation. The hatchery manager will be responsible for implementing all treatments recommended by the pathologist.

All facility rearing facilities are monitored daily/hourly for oxygen level, water temperature and depth. The facility is equipped with flow alarms that alert staff to low water levels in raceways or stoppage of water flow into raceways. The raceways are safeguarded by a low flow stop point that prevents raceway depth from dropping below a depth of 0.5m. Program staff include a hatchery manager and multiple level 1 and 2 technicians. In general, technicians take classes in fisheries terminology, salmonid life history, water quality, spawning, incubation, rearing, fish feeding, disease identification and treatment, hatchery operations (mechanical, electrical, biological), capture and release techniques and record keeping.

2.5.3. Genetics and Life History Variation

Life history expression of steelhead is influenced by both genetic makeup and environmental conditions (Doctor et al. 2014; Berejikian et al. 2016). There is an abundance of evidence suggesting hatchery-reared salmonids have deleterious effects on genetic variation and heritability of wild populations (Lynch and O'Hely 2001; Araki et al. 2007; Satterthwaite and Carlson 2015). This is especially true when hatchery broodstock represent a relatively small proportion of natural genetic variation (Berejikian and Ford 2004; Araki et al. 2007). Van Doornik et al. (2010) has shown that supplementation programs that incorporate sufficient genetic diversity do not cause substantial changes to genetic diversity or effective population size. Captivity-reared populations representing the genetic diversity of the population thus avoid the issues typically associated with inbreeding, such as loss of genetic and life history variation. This is the case for steelhead reared in the UACG Hatchery, which are the progeny of wild steelhead rather than of hatchery broodstock, meaning their genetic variation mimics that of the wild population (wild-reared).

Environmental conditions can also act on growth-mediated life history traits that may influence life history expression (Doctor et al. 2014; Berejikian et al. 2016). For example, incubation and rearing in artificial conditions exerts selective pressures on growth rates, body size, competition, and predator avoidance (Berejikian and Ford 2004; Fritts et al. 2007; Berejikian et al. 2016). In particular, the temperature and feeding regimens steelhead experience during captive-rearing directly impact their growth rate and thus their size at smolting. Similarly, competition and stress resulting from hatchery conditions may indirectly influence growth rate and fish size. The variation in growth rates from captive rearing conditions could have a direct consequence on a population since the age and size of steelhead at smolting is correlated with marine survival, with larger smolts having a higher rate of survival (Doctor et al. 2014, Bond et al 2008). Christie et al. (2011) states that minimizing time in captivity is a way to reduce the impact of the culture environment on hatchery-reared fish. We believe the relatively short time periods that steelhead are kept in the UACH Hatchery will limit the impact of captive-rearing conditions on phenotype and behavior.

Genetic samples (tissues) will be collected from all juvenile steelhead captured in each stream each year. The effectiveness of both the rescue and rearing programs to increase steelhead abundance will be determined by using PBT genetic analysis to estimate the contribution of program fish to natural steelhead production each year (Hess et al. 2009, Anderson and Garza 2006).

No more than 2,400 juveniles will be released into any of the target streams in any given year. These juveniles are to be collected in a such a manner that they represent the spatial structure and diversity of the population of each stream. When they return as adults, they will be able to mate naturally, thereby allowing for natural selection to occur. Releasing fish to the streams they were collected is expected to ensure high adult homing fidelity. However, because each stream is a component of the Petaluma River population some straying of hatchery fish is expected and is not considered to be a major risk.

Rescue operations will continue if the results of genetic testing show that rescued fish contribute to the next generation of steelhead at rates greater than fish left to rear naturally in the portions of the stream where rescue operations occurred. Hatchery rearing operations will continue if genetic testing shows that cultured fish contribute to the next generation of steelhead at rates equal to or greater than naturally produced fry. In short, the two activities must be shown to provide a demographic boost to the population, if not they will be terminated, or protocols adjusted as defined by the TAC.

The ecological and genetic risk the emergency rearing fish pose to natural salmon populations are to be described in their respective HGMPs.

2.5.4. Density and Disease at Release Locations

Releasing rescued fish in portions of the stream that already support steelhead will increase fish density in these areas. This in turn may result in an increase in density dependence effects which could reduce overall fish survival. Due to a lack of data on juvenile fish abundance and distribution in the target streams, it is not possible to quantify the predation and competition effects hatchery fish pose to natural production. As this type of information is gathered a PCD-Risk analysis will be performed to estimate these effects (Busack et al. 2005). The results of this analysis will be reviewed by the TAC to determine if program protocols should be altered.

For this analysis, NMFS assumes that the carrying capacity in the perennial reaches of the Petaluma River watershed will not be exceeded by steelhead translocations. We are basing this assumption on the following: 1) NMFS expects rearing habitat space will be available nearby for juvenile fish in perennial reaches should they experience crowding from the addition of translocated fish; and 2) fish will be reared to a similar size (180mm) as natural origin fish so that they do not have a size advantage that may result in higher survival rates than natural fish after release.

Hatchery-reared, natural-origin fish released to the target streams may pose predation, competition and disease risks to natural origin steelhead present in these streams. However, data on adult fish returning to the basin indicate that abundance is so low that without hatchery intervention is it likely the populations in these streams will go extinct. Thus, the risks hatchery fish pose to natural-origin fish are small in contrast to the demographic boost to the population anticipated from the hatchery program. Disease risk to natural steelhead populations from the release of hatchery fish will be controlled by only releasing fish deemed healthy by a certified fish pathologist.

The rearing component of the program will reduce steelhead fry densities in streams where they are collected. This action may decrease density dependence effects for fish remaining in the stream and may result in an increase in natural-origin fish survival and possibly an increase in fish size and condition factor. The expected increase in adult steelhead production from rearing will result in benefits to both steelhead and other aquatic and terrestrial species. Steelhead eggs and carcasses will provide food for multiple species inhabiting the Petaluma River system. If rescued fish survive at higher rates than non-rescued fish the resulting adult production will increase steelhead abundance in the watershed and increase the food supply for other species dependent on this resource.

Predation and competition risks to natural steelhead populations is minimized by releasing program fish in the spring when steelhead fry have either yet emerged from the gravel or are of a size where they utilize shallow water habitat not accessible by the larger hatchery fish. Releasing fish as smolts will help ensure that hatchery fish migrate quickly out of the systems, reducing interaction time with naturally produced fish. If field crews observe large numbers of steelhead residualizing in the streams, smolts may be released lower in the system.

The maximum number of hatchery fish released is such that the number per kilometer of stream is low, at less than 114 fish. The lower the fish density, the less likely that negative effects to natural populations will occur. If field observations indicate that hatchery fish reside in the system for more than 1-week, hatchery releases may be staggered, or fish released near stream mouths, to reduce fish density even further. Each stream where fish are released will be sampled in the low flow season as part of rescue operations. Any hatchery reared steelhead present (as indicated by physical or internal mark) will be enumerated and transported to the mainstem Petaluma River to reduce interactions with natural populations. Results from this sampling effort will be used to adjust rearing and release protocols to better meet performance metrics.

2.5.5. Increased Abundance

The goal of the RRMP is to increase adult CCC steelhead abundance in the Petaluma River to levels greater than the High-Risk adult abundance depensation threshold level (64 adults) as identified by NMFS in the recovery plan for this population (NMFS 2016). The adult depensation abundance value for each stream is based on the kilometers of intrinsic potential (IP km) present in each stream (Figure 1) - with each IP km equaling one adult steelhead. Thus, the adult depensation abundance goal for the five target streams are as follows:

Adobe Creek	9 adults
Lynch Creek	6 adults
Lichau Creek	9 adults
Willow Brook Creek	7 adults
San Antonio Creek	21 adults
Total	52 adults

The remaining 12 adults needed to achieve the High-Risk adult abundance depensation value will come from natural steelhead production in the five target streams plus Ellis Creek, Petaluma River, and miscellaneous small tributaries.

For initial planning it has been assumed that the average smolt-to-adult survival rate (SAR) for hatchery reared steelhead will be approximately one percent.[11] The assumed SAR for rescue and released fry, fingerling, and 1+ rescued smolts is 0.5 percent and 2 percent, respectively. Although speculative, these survival rates are used to set the maximum number of juveniles that may be rescued or reared by the program (Table 1). Regardless of fish survival rates measured over time the numbers in Table 1 will not be exceeded.

A total of 114 adult steelhead will be produced if the juvenile numbers shown in Table 1 are achieved. However, because of substantial uncertainty associated with SAR, total juvenile production in each stream, and the size (life stage) of the fish rescued each year[12], adult steelhead production could be substantially lower or higher than 114 fish. To account for this outcome, program assumptions will be reviewed every five years (~ 1-generation) and program rescue and rearing numbers adjusted accordingly.

The rearing component of the program may continue for up to 10 years if shown to provide benefits to Petaluma River steelhead. Program progress will be checked every year by the TAC, and at the 5-year and 10-year mark to confirm program benefits. At these times, the results of monitoring and evaluation (M&E) activities conducted to evaluate program performance will be formally reviewed by the TAC and a decision made as to whether to continue rescue and/or rearing activities.

Fish from Groups 1 (Hatchery Program) and Group 3 (Rescue Program) are expected to have higher survival rates and, therefore, produce more adults than Group 2 (Natural Rearing - Fry) and Group 4 (Natural Rearing - Juveniles). In subsequent sample years, natural juvenile production is expected to come more from program produced adults than from fish returned to the streams to rear naturally.

For the hatchery program to be considered successful, Group 1 (Hatchery Program) steelhead production is ≥ Group 2 (Natural Rearing - Fry) steelhead production. For the rescue program to be considered successful, Group 3 (Rescue Program) steelhead production is > Group 4 (Natural Rearing – Juveniles) steelhead production. The success of the emergency incubation/rearing component will be based on the survival rate of the reared fish and eggs. The fish survival rate from transfer into, rearing, and transport out of the UACG Hatchery is expected to be greater than 90 percent. Egg survival rates during incubation are expected to achieve levels identified in the HGMP for each program transferring eggs to the hatchery.

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[11] Russian River hatchery fish have an SAR of approximately 2 percent It is assumed that fish reared for this program will have half that survival to account for possible losses due to transport and release back to the streams and poorer habitat conditions present in the Petaluma River watershed.

[12] Larger fish are expected to have higher survival than smaller fish. For this analysis it is assumed that fry are <60mm in length, fingerlings 61-149 mm and 1+ smolts 149+ mm.

2.5.6. Effects to Critical Habitat

As described above, NMFS anticipates only a temporary reduction in rearing habitat quality (reduction in habitat space from crowding) in perennial reaches from the addition of translocated fish. This impact will be minor and cease once fish disperse to less crowded habitat. Based on our analysis, NMFS finds that it is improbable that the operations outlined in the RRMP will have more than minor and temporary effects to critical habitat.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation [50 CFR 402.02 and 402.17(a)]. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Actions occurring outside of the action area may affect the action area. For example, a new water diversion upstream may affect flows in the action area. Therefore, future actions occurring in the watershed may be considered cumulative effects, depending upon their specific location and impact. Future Federal actions, including the ongoing operation of dams, hatcheries, fisheries, water withdrawals, and land management activities will be reviewed through separate ESA section 7 consultation processes and are not considered here.

Additional development, tourism, and accompanying infrastructure construction is expected to occur in the affected watersheds based on the general and specific plans of local communities and Sonoma County. Additional development is likely to lead to increasing water demands, which may impact stream flows if current allocations are not being fully utilized. Agricultural activities surrounding the action area are primarily the cultivation of crops, mainly viticulture as well as dairy farms. The impacts of this land use on aquatic species include decreased bank stability, loss of shade and cover-producing riparian vegetation, increased sediment inputs, decreased ground and surface water supply, and elevated coliform bacteria levels. Agricultural development and management will continue to impact salmonid habitat by increasing sediment delivery to streams, diverting and decreasing stream flow, and encroaching on riparian habitat.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4).

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

Although steelhead are present in most streams in the CCC DPS, their populations are significantly less than historical estimates, fragmented, unstable, and more vulnerable to stochastic events (Williams 2016). Steelhead in this DPS have declined in large part as a result of anthropogenic influences associated with agriculture, mining, and urbanization activities that have resulted in the loss, degradation, simplification, and fragmentation of habitat (NMFS 2016), and to some degree disease and predation. However, the greatest threats to the CCC steelhead DPS populations are the degradation of habitats, impassable dams, surface water withdrawals, and groundwater extractions (NMFS 2016). Natural environmental variation (floods and droughts) have also periodically reduced spawning, rearing, and migration habitats. In recent history, the DPS experienced one of the worst California droughts on record (2012 to 2016). Unfortunately, the threats from projected climate change are likely to exacerbate the effects of environmental variability on steelhead and their habitat in the future. Thus, increased environmental variability resulting from projected climate change is now recognized as a new and more serious factor that may threaten the recovery of the CCC steelhead DPS (Williams et al. 2011, Williams et al 2016).

As an independent population, federally threatened CCC steelhead within the Petaluma River watershed, are important to the recovery of the DPS. The steelhead populations that use the action area, while substantially reduced from historical numbers, appear to be relatively stable. These populations are likely to persist with enough resiliency to rebound from limited impacts for the foreseeable future. However, due to their low numbers, the continuation of impacts from current baseline conditions to the population's numbers, distribution, or reproduction could limit their chance of survival and recovery. The recovery of these populations will, therefore, depend upon programs that protect and restore aquatic habitats in watersheds and the continued reduction of impacts from land use and water withdrawal.

Priority recovery actions in this watershed include: improving riparian and canopy, reducing the input of sand and silt, improving stream flows in tributaries, removing passage barriers, addressing water pollution problems, and <u>increasing population numbers through supplementation efforts</u> following significant habitat restoration to address the above issues. According to the Recovery Plan (NMFS 2016), the Petaluma watershed can play a significant role in increasing adult abundance in the Interior Bay Diversity Stratum because of its relatively high potential for habitat restoration and the presence of a functional fish hatchery in the watershed. San Antonio, Ellis, Adobe, Lynch, Lichau, and Willow Brook creeks are high priority areas for implementing the following recovery action:

> ***Increase Abundance and Prevent Extirpation***
> *Consider and evaluate the role of a conservation hatchery or hatchery stocking within the Petaluma River basin, as part of a program for the larger Interior San Francisco Bay diversity stratum. Such a program would preserve the remaining genetic and phenotypic characteristics that promote life history variability through a captive broodstock,*

supplementation, or rescue rearing program, and reduce the short-term or immediate risk of extinction. Evaluate the feasibility of using the existing UACG Hatchery for such a program.

The RRMP as proposed is likely to improve the VSP parameters within the CCC steelhead DPS over the next 5 years. Although the program will have some short-term adverse effects to CCC steelhead during capture, collection, transport and rearing, these adverse effects will not be sufficient to reduce the survival and recovery of these species. The goal of the RRMP is to increase CCC steelhead abundance in the Petaluma River watershed and if successful will provide a demographic boost and benefit recovery of the species.

The effects of the proposed action, when added to the environmental baseline, cumulative effects, and species status, are not expected to appreciably reduce the quality and function of critical habitat. The translocation of rescued and reared fish will have a minor and temporary impact on critical habitat (from crowding) in the perennial reaches that receive translocated fish, until fish in those reaches disperse to available habitat. While the environmental baseline remains in degraded condition due to urban development, historical agricultural practices (channelization, etc.) and other impacts, SCWA has taken steps described above in the environmental baseline to restore channel functions and reduce impacts on aquatic habitat that is already providing improved habitat conditions. These restorative actions are expected to continue during the period of the proposed action, and habitat quality is expected to continue to improve in many portions of the action area.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of CCC steelhead or destroy or adversely modify its designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that annual incidental take is reasonably certain to occur as follows for CCC steelhead, all of natural origin. The incidental take will occur when steelhead incidentally die from rescue, rearing, and release operations.[13] See Appendix A for specific take numbers expected from each stream. Rescue of steelhead and steelhead that are sacrificed for disease testing, is direct take covered under the Section 10(a)(1)(A) permit.

Annually over the next five years:

- During rescue and translocation operations 310 juvenile (fry and fingerling) steelhead may be killed;
- During rescue and translocation operations 82 smolts may be killed; and
- During rearing and release operations 595 fry juvenile (fry, fingerling, and 1+smolts) may be killed.

2.9.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. Abide by all terms in the Section 10(a)(1)(A) to minimize impacts of the RRMP on CCC steelhead.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, UACG must comply with the following terms and conditions. UACG has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the terms and condition, protective coverage for the proposed action would likely lapse.

1. NMFS CCO shall monitor compliance with the Section 10(a)(1)(A) permit.
2. If UACG exceeds the take limits, NMFS will work with UACG to develop new minimization measures.
3. UACG shall provide a comprehensive annual report to NMFS each year through NMFS' Authorizations and Permits for Protected Species (APPS) site NMFS' APPS Website. The annual report for Permit 24025 should will? describe the permitted

[13] Take occurring during emergency incubation or rearing will be covered, and attributed to the host HGMP and Take permit.

rescue and rearing activities, and the actual take of ESA-listed salmonids that occurred during the year.

4. The program will prepare and submit to NMFS an annual report by U.S. mail or e-mail that documents all rescue activities completed during the calendar year by January 31 of the following year. Report will include the following:

   - Fish rescue objective(s),
   - Criteria for decision,
   - Rescue locations, dates, and times,
   - Methods used for the rescue operation,
   - Actual number of fish rescued by species and life stage,
   - Incidental mortalities by species and life stage,
   - Disposition of rescued fish.

5. The program will complete the CNDDB Online Field Survey Form providing information for each rescue site at which the Permittee conducts fish rescues:
   https://www.wildlife.ca.gov/Data/CNDDB/Submitting-Data
6. All reports, as well as all other notifications required in the permit, shall be submitted electronically or by hard copy to the NMFS North Coast Brach Chief:

   Bob Coey (707) 575-6090, bob.coey@noaa.gov
   National Marine Fisheries Service
   777 Sonoma Avenue, Room 325
   Santa Rosa, California 95404.

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, "conservation recommendations" are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. UACG should explore different rearing options at the facility that would modernize their operations, including the additional round tanks and use of circular flow in round tanks for rearing rescued steelhead until release. Modernizing the facility would likely improve survival rates.

2.11 Reinitiation of Consultation

This concludes formal consultation for Rescue and Rearing Management Plan for Petaluma River Steelhead.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

3. Data Quality Act Documentation and Pre-Dissemination Review

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

3.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is UACG. Other interested users could include citizens of affected areas, and others interested in the conservation of the affected DPS. Individual copies of this opinion were provided to UACG. The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

3.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

3.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR part 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion [*and EFH consultation, if applicable*] contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA [*and MSA implementation, if applicable*], and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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5. APPENDICES

Appendix A - Take Table

Incidental take in the form of mortality of CCC steelhead (natural origin, winter run) anticipated each year within the Petaluma River watershed as part of RRMP implementation. NOTE: Collection of steelhead and steelhead that are sacrificed for disease testing, is direct take authorized under the Section 10(a)(1)(A) permit.

Lifestage	Location	Collected for Rescue and Release (no rearing)	Mortality	Collected for Rear and Release[1]	Reared at the UACG Facility	Mortality[2]
Fry-Fingerling-parr	Adobe Creek	1,800	90	2100	1,050	105
	Lynch Creek	1,200	60	1400	700	70
	Lichau Creek	1,800	90	2100	1,050	105
	Willow Brook Creek	1,400	70	1640	820	82
	San Antonio	0	0	4,650	2,325	233
	UACG Hatchery Intentional mortality for disease testing	NA	NA	NA	NA	60
	Total	**6,200**	**310**	**11,890**	**5,945**	**655**
1+ Smolts	Adobe Creek	450	23			
	Lynch Creek	315	16			
	Lichau Creek	475	24			
	Willow Brook Creek	375	19			
	Total	**1,615**	**82**			

[1] A maximum of 11,890 fry fry will be collected for hatchery rearing component of the RRMP. Of the fish collected, 50 percent may be taken to the hatchery for rearing and the other 50 percent returned to the stream. The maximum number of fry that can be reared at the hatchery will not exceed 5,945 fish.

[2] The number of juveniles needed for the rearing program assumes a juvenile collection and transport mortality of <5 percent, rearing mortality of <5 percent.

NOAA FISHERIES
NATIONAL MARINE FISHERIES SERVICE

Authorizations and Permits for Protected Species (APPS)

File #: 26016
Title: Renew: Petaluma Watershed Steelhead Monitoring

File Number: 26016

Applicant Information

Affiliation: United Anglers of Casa Grande

Address: 333 Casa Grande Rd

City, State, Zip: Petaluma, CA 94954

Phone Number: (707)778-4703

Fax Number: (707)773-4974

Project Information

File Number: 26016

Application Status: **Draft**

Project Title: Renew: Petaluma Watershed Steelhead Monitoring- United Anglers of Casa Grande (UACG)

Project Status: Renewal

Previous Federal or State Permit/Authorization: 24078

Permit/Authorization Requested: State 4(d) coverage

Where will activities occur? California (including offshore waters)

State department of fish and game/wildlife: N/A

Research Timeframe: **Start:** 01/01/2022 **End:** 12/31/2022

Sampling Season/Project Duration: Adult abundance surveys (redd, carcass, & live adult count surveys):
Jan 1-Apr 30; and Dec 1- Dec 31, every 7-10 days;
Juvenile distribution surveys: Apr 15-Nov 15,
-Visual Inspection: every 7-14 days April 15-Nov 15
-Fyke Netting: April 1 - June 15, continuous
-Pole seine: April 15-Nov 15, at an irregular frequency (approx. two sites per month)
-Electrofishing: June 1-Nov 15, at an irregular frequency (approx. two sites per month)Habitat surveys: Jun 15- Nov 15, daily

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Project Description

Purpose: Overall Objective/ Hypothesis Being Tested:

- Estimate the abundance, productivity, and spatial structure of CCC steelhead in the Petaluma River watershed.
- Collect data that will enable evaluation of the genetic diversity of steelhead in the Petaluma River watershed.
- Collect habitat data that will enable a comprehensive evaluation of habitat conditions in the Petaluma River watershed.

Federal/State Agency Requirements:
N/A

Relation to Larger Series of Projects or Research Plan:
Information regarding CCC steelhead in the Petaluma watershed will be shared and added to previous data collected on CCC steelhead by CDFW, NMFS and the NMFS SWFSC.

Direct Species Benefit/Critically Important Research Need:
The Petaluma River has been identified as an Independent population by the NMFS TRT, and is an 'essential' to the Recovery of CCC Steelhead (NMFS 2016 Multi-species Recovery Plan). Evaluating habitat conditions, spatial structure and the hatchery program at UACG are high priority recovery actions identified in the MS Species Plan, since little is known about the status of the CCC steelhead population or habitat in the Petaluma River watershed. The United Anglers of Casa Grande High School (UACG) with oversight provided by the National Marine Fisheries Service (NMFS), and in cooperation with the California Department of Fish and Wildlife (CDFW -have been coordinating since 2012) is developing and implementing a comprehensive monitoring program to complement the existing and ongoing educational program at UACG. Physical habitat surveys, biological surveys and problem site assessment (noting predation and poaching) are critical to the objective of collecting watershed information to address what areas the steelhead are migrating to and rearing in, what areas need the most restoration work, and to describe the spatial and annual structure and distribution. With greater information regarding these aspects of the fishery and watershed, restoration and conservation efforts may be based off of our findings.

Past Findings:
The activities outlined in this proposal will persist in the monitoring activities started in 2013. Over the long-term, the data collected from this monitoring program will enable managers and researchers to better evaluate the population's continued progress towards recovery goals, identify restoration opportunities, and track the performance of restoration projects.

Description: To determine CCC steelhead spawner abundance and distribution, researchers will conduct redd, carcass, and live adult counts for adult steelhead in the winter and spring (Jan-April; and Dec). To determine juvenile abundance and spatial structure, researchers will conduct electrofishing sampling of juvenile steelhead from June through November. This time frame occurs after steelhead have hatched and dispersed from redds. Seining may also be used during juvenile surveys in areas where electrofishing wouldnot be effective (e.g. brackish reaches or deep pools). Fyke nets may be used in tributaries if funding becomes available. Fyke nets will be checked daily, and all steelhead and salmon will be measured, fin clipped for tissue samples, and released immediately.

Diversity traits of steelhead in the Petaluma River watershed will be monitored by collecting data on spawning times and locations, adult sex, age distributions of juvenile andadults (scale analysis and length frequencies). The collection of tissue samples from adult carcasses and live juveniles has been requested by the NMFS Southwest Fisheries Science Center (SWFSC) to assist in describing the genetic diversity of the Petaluma River population, and the larger CCC steelhead DPS structure, specifically in the InteriorSF Bay Diversity strata where individuals are relatively scarce or rare. Habitat surveys will be conducted throughout the Petaluma River's watershed to analyze habitat constraints on steelhead abundance in the watershed, and to assist in describing trends in steelhead densities.

Fish will be collected using a combination of electrofishing (two-pass) and netting. Field crews will start capturing steelhead fry near the mouth of each stream, or the lowestpoint where they have stream access. Capture activities will proceed upstream until the extent of anadromous fish zone. Because of a lack of access to certain portions of thestream, capture activities will not be conducted in these areas.

All collection activities will be conducted according to protocols published in the AFS Salmonid Field Protocols Handbook (Temple and Pearsons 2007) and the NMFS Electrofishing Guidelines (2000). Following these methods is expected to result in the lowest injury and highest survival rates for collected fish based on the environmental conditions present in each stream.

Only seines or other netting methods will be used to collect fish when stream temperature exceeds 18 degrees Celsius to prevent excessive loss and injury of captured fish andfish exposed to collection activities. Seines (and other nets) will be made from low abrasion knot-less woven materials to prevent descaling and injuries to collected fish.

Fish will be anesthetized with Alka-Seltzer Gold tablets. Only a few fish will be added to the water at a time to ensure that dosage is not fatal. Water temperature of theanesthesia water will not exceed 18 degrees C.

After juvenile collection and release activities have been concluded, sample areas and release sites will be visually inspected for dead or injured fish, including non-target species. A subset of the pools where fish were rescued released would be visually examined within 24-48 hours for dead fish. These actions are designed to ensure that chronicmortality rates on handled and released fish are low.

If survival rate of rescued fish are less than a target rate set annually by the TAC, fish handling and release protocols will be altered, rescue operations terminated, or if space isavailable at the hatchery, the rescued fish will be reared and released as 1+ yearlings.

Fall-run Chinook are present in the Petaluma River watershed. These fish are most likely of hatchery-origin. Since hatchery-origin fall-run Chinook are not listed as threatenedor endangered under the Endangered Species Act, UACG is not requesting take of Chinook even though they are likely to be encountered during adult and juvenile surveys.

Although the monitoring will be focused on steelhead, information on other fish species encountered during monitoring activities will be recorded as well.

Supplemental Information

Methods: SAMPLE FRAME

Ultimately, UACG would like to develop a sample frame that encompasses all steelhead intrinsic potential (IP) and spawning habitat below impassable barriers in thePetaluma River watershed (approximately 95 IP km [NMFS 2012]) and identifies sample units to be surveyed annually using a robust unbiased sampling scheme (e.g., Generalized Random Tessellation Stratified [GRTS] method). Sample units for adult and juvenile sampling will likely range between 30 meters to several miles. The goal will be to conduct adult, juvenile, and habitat surveys in at least 10 percent (9.5 km) of the IP habitat in the watershed. Currently; however, monitoring is limited by landowner access agreements and availability of manpower. Streams of interest, passage barriers, and landowner access as of March 2015 (no change in access occurred in 2019) are shown on the attached PDF map of the Petaluma Watershed.

Initial habitat sampling will be conducted to target data gaps in stream inventory reports produced by CDFG in 2007 (CDFG 2007). Initial habitat surveys may require completely resurveying the same streams already inventoried by CDFW. Following this baseline assessment, random sampling schemes may be implemented.Development of GRTS sample reaches will be coordinated with CDFW's CMP Program.

ADULT MONITORING

Redd Surveys, Carcass Counts, and Live Adult Fish Counts
Redd surveys will be conducted according to protocols published in the American Fisheries Society (AFS) Salmonid Field Protocols Handbook (Gallagher et al. 2007). Selected sample units will be surveyed every 7-10 days throughout the season. Two- to four-person crews will walk the sample unit searching for redds and noting live fish, carcasses, and recording information in field notebooks. Redds will be tagged with flagging tape along the bank to avoid double counting. Redds willbe identified to species and completed redds will be measured per Gallagher et al. (2007). Redd data will be used to estimate escapement. During redd surveys live fish and carcasses will be identified and tallied.

Procedures Used (see description below): Live fish will be visually sexed and their size will be visually estimated. Any tags or marks on live fish will also be noted. Carcasses will be assigned a sample ID Number, measured (standard length), sexed, and then marked by cutting off their tails. A scale sample will be collected from all carcasses due to the limited number observed. A tissue sample may also be taken. When a Chinook carcass with an adipose clip is observed, the head of the carcass will be removed and kept for Coded Wire Tag (CWT) processing. When a steelhead carcass with an adipose clip is observed, it will be noted but the head willnot be collected since hatchery steelhead do not contain CWTs.

JUVENILE MONITORING
CCC steelhead will not be handled if stream temperatures at the capture site exceed 18° C. Under these conditions, fish will only be identified and counted. Visualinspections of reaches will be conducted every 7-14 days. (Note: UACG personnel also conduct snorkel surveys of non-listed chinook salmon in the mainstem Petaluma river under their SCP, however, these methods are not proposed for ESA listed species).

Electrofishing
Electrofishing will be conducted according to protocols published in the AFS Salmonid Field Protocols Handbook (Temple and Pearsons 2007) and the NMFSElectrofishing Guidelines (2000). Electrofishing will not be conducted if pool water temperature exceeds 18 degrees Celsius. Initial water quality, including temperature, conductivity and specific conductance, and salinity of the tailout, will be measured and recorded prior to any electrofishing attempts. Water quality will be measured using an YSI 30 or 85 meter, if using a YSI 85 the dissolved oxygen will also be measured. All initial electroshocker settings will be adjusted according to the conductivity and temperature measured and the voltage, pulse width, and pulse rate will be set to the minimum possible values. The voltage used will range between 100V and 1100V according to NMFS Electrofishing Guidelines (2000). Electrofishing sites will be broken into approximately 10-30 meter

units. Each unit within the reach will be isolated using block nets spanning the stream upstream and downstream. The block nets will be installed perpendicular to the thalweg of riffles and the bottom and ends will be sealed with rocks and gravel to ensure no fish can get through. Riffles with a length less than one stream width are not considered separate habitat units and will be included in the nearest downstream unit. The unit will be sampled in two passes, with each pass consisting of an upstream and downstream sampling session. One person will operate the electrofisher and two field assistants will net stunned fish. Captured fish will be immediatelyplaced in live wells (5-gallon buckets). The seconds on the electrofisher will be recorded and reset after each pass. Researchers will wait a minimum of 20 minutes between passes to allow uncaptured fish to recover and suspended sediments to settle. Once all passes are completed for the unit, the block nets will be removed and captured fish will be released near their point of capture.

Please Note Daniel Hubacker is now e-fishing certified through three-day training at Smith Root Facility Washington State (Feb. 2017).

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Seining
Seining will be done using a pole seine that is stretched out between two people and pulled through the water. At the end of the sweep, the lead line will be scooped into the air, trapping fish in the bunt of the net. Fish captured in the bunt of the net will be kept submerged in water until they are transferred by dip net to aerated holding containers. Seining will typically be done using short seines (<10 meters). Seines will be knot-less woven nylon, 1/8 inch or similar sized mesh. Four surveyors will conduct the survey and terrain conditions will determine the time of the survey. One to two consecutive hauls will be made at each location. Each seinehaul will take approximately five minutes to complete. Sample areas will range from 5-15 feet. Fish will be collected in live-wells and processed according to the methods described below. Seining will not be conducted if the pool water temperature exceeds 20 degrees Celsius.

Procedures Used for Electrofishing/Seining (see description below): All captured fish will be kept in live wells that are maintained in suitable water quality conditionsat all times. Steelhead will be processed before other species. Sampled steelhead will be sedated using carbon dioxide (Alka-Seltzer®) to facilitate handling and minimize stress to the fish. Other fish may also be sedated prior to handling if needed. Weights, lengths, scales, and tissue samples will be collected from a subsampleof at least 25 percent of captured steelhead. Other species will be identified, enumerated, and the first 10 individuals of each species will be measured and weighed.

All salmonids will be identified to species and age class (YOY or 1+) and counted. Fish will be measured to the nearest mm, and weighed to the nearest 0.01 g usingan electronic scale. The 1+ category will include steelhead older than one year. In general, steelhead >100 mm fork length will be considered 1+ and those steelhead <100 mm will be considered YOY. This size break may be adjusted up or down if there is an obvious gap in the distribution of observed lengths. After processing each fish, it will be placed in an aerated "recovery bucket", keeping larger non-salmonids in separate buckets to avoid predation on smaller fish. The recovery bucketwill be a different color (preferably blue or other dark color) or located away from the holding buckets to avoid confusing fish that have and have not been processed.For any juvenile salmonid mortality, scales and/or tissue samples will be collected in accordance with current permit requirements.

Fyke nets will be set in shallow water with the net mouth approximately 12 in under water. Traps will be set approximately 2m from shore perpendicular to the bank ateach location. A leader constructed of 7mm delta stretch nylon netting is attached to the center bar of the first of two 90cm wide by 75cm high rectangular steel frames. The second frame consists of two 10cm wide by 70cm high openings, one on each side of the frame's center bar, and is followed by four steel hoops. The trapis covered by 7mm delta stretch mesh nylon netting and has 10cm diameter throats located between the second and third hoops. The cod end of the net has a 20.4cm opening leading to a 1.2m by 0.8m by 0.8m live box. Fish will be protected from high velocity water in the live box by internal baffles. Weir panel fencing covered with 1/4in mesh will be configured in a "v" shape covering the entire width of the channel with the fyke net set at the apex of the "v". The fencing will be anchored with sandbags. Passage will be afforded over the sandbags to allow for adult fish movement in both directions while still funneling juveniles into the trap. Traps will be checked and cleaned at least once per day and more frequently if needed due to debris load, holding capacity, and/or species captured. Fish will be carefully removed from the live box with 3/16" cloth mesh (or finer) long handled dip nets and placed into 5-gallon aerated buckets containing fresh river water. The temperature of the water in the buckets will be monitored to ensure it remains within 5 degrees of the river temperature. CDFW will oversee initial setup for operationof the trap, and assist in identifying locations for deployment. Up to 3 Fyke traps will be operated on mainstem Petaluma (below upper tributary confluences), Adobe and San Antonio creeks.

HABITAT TYPING

Habitat surveys will be conducted according to habitat typing protocols and methodology described in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). To complete the baseline surveys, habitat units will be classified to "Level IV". Following baseline surveys, habitat units will be classified up to "Level III" , which classifies habitats as either "main channel pool", "scour pool", "backwater", "pool", "riffle", "cascade", or "flatwater," (Flosi et al. 1998). The habitat surveys will be conducted prior to any significant rainfall. Habitat surveys will generally require a team of two people for safety and efficiency, although one person can do it alone if necessary. Beginning at the downstream end of the sample unit and working upstream, the team will identify, classify, and number sequentially all habitat units. Habitats shorter than the stream width (typically short riffles) will be lumped with the upstream unit and not identified as separate habitatunits. Measurements will be taken using a measuring tape and measuring rod. The length of each unit should be measured to the nearest 0.1 ft using a measuring tape,string box/hip chain, or measuring rod and the average width may be visually estimated or measured. To maintain consistency, unit classification and width estimation will be done by the same person for the duration of the survey. Data will be recorded in feet on standard California Department of Fish and Wildlife (CDFW) data sheets copied to write-in-the-rain paper.

PROCEDURES

Anesthetic
Anesthesia will be prepared by filling a clean, 5-gallon bucket (white) with a couple inches of fresh stream water and dissolving half of an Alka-Seltzer® tablet (onlyplain un-medicated Alka-Seltzer® will be used) in the water. A few fish will be added to the treated water at a time. Researchers will wait a couple minutes until the fish are adequately sedated. Fish will be processed once they are sluggish enough for easy handling, but before they begin to turn over. If fish do turn over they will be processed and/or returned to an aerated holding bucket immediately. The number of fish sedated at a time will be adjusted as necessary. More Alka-Seltzer® maybe added if necessary, but no more than a quarter tablet will be added at a time.

*Tissue Samples*Adult Monitoring
Carcass tissue samples will be collected according to NOAA SWFSC Collection Protocols. Either a 1 cm square clip from the operculum or caudal fin will be taken.Juvenile Monitoring
Juvenile tissue sampling will be conducted according to NOAA SWFSC Collection Protocols. When sampling for tissue, juvenile steelhead will be sedated using the methods described above. Scissors will be used to clip a small portion (approximately 4mm square) of the upper caudal fin. Under most circumstances, tissue sampleswill not be collected from fish less than 90 mm fork length. Fin clips will be placed on blotter paper and placed in an envelope, along with the standardized tissue collection data sheet to the Salmonid Genetic Repository, Santa Cruz, CA.

Scale Samples
Adult Monitoring - Carcasses only
Complete scales (20-30, as per sample collection protocol for genetic tissue collections of carcasses from NOAA Southwest Fisheries Science Center Santa Cruz Laboratory), will be removed using scissors and forceps and placed on a piece of dry blotter/filter paper (e.g. Whatman brand). The blotter paper will be folded overfor temporary storage. Samples will be air dried as soon as possible (within 8 hours). When tissue/paper is dry to the touch, it will be placed in a clean envelope labeled with Sample ID Number and sealed. Samples will be mailed along with the standardized tissue collection data sheet to the Salmonid Genetic Repository, Santa Cruz, CA.

Scale samples collected from carcasses for the purpose of determining the age and origin of the fish will be collected according to the AFS Salmonid Field Protocols Handbook (Crawford et al. 2007). Three scales will be taken from each side of the carcass using forceps and placed on scale cards. If scales are missing from one sideof the fish, six scales will be collected from one side.

Juvenile Monitoring
When sampled for scales, steelhead will be sedated using the method described above to facilitate handling and minimize stress to the fish. Samples will be collectedusing the open blade of a pair of surgical scissors, and by gently scraping "against the grain" to collect scales from the side of the fish, above the lateral line and slightly behind the dorsal fin. Scales will be placed on a piece of blotter paper and stored in a sample envelope. Researchers will avoid scraping off too much of the protective slime coating from the fish, and be careful not to take too many scales from one spot on the fish. Fish will be allowed to recover in a recovery bucket containing a fish conditioner (Stress Coat) to ward off potential of infection associated with the scale sampling.

United Anglers of Casa Grande shall submit electronically a weekly summary of proposed activities, previous week's observations, and any reported take, as well as acopy of the final 4(d) annual report to district fisheries biologist, Ryan Watanabe.

Intentional Lethal Take: Not Applicable

Anticipated Effectson Animals: Spawning surveys may frighten adult and juvenile steelhead, which may cause the fish to seek temporary refuge behind rocks, vegetation, and deep water areas. Frightened juveniles return to feeding habitats, and adults return to holding and spawning habitats within seconds after the observer passes through the habitat unit.

Electrofishing, seining, fyke netting and handling cause stress to captured specimens. A small percentage of fish may be injured or killed during electrofishing (up to 2 percent of captured fish) and seining (up to 2 percent of captured fish). There are two major forms of injuries from electrofishing; hemorrhages in soft tissues and fractures in hard tissues. Capture by seine can injure or kill fish through entanglement, scale and mucus abrasion, suffocation, and crushing.

Measures to Minimize Effects: To reduce the likelihood of capturing adult CCC steelhead by the electrofisher or seine researchers will: (1) visually inspecting the survey site prior to backpack electrofishing or seining to ensure that no adult CCC steelhead are present; (2) eliminate these capture methods in stream reaches where adult CCC steelhead are identified; and (3) cease activities once an adult CCC steelhead is captured. Furthermore, researchers will not initiate e-fishing in the fall after storms have occurred that may have allowed adult CCC steelhead to begin migrating to upstream reaches. Fyke Nets are checked daily, and will not be fished during extreme high-flow events when equipment damage may occur or injury/mortality is likely to occur in the trap. Additional cover (e.g. ferns, baffles, etc.) will be placed in the trap's livebox to reduce density related stress and predation during holding.The Fyke net will not be fished is flows exceed 1500cfs or if water temperatures exceed 21°C.

UACG will also adhere to the guidelines set forth in National Marine Fisheries Service Guidelines for Electrofishing Waters Containing Salmonids Listed Under theEndangered Species Act (NMFS 2000). All field personnel will closely observe the condition of fish and adjust electrofisher unit settings appropriately. All persons operating under this permit would be properly trained and use properly maintained state-of-the-art equipment. Prior to the start of backpack electrofishing at each location, water temperature and conductivity measurements shall be taken and recorded.

Researchers will utilize seines and dip-nets with knot-less nylon mesh to minimize scale and mucus abrasion.Tissue collection will be done in non-lethal manner.

All CCC steelhead captured will be held in livewells filled with clean water and equipped with battery powered aerators before and after handling. All steelhead will be allowed to recover fully before being released back into the water at, or close to, the location from which they were taken. Water temperatures will be measured and documented within sampling and fish holding areas. Researchers will limit the amount of fish in each livewell to prevent overcrowding. Fish will not be held in livewells or handled for more than the minimum time required to collect the necessary data. If adults are encountered they will be processed and released immediately following capture.

CCC steelhead individuals will be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. Adequatecirculation and replenishment of water in holding units is required. CCC steelhead individuals will be processed first and released as soon as possible after being captured to minimize the duration of handling stress.

When using anesthesia, care shall be taken to use the minimum amount of substance necessary to immobilize CCC steelhead for handling, measuring, and weighing.CCC steelhead will not be handled if stream temperatures at the capture site exceed 18C. Under these conditions, fish will only be identified and counted.

	Sites will be visually inspected prior to conducting electrofishing to ensure adult steelhead are not present. All techniques will account for foothill yellow-legged frog (FYLF). Fyke nets will provide devices to prevent drowning. Prior to electrofishing and seining the siteswill be surveyed for FYLF egg masses and tadpoles to avoid impacting this species.
Disposition of Tissues:	Samples will be mailed along with the standardized tissues data sheet to the Salmonid Genetic Repository, Santa Cruz, CA. Heads of Chinook carcasses will bestored in plastic bags, frozen and then sent to the CDFW Ocean Salmon Project Office, 5355 Skyline Blvd, Suite B, Santa Rosa, California 95403 Coastal salmon & steelhead tissue samples (fin-clips only) collected under the authority of this 4(d) authorization must be transferred to the SWFSC prior to any processing or transfer to any other recipient named in this permit. Collection and storage methods shall follow the attached CVTA protocols. Any deviation from these protocols shall be coordinated with Carlos Garza, NMFS, 110 Shaffer Road, Santa Cruz, CA 95060, (831)420-3903 prior to sampling. Should any incidental mortality or take of moribund Southern CA or South-Central CA Coast DPS steelhead occur as a result of the permitted activities, whole fish shall be sent to Matt McGoogan, NMFS, Southern CA Office, 501 W. Ocean Blvd. Suite 4200, Long Beach, CA 90802, (562)980-4026. Coordination with Mr.

McGoogan is required prior to transfer. Should any incidental mortality or take of any other coastal steelhead or salmon occur as a result of the permitted activities, the permittee shall collect a tissue sample in accordance with CVTA protocols prior to freezing the salvaged fish, or samples thereof, to minimize sample destruction caused by freeze/thaw cycles.

All samples, salvaged fish, and/or parts thereof, collected under the authority of this 4(d) authorization must be accompanied by a chain of custody form(attached) establishing an unbroken trail of accountability for custody, control, and transfer of the samples, salvaged fish, and/or parts thereof.

All third-party holders must obtain a CESA MOU and federal permits, or be named as a recipient in this 4(d) authorization, to possess samples, salvaged fish, and/orparts thereof, of CESA listed species collected under the authority of this 4(d) authorization.

Public Availability of Product/Publications: All data collected during this program will be entered into a database managed by UACG. A summary of monitoring activites will be distributed via annual reports to NMFS and CDFW. Reports may be made available to the public on the UACG website (UACG.org) as well.

Biologist Comments

This section is currently empty.

Federal Information

No Federal comments or authorizations.

Location/Take Information

Location

Research Area: Pacific Ocean **State:** CA **Sub Basin (4th Field HUC):** San Pablo Bay **Stream Name:** All streams and sloughs with steelhead IP in Petaluma River WS: Donahue Slough,Mud Hen Slough, Mud Slough, Woloki Slough, Tule Slough, San Antonio Cr, Ellis Cr, Adobe Cr, East Washington Cr, Washington Cr, Lynch Cr, Willow Brook Cr, Lichau Cr.
Location Description: All streams and estuarine areas containing CCC steelhead intrinsic potential habitat in the Petaluma River watershed.

Take Information

Line	Ver	Species	Listing Unit/Stock	Production /Origin	Life Stage	Sex	Expected Take	Indirect Mort	Take Action	Observe/ Collect Method	Procedure	Transport Record	Begin Date	End Date
1		Steelhead	Central California Coast (NMFS Threatened)	Natural	Adult	Male and Female	50	0	Observe/Harass	Spawning surveys		N/A	1/1/2022	12/31/2022

2		Steelhead	Central California Coast (NMFS Threatened)	Natural	Spawned Adult/ Carcass	Male and Female	50	0	Observe/Sample Tissue Dead Animal	Spawning surveys	Tissue Sample Fin or Opercle; Tissue Sample Scale	N/A	1/1/2022	12/31/2022
3		Steelhead	Central California Coast (NMFS Threatened)	Natural	Juvenile	Male and Female	250	5	Capture/Handle/Release Animal	Electrofishing, Backpack		N/A	1/1/2022	12/31/2022
4		Steelhead	Central California Coast (NMFS Threatened)	Natural	Juvenile	Male and Female	100	2	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Electrofishing, Backpack	Anesthetize; Tissue Sample Fin or Opercle; Tissue Sample Scale	N/A	1/1/2022	12/31/2022
5		Steelhead	Central California Coast (NMFS Threatened)	Natural	Juvenile	Male and Female	250	5	Capture/Handle/Release Animal	Seine, Beach		N/A	1/1/2022	12/31/2022
6		Steelhead	Central California Coast (NMFS Threatened)	Natural	Juvenile	Male and Female	100	2	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Seine, Beach	Anesthetize; Tissue Sample Fin or Opercle; Tissue Sample Scale	N/A	1/1/2022	12/31/2022
7		Steelhead	Central California Coast (NMFS Threatened)	Natural	Juvenile	Male and Female	750	15	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Net, Fyke	Anesthetize; Tissue Sample Fin or Opercle; Tissue Sample Scale	N/A	1/1/2022	12/31/2022

Project Contacts

Responsible Party: Daniel Joe Hubacker

Primary Contact: Daniel Joe Hubacker

Principal Investigator: Daniel Joe Hubacker

Other Personnel:

Name	Role(s)
Jodi Charrier	Co-Investigator
Robert Coey	Co-Investigator
Joshua Fuller	Co-Investigator
Katherine Marie Robbins	Co-Investigator

Collector Comments: Students of the Casa Grande High School program and other volunteers will assist with field work.

Attachments
Contact - Daniel Joe Hubacker (Added Jul 20, 2020)
Contact - Daniel Joe Hubacker (Added Jan 31, 2019)
Contact - Daniel Joe Hubacker (Added Jan 31, 2019)
Contact - Jodi Charrier (Added Sep 9, 2019)
Contact - Joshua Fuller (Added Oct 25, 2018)
Contact - Katherine Marie Robbins (Added Sep 28, 2015)
Contact - Robert Coey (Added Sep 10, 2020)
Contact - Robert Coey (Added Sep 10, 2020)
Contact - Robert Coey (Added Dec 13, 2016)
Project Description - (Added Sep 8, 2021)
Project Description - (Added Sep 8, 2021)
References - (Added Sep 8, 2021)
References - (Added Sep 8, 2021)
References - (Added Sep 8, 2021)
References - (Added Sep 8, 2021)
References - (Added Sep 8, 2021)

Renewal Summary
The proposed research activities **did NOT** change. Any changes were only editorial in nature to improve description of the research, update project dates, update federal funding, or update project personnel.

Summary of Take Information by Location

Original Location: Pacific Ocean; State/Territory: CA; San Pablo Bay; All streams and sloughs with steelhead IP in Petal (All streams and estuarine areas containing CCC steelhead intrinsic potential habitat in the Petaluma River watershed.)
Renewed Location: Pacific Ocean; State/Territory: CA; San Pablo Bay; All streams and sloughs with steelhead IP in Petal (All streams and estuarine areas containing CCC steelhead intrinsic potential habitat in the Petaluma River watershed.)

Species	Listing Unit	Capture Method	Lifestageor Stock	Productionor Origin	Previous Anticipated Take	Previous Indirect Mortality	Reported Actual Take	Reported Indirect Mortality	Current Anticipated Take	Current Indirect Mortality
Steelhead	Central CaliforniaCoast	Electrofishing, Backpack	**Juvenile**	**Natural**	**350**	**7**			**350**	**7**
Steelhead	Central CaliforniaCoast	Net, Fyke	**Juvenile**	**Natural**	**750**	**15**			**750**	**15**
Steelhead	Central CaliforniaCoast	Seine, Beach	**Juvenile**	**Natural**	**350**	**7**			**350**	**7**
Steelhead	Central CaliforniaCoast	Spawning surveys								
Steelhead	Central CaliforniaCoast	Spawning surveys Carcass	Spawned Adult/	Natural50 0	50	0				

Status

Application Status: Draft

Date Submitted: September 8, 2021

Last Date Archived: December 1, 2021

- **State 4(d) coverage**

  Current Status: N/A

Expire Date: **Status Date:**

Analyst Information:

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