PACIFIC STATES MARINE FISHERIES COMMISSION
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July 15, 2016

USFWS, Region 1
911 NE 11th Avenue
Portland, OR 97232
Attn.: Jeremy Voeltz

Dear Jeremy,

Please find the final report for the Western Native Trout Initiative Project "Rangewide Assessment of Coastal Cutthroat Trout" Agreement No. F13AC00614 completed by the Pacific States Marine Fisheries Commission (PSMFC), lead contractor Kitty Griswold.

As stated in the report the assessment will continue with separate funding from the National Fish and Wildlife Foundation "Bring Back the Natives" in the remained of the geographic range of the subspecies. We will provide USFWS an additional report when that work is completed.

Please feel free to call me, or Kitty Griswold if you have any questions. Thank you for supporting our project.

Sincerely,

Stephen Phillips
Senior Program Manager

cc Therese Thompson, Western Native Trout Initiative

Recipient: Pacific States Marine Fisheries Commission, (Kitty Griswold, PhD, lead Contractor)
Title: Coastal Cutthroat Trout Range-wide Assessment, Agreement No. F13AC00614 (including WNTI funds $62,900.)
Report date: July 15, 2016.
Period of performance: August 21, 2013 – June 1, 2016.
Timeline of the study: This is a final report for the grant agreement "Coastal Cutthroat Trout Range-wide Assessment" (Agreement No. F13AC00614) and reflects work conducted with funds received from the Western Native Trout Initiative (WNTI) though the USFWS. We have completed task one and two identified in that agreement. We divided the assessment area into four regions to conduct a range-wide assessment of Coastal Cutthroat Trout (CCT). Because funds in addition to those received under this agreement are needed to conduct the assessment in locations in Alaska and Puget Sound, WA this report covers only a *portion* of the full geographic range of CCT. Additional funds from the National Fish and Wildlife Foundation's (NFWF) Bring Back the Native's grant fund were received in 2014 and will be used to complete the assessment. The period of performance noted in the cooperative agreement between PSMFC and USFWS (Agreement No. F13AC00614) ends July 31, 2018. **Please note that this report is being submitted two years in advance of the expiration of that agreement.** This solution was developed through conversations with the PSMFC lead contractor Kitty Griswold, Jeremy Voeltz (USFWS), and WNTI coordinator Therese Thompson on June 24, 2016.

We have completed the following tasks as outlined in Agreement No.: F13AC00614:

- Task one: Refine existing tools and gather additional data to assess CCT.
- Task two: Conduct assessments which use both data in-hand and expert professional judgement.

For Task one, we developed and completed two sub-tasks:

Sub-task one: Develop a protocol to assess CCT based on May et al. (2007) including modified assessment modules in the following areas:
- Estuaries
- Uncertainty (we implemented a reliability rating)
- Anadromy (life history diversity)
- Biologically specific risk factors
- Biologically specific conservation stronghold criteria (some element are still in development and will be included in the final status report.)

Sub-task two: Develop or gather stream layers for an Intrinsic Potential analysis, identify and develop a uniform hydrography GIS layer, and identify accounting Unit (HUC's level) for reporting.

Please see Appendix A for further elaboration on the protocol development and issues related to hydrography.

For Task two, we worked with agency biologists and CCT experts during the performance period to organize and conduct local assessment workshops. The range of CCT is large and diverse and includes areas in British Columbia and Alaska in addition to a vast area in California, Oregon, and Washington (Figure 1). We knew the WNTI funding alone would not allow for complete assessments throughout the geographic range, so we divided this part of the project into multiple phases. Working in a phased, step-wise fashion has shown to be successful in past, similar efforts.

Initially we identified Phase one to include workshops in California, Oregon, and Southwest Washington. We proposed four workshops following the existing ESU boundaries (Northern California, Coastal Oregon, Willamette River, and Southwest Washington/Columbia River). Note that while we completed Phase one in June, 2015, we found that local agency restrictions on travel made it difficult for biologists to participate. To address this, we added workshop locations within the workshop boundaries but in towns or cities near agency regional offices to ensure that biologists could attend and were not barred from participation through travel or budget restrictions. We conducted eight workshops instead of the four proposed (Figure 2).

For Task two, we have completed all of the proposed sub-tasks for the workshops:

• Work with agencies to identify local contacts and workshop leads.
• Create a calendar for the workshops to be held.
• Identify locations and equipment needed for the workshops.
• Refine map viewer remote tools to help with pre-workshop data gathering.
• Conduct the first of four workshops in Northern California.
• Refine any issues from "lessons learned" at the first workshop, then conduct the remaining workshops (specific locations are to be determined.)
• Complete quality assurance/quality control measures on data collected at workshops.
• Complete data analysis and report writing (some analysis for individual states is still in progress.)

Phase two of the assessment focuses on the rest of Washington State. We conducted one general informational meeting (Olympia, Washington; December, 2014 using WNTI funds). In January 2016, we conducted two workshops, one in Forks, WA and one in Quilcene, WA (Figure 2). A future workshop in Puget Sound will be planned to complete Phase two of the assessment using NFWF funds.

To complete Phase three, we are planning workshops in Alaska for the fall of 2017 using NFWF funds. Assessment of British Columbia may be conducted through remote access video conferencing in early 2017 if funding is available.

Project activities

Some examples of our accomplishments are below:

- We have gathered 102,002 records that describe a field survey for CCT (incidental or otherwise) throughout the geographic range of CCT. Of these, there are 74,266 positive observations (at least one CCT was observed in the survey).
- We have collected survey records from 52 governmental agencies, universities, tribal nations, consultants, and NGO’s.

- We have met with over 157 professional biologists in eight workshops.
- We have assessed 49,865 square miles, or approximately 13 million hectares, which represent hundreds of level five hydrologic units (areas corresponding to watersheds).
- We created a website that houses our map viewer with distribution data and other information http://www.coastalcutthroattrout.org/

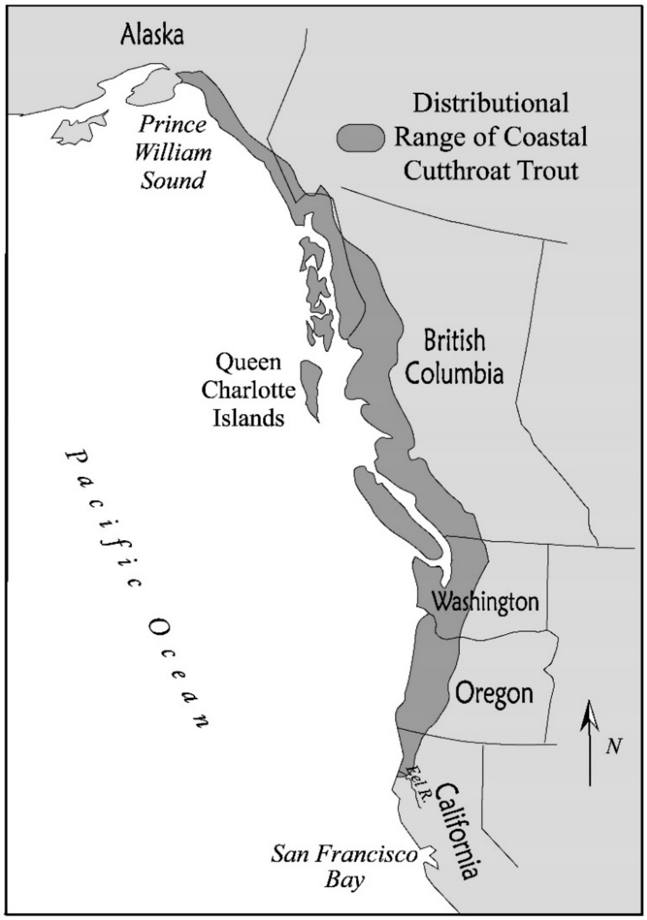

Figure 1. A map depicting the generalized range of Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii*) and the assessment scope for this project.

In addition, with support from this grant, we developed a potential habitat data layer for CCT using an Intrinsic Potential (IP) model. This model has been used to support the CCT assessment and has demonstrated potential for better understanding the upstream extent of CCT distribution. One publication where this model has been applied is currently under peer review.

Finally, this grant allowed us to develop a standard protocol that can be used to uniformly assess CCT using a combination of data and professional judgment. The protocol we developed has been successfully implemented in eight workshops to date. Initial results and some examples of the application of the protocol are included in Appendix A.

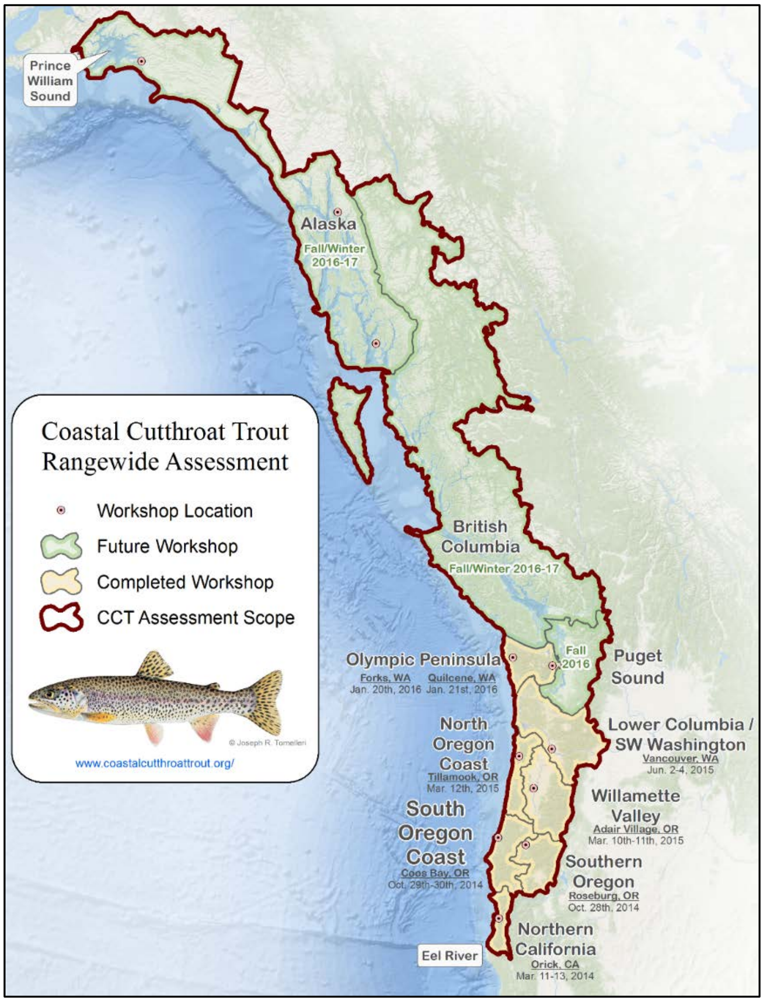

Figure 2. Location of CCT assessment workshops conducted as of June 2016.

Evaluation

To date, we have used and incorporated peer review and evaluation from members of the CCT Interagency Committee, USFWS, and WNTI. The assessment protocol and the IP model were shared with experts within those disciplines for feedback.

The biologists who attended the assessment workshops provide continual feedback. Our team is careful to stick to our standard workshop protocol but have made minor adjustments to the protocol to clarify language or intent and implemented improvements for each workshop. We have found that accommodating biologists in terms of location, timing of meeting and other factors makes for the best outcome for attendance and participation.

Continuation of the Project

The assessment project for CCT will continue with support from other agencies and grants. Long-term support of the CCT Interagency Committee will be dependent, in part, on future support from agencies.

During the duration of this agreement, the data needs for agencies have changed. The need for and interest in standard fish distribution data appears to have increased. Because we have gathered data from many different agencies in many different formats our distribution data may lack specific data fields for specific agencies, such as reach level information. In addition, in order to make data compatible with state agency databases we used state agency hydrography. If there is a desire to create distribution data that are compatible with federal agency databases and hydrography, additional work and funding will be required. Alternatively, agencies have access to the traced distribution data and observation data as well as the map viewer. The map viewer has been identified as a useful tool for agency field biologists as viewing the data requires no special software or licenses. In addition, GIS data layers may requested from PSMFC. Metadata for the GIS distribution data was completed in June 2016.

Long-term Impact

The long-term impact of this project cannot be overstated. The efforts of the CCT Interagency Committee, the data collected for the observation and distribution database, the potential habitat model, and results of the assessment are the most significant contribution to improve the management and conservation of CCT throughout their native distribution to date.

Grant Products

- Northern California Hydro/Distribution: CCT draft distribution created by tracing downstream using CDFW's hydrography.
- Oregon traced Distribution: CCT draft distribution created by tracing downstream using ODFW's hydrography.
- Washington traced Distribution: CCT draft distribution in two ESU's created by tracing downstream using WDFW's hydrography.
- Traced NHD: These locations were manually added to the dataset when a state's hydrography did not contain the feature, but high-resolution NHD did (note: in some cases, CCT are found upstream of the existing hydrography).

- Intrinsic Potential trace: These locations were manually added to the dataset when neither the state hydro, nor high-res NHD had features depicting the stream. Sources for the IP data come from a mixture of NOAA, CLAMS, and NetMap/TerrainWorks.
- Development of data standards and metadata for GIS layers and distribution data.
- Online data viewer with workshop scope, observation data with associated information, distribution (both documented and professional judgement), barrier data (waterfall and man-made), and other relevant layers. http://www.coastalcutthroattrout.org/
- Professional paper presented on the progress of the status assessment presented at National American Fisheries Society meeting, Portland Oregon, August, 2015 by contractor Kitty Griswold

Data that are available that have not been shared to date include the Intrinsic Potential output and CCT resident reaches. In addition, professional judgement data regarding the population status and health will be available in the final reports. The attached “Appendix A” report include more detail on the workshops and some draft results.

Draft results from the Coastal Cutthroat Trout Assessment in Northern California, Oregon, and parts of Washington.

K.E. Griswold [1, 2], Van Hare[2], Brett Holycross[2], Stephen Phillips[2]

Idaho State University[1], Pacific States Marine Fisheries Commission[2]

Introduction

Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii*; CCT) are classified as one of the major Cutthroat Trout subspecies in North America. They are important ecologically, socially, and are a highly valued sport fish. There is a long history of litigation and proposed listings under the Endangered Species Act (ESA) for CCT, and the USFWS considers them a sensitive species (Finn et al. 2008). There is no established interjurisdictional management or conservation plan or agreement in place for CCT at this time. Information for the subspecies tends to be in agency reports or unpublished databases. The goal of our project is to provide a science-based framework for improved conservation actions for CCT. The outcome of this work will improve our understanding of CCT and in turn help us better manage and conserve the subspecies. Our work supports the goals of the Western Native Trout Initiative (WNTI) and the National Fish Habitat Action Plan (NFHAP) and numerous state and federal agencies that have jurisdiction over the subspecies. The CCT Interagency Committee, a multi-agency work group, has identified that conducting an assessment which delineates the distribution of the subspecies and identifies conservation populations is a precursor to a conservation plan and better management and monitoring.

Developing a conservation plan or agreement was identified as a priority by the USFWS (Finn et al. 2008), the CCT Interagency Committee (Griswold and Phillips 2010), and WNTI (WNTI 2010). While CCT likely benefit from habitat conservation directed at other salmonid fishes, there is little scientific data to support whether these actions are adequate given the unique habitat requirements and life history of CCT. For example, CCT are found in higher elevation headwater streams than other salmonid fishes in the region. In some cases, these headwater streams are excluded from monitoring sample frames so the upstream distribution is unknown. In some watersheds, CCT migrate from these small tributaries downstream and may reside for several months in the estuaries or seasonally migrate to the open ocean. The health of estuaries and headwater streams and the connection between the two habitats are critical for the health of CCT populations. Because the subspecies is iteroparous (repeat spawners), they may use these migration corridors repeatedly. These are just two examples of why it is important to conduct an assessment that focuses on CCT specifically.

Coastal Cutthroat Trout are found in freshwater and coastal marine ecosystems from the Eel River, California, to Prince William Sound, Alaska, encompassing four states and the Province of British Columbia (Figure 1). This project is the first assessment conducted for CCT with a range-wide perspective. State-led assessments and reviews have been conducted as part of planning for native fish, (http://www.dfw.state.or.us/fish/ONFSR/docs/volume-1-final.pdf), special symposiums (Hall et al. 1997), or resulting from federal actions under the ESA (Johnson et al. 1999). The goal of our project is to update these assessments using a common protocol that can be applied throughout the native range of CCT.

In this report, we present the draft results from the first phase of a range-wide assessment for CCT in California, Oregon, and a small portion of Washington. There are two elements to the assessment, the first focuses on potential habitat and distribution. When possible, we included attributes associated with the distribution similar to best available fish habitat data sets (ODFW, 2011). The second element focuses on watershed scale questions associated with population health, habitat health, non-native species interactions, hybridization, and threats and conservation opportunities similar to that developed by other authors conducting similar assessments (May et al. 2007). The assessment consists of pre-workshop collection of existing data from agencies and other sources which is used as the basis for a geo-database, travel to local areas to hold assessment workshops with professional biologists, and post-workshop data processing.

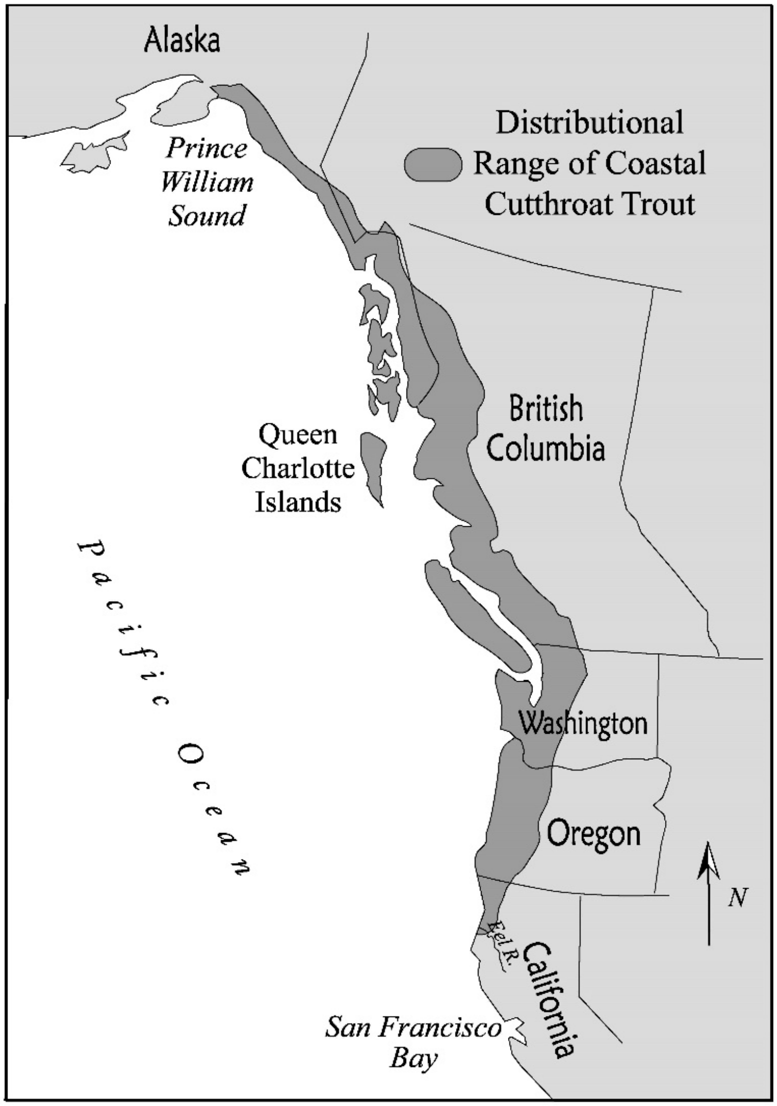

Figure 1. A map depicting the generalized range of Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii*) and the assessment scope for this project.

Methods

Assessment area

This report includes assessment information for northern California, Oregon, and a small region of southern Washington, and the Olympic Peninsula. The assessment area includes the Klamath, Coast Range, Cascade, Willamette Valley, Puget Lowlands, and North Cascades level three ecoregions. Estuaries were assessed and were classified into three categories; riverine, lagoonal, and embayment/bay. Workshop areas are generally based on Evolutionary Significant Units (ESU) identified by Johnson et al. (1999). Remaining assessment areas in the United States include Puget Sound, WA and Alaska.

Pre-workshop data gathering

Observation database

The observation database, the initial data-gathering effort of the CCT Interagency team, served as the foundation for the distribution data layers. (WNTI project CCDP-2008-4 -- Coastal Cutthroat Trout Database Project.) In spring of 2009, existing databases were identified as priorities for data entry with input from the CCT Interagency Committee. The criteria for prioritizing the data sets for the initial phase of the project included the following: 1) electronic format with location data, 2) geographically representative of the distributional range, including above barrier locations, and 3) collected within the past 15 years (older data was incorporated later in the assessment). These data sets represented a broad range of data types from a variety of agencies including universities and agency monitoring and research efforts. This data set served as the foundation for the current assessment.

Data gathered from agencies and catalogued in the CCT database included standardized geo-referencing to enable the display and query of observation sites in a GIS. This included documentation of the original source location coordinates and methods used and, where necessary, conversion of location coordinates to a common mapping framework (latitude/longitude, decimal degrees based on NAD83 datum). Some agencies provided location data as stream reach segments tied to NHD along with beginning and ending latitude, longitude coordinates in order for the geo-referencing to be consistent across the CCT database, the PSMFC GIS specialist used the highest upstream point when provided with reach-level data. Once sighting locations were described following this standard, a partially automated process was used to further reference the observation sites to watersheds (level 6 hydrologic units) based on the nationally standard Watershed Boundary Dataset (WBD). This step allows users to query the CCT database based on unique watershed identifiers. It also allows the creation of maps and reports identifying watersheds for which CCT observations data exist. Since actual point coordinates are retained in the database, observation sites may be displayed based on their recorded point location. With additional effort and quality assurance measures, the individual observation sites could be further referenced to individual streams or stream reaches based on regionally or nationally standardized hydrography layers.

Once georeferenced, observation records in the CCT database were compatible for presentation and query via web based mapping applications. The web application was updated with a new web based map application by PSMFC personnel and made available through the public website for the CCT Interagency Committee's web page http://www.coastalcutthroattrout.org. PSMFC updates the map viewer as new information is gathered. Currently the map viewer includes assessment workshop areas, distribution data from observations and professional judgement, total barriers to anadromy, barrier data from workshops, barriers that intersect CCT distribution, observation data, Oregon Department of Forestry Fish Presence data, land ownership layers, and other layers provided by member states.

Current Distribution

To develop a CCT distribution layer from observation data, we identified the uppermost observation of CCT and traced downstream. This assumed downstream access was available. Distribution data were shared with participants in advance of workshops using the online map viewer to help participants identify data gaps or correct errors. Business rules for the applications of data standards follow those from the Oregon Fish Habitat Distribution Data Standards (version 2.0 2010) (OFHDDS) (ODFW, 2011). Following this standard, fish habitat distribution is georeferenced to watercourses (streams and rivers) and waterbodies (lakes, reservoirs and estuaries). In California, our modifications of the standard facilitates using the base hydrography dataset that form the common spatial framework used by California Department of Fish and Wildlife (CDFW) and its partners. In Oregon and Washington, state agency base hydrography was used.

Intrinsic Potential

In general, it is assumed that CCT occupy much of their historic range, although local extirpation has been reported (Slaney and Roberts 2005). The upstream extent of distribution within watersheds is largely unknown however and detailed distribution (stream-level) data of the subspecies distribution is generally not available in agency databases. To help better understand distribution of CCT, we developed an Intrinsic Potential (IP) habitat model for CCT to serve as a surrogate for historical habitat and help frame potential CCT habitat. This approach is similar to the application of IP models for other salmonid fishes (Oregon Fish Passage Barrier Data Standard version 1.1; Wild Salmon Center, 2012) and lamprey (USFWS, 2011). The models are intended to represent the potential habitat of juvenile (spawning and rearing) CCT by identifying landscape features that are relatively stable over long time periods. As such, IP delineates the *potential* for occupancy but does not represent the current distribution of the subspecies.

The CCT IP habitat model we developed includes landscape attributes of mean annual discharge, channel width, and gradient. The model was developed following the methods of Burnett et al. (2007) and Agrawal et al. (2007). Data sources for the model were provided by NOAA and CLAMS in coastal regions of California and Oregon, and TerrainWorks (NetMap) in the Willamette Valley and Lower Columbia and SW Washington ESUs. The attribute values to develop IP suitability curves for CCT were derived from a review of scientific literature. The resulting model was reviewed by professional biologists and hydrologists from the CCT Interagency Committee and their recommendations were incorporated to the current draft model. In California, high resolution gradient data developed by CDFW were used in order to limit the upstream extent of potential distribution to gradients under 20%.

Barriers

Understanding watershed conditions through the examination of barrier data was identified as an emerging issue by Lanigan et al. (2012). CCT commonly occur above natural barriers throughout their geographic range, a condition which shapes their distribution and persistence on the landscape. Anthropogenic barriers within the distribution of CCT (especially where migratory forms are present) are important to identify as they may fragment stream connectivity. For California watersheds, data on barriers from the California Fish passage data were added as a data layer. Existing barriers from state and federal agency databases in Oregon and Washington were added as a GIS layer in advance of the workshops. Graphical data elements and GIS descriptions follow those presented in the documentation for StreamNet.

Data quality (protocol development)

The CCT Interagency Committee reviewed numerous assessments that focused on Pacific Salmon or for Cutthroat Trout subspecies located in the interior western U.S. (May et al. 2005, Wild Salmon Center 2012, Johnson et al. 1999, for example). We concluded that we needed to develop an approach that would: 1) accommodate data from multiple agencies using multiple formats including professional judgment; 2) create a reproducible protocol that could be used in workshops; 3) incorporate data that can be compared to interior trout assessments; and 4) gather information relevant to coastal watersheds where CCT reside. We divided the assessment into two parts. The first part included various approaches to better understand and document distribution and attributes associated with stream distribution (barriers, life history, and habitat use). In the second part, we increased the spatial scale to the sub-watershed or watershed scale (level 6 or 5 hydrologic units) to assess factors associated with CCT including hybridization, impacts from non-natives, relative health of populations and habitat, estuary health, and ongoing conservation activities and limiting factors.

Incidental data and the opinions of experienced professional biologists have value when conducting status assessments. Because data are limited for CCT, expert opinion is essential. However, as critical as expert judgment is, it can vary in quality. We developed a system to track the data source at the workshops, and weighed professional judgment depending on a number of factors (Table 1) based on existing protocol developed by the state of Oregon (ODFW 2011). We also developed look-up tables and "domains" to standardize assessment question and responses. The intent was to make workshops more efficient and ensure that we standardized our approach as much as possible among the participating biologists within workshops and among workshops. However, important comments or feedback that was not identified in the lookup tables could be captured by the MapNote feature in the GIS interface.

Table 1. Description and classification of information source for workshop data gathering. Participants were prompted to identify the information source or basis for decision for each question. The basis for their response was recorded in the GIS database.

Information Source (Basis for response)
Highest level of reliability. Major amount of sampling; Generally contained in agency databases, a Thesis or Dissertation or a published paper (generally, peer reviewed).
High level of reliability. Minor sampling; contained in agency databases, reports and summaries (generally, non-peer reviewed).
Undocumented professional observation. Field biologist observed, or knows other biologists who observed but not documented in a report or survey.
Professional opinion, Area where species in question is like present based on geography or other conditions, but the location has not been surveyed, and no direct observations made.
N/A

Workshop organization and data gathering

Our goal was to conduct workshops in places that would be convenient for knowledgeable biologists from multiple agencies to attend. We worked with agency partners to identify strategic locations to hold workshops within ESU's. In some cases, multiple workshops in multiple locations were held within an ESU to balance the assessments' team workload and make travel convenient for local biologists. In advance of each workshop, existing data was shared via the map viewer: http://www.coastalcutthroattrout.org/sample-page/cct-interactive-map. Biologists were asked to add information and fill data gaps with existing data in advance of the workshop.

At each workshop, assessment areas were again subdivided based on level five hydrologic units (we used level 6 hydrologic units in California) and data for those areas was preloaded into laptops with ERSI's ArcMap GIS software (version 10.1). We set up two to four GIS stations at each workshop depending on the number of participants. Each GIS station consisted of a laptop preloaded with maps depicting the appropriate geographic area with CCT draft distribution, CCT intrinsic potential data layer, the known steelhead (*O. mykiss*) and Coho Salmon (*O. kisutch*) distribution, barrier data, and other informative layers that could assist biologists (roads or land ownership, for example). Each laptop was connected to a projector to ensure a large group could view the maps being displayed. A GIS interface with the CCT assessment protocol was also preloaded onto the laptops. Each station was run by a GIS analyst. A facilitator, and when possible a note-taker, were assigned to each station. The project coordinator moved among stations to ensure the groups were consistently applying the protocol. Printed posters with CCT draft distribution, IP data, and barriers were also available for biologists to examine and edit. To keep track of the edits and source on the printed posters, biologists were provided notepads to track and annotate any changes that they made. These notes where added to the database post-workshop.

Each morning at the start of the workshop, participants were given a briefing on protocol and business rules. Participants were then divided into small groups based on their knowledge of a particular geographic area. The team worked to ensure the groups were balanced in terms of agency representation. Each group would complete the first part of the assessment (distribution and attributes) and if necessary, participants would shift groups to provide their expertise in additional geographic areas. When part one was complete for a given geographic area, the participants would complete part two (watershed level assessment). Keeping groups balanced and ensuring the experts were able to participate in all of the geographic areas where they had expertise was the job of the facilitator. The GIS analyst or facilitator was trained to read questions from the protocol verbatim. If prompting or clarification was needed in some cases the facilitator was called in to clarify or provide guidance. Lively conversation and debate was encouraged.

Observations, Current Distribution, Barriers and other attributes

During workshops we followed the protocols developed for the OFHDDS to evaluate distribution and associated attributes. We used MapNotes in GIS as a type of shorthand to capture information. Biologists were prompted to review the barriers depicted on the paper and electronic maps and ask for feedback on location and barrier passage status. In California, barrier assessment followed the protocols of the California Fish Passage Assessment Data protocol (modified in 2014). In other jurisdictions, barrier assessment was based on the StreamNet Exchange Standard (Version 2012.1). This data standard was identified because it is comprehensive and the data definitions align with the barrier types that are present within the entire geographic range of coastal cutthroat trout. Barrier type, origin of the barrier (human or otherwise), and severity of the barrier in terms of fish passage were included (Table 2).

Table 2. Information source to evaluate the passage status of existing barriers.

Passage Status Evaluation Method (Barrier Information Source)
Full Passage Assessment (FishXing, for example)
Other full passage assessment
USFS/BLM Partial assessment
Other partial assessment (including professional judgment)
By evaluation of design plans
Unknown
Not applicable

We also asked participants to characterize fish occurrence above barriers (resident Coastal Cutthroat Trout or Rainbow Trout) and management activities (planned removal or modification of barriers). These data were incorporated into the barrier layer by PSMFC analysts post-workshop.

Other

In addition to distribution and barriers, we asked participants for information on the following data types at the stream segment scale: 1) the basis of the observation (for example, survey vs. professional judgment); 2) the life history forms present (resident, fluvial, adfluvial, and anadromous); 3) habitat distribution use type which specifies to the best of available knowledge the spawning, rearing, migration and other habitat use locations; 4) population origin, and 5) population production. For most localities, the latter two attributes (population origin and production) were set to the default of “native” in terms of origin and “native” in terms of production. The attributes of habitat use and life history were largely unknown. For life history, the default category “mixed resident and anadromous” was commonly used to identify life history as specific habitat use by life history form is not widely known for CCT. A number of additional attributes in the OFHDDS standard were be pre-filled across the board or transcribed post-workshop. These attributes were skipped during the workshop for sake of expediency but they are included in the final products (examples include taxonomic classification at the genus, species and subspecies level, name of source originator & name of source agency/entity providing data and or lending professional judgment).

Watershed assessment, threats, and opportunity

One of the goals of the CCT Interagency Committee is to develop a better understanding of the status of CCT. To address this, the assessment focused questions on non-native species, hybridization, relative habitat health, relative population health, conservation and threats, and estuary health. Because data are limited we asked biologists to rate the relative quality of habitat and population health using the following question format:

1) Relative quality of occupied stream habitat. This question is intended as a qualitative evaluation including combined conditions of habitat for CCT. Includes consideration of large woody debris, pool frequency and pool depth, substrate, and riparian habitat. Question: Using

professional opinion, provide a rating of the CCT habitat in the 5th level HUC relative to the entire region we are assessing (all subunits).

1) High- Excellent to Good habitat quality (e.g., majority of attributes identified as high (e.g. Large woody debris present, ample pool frequency and depth, high quality spawning habitat, quality riparian habitat, etc.).
2) Medium- Medium habitat quality (may have some habitat attributes viewed as high quality and others that are slightly less than ideal)
3) Low- Poor habitat quality (most habitat attributes reflect inferior conditions)
4) Unknown
5) N/A

2) Using professional opinion identify the level of CCT abundance and viability. This question is scaled at the 5th level HUC (use the past ten years as reference) compared to all subunits being evaluated in the workshop.

1) High- CCT are abundant at multiple age classes, mature adults are observed and support a recreational fishery. The population is increasing or stable.
2) Medium- CCT are observed in moderate abundances across age classes. Adults are observed in moderate numbers. Populations are stable.
3) Low- CCT abundances are low, recruitment to larger size or age class is depressed. Populations are declining.
4) Seldom observed- CCT of any age class are rare or rarely observed.
5) Unknown or 6) NA

We provided reference conditions derived from agency reports or monitoring to help bracket the categories for relative habitat and population health responses. These conditions were based on agency reports or published papers (Flosi et al. 1998, Foster et al. 2001, Cannata et al. 2006, for example). We asked participants to rate their basis of response with the criteria shown in Table 1.

In advance of the assessment, we reviewed published and gray literature to understand the known threats to CCT. CCT are vulnerable to factors associated with loss of habitat, including loss of spawning beds and complex off-channel rearing habitat, habitat fragmentation through loss of connected tributaries and rivers, and loss of complex estuary habitat. Connectivity is important to maintaining life history (migratory forms) in CCT thus, diversions, culverts, and dams create upstream, and in some cases down-stream, fish passage barriers, which limit migration corridors were identified as threats. Similarly, dikes or drainage systems for agriculture or flood control can reduce the number of side channels and simplify complex habitat in low-lying coastal areas and estuaries, locations that can be important feeding habitats for sub adult and adult CCT. Increasing pressure on water allocation and introduced and invasive species can lead to non-physical migratory blockages. Because CCT are more reliant on freshwater systems and are found in smaller, steeper, and higher elevation freshwater streams, they may be vulnerable to loss of habitat or potential change in flow regimes (for example, reduced peak flows or reduction in the extent of habitat in headwater streams due to sub-standard base flows) resulting from climate change. During the workshops we provided categorical responses (see below) to participants followed by an open-ended comment period to record these and other types of threats.

Ongoing threats included:

1) Existing or proposed roads
2) Urbanization
3) Mining activities
4) Timber Harvest
5) Agriculture
6) Dams, diversions
7) Barriers
8) Harvest
9) Hatcheries
10) Climate change

We also provided participants and opportunity to record ongoing conservation activities. Conservation activities included:

1) **Instream** a) channel restoration b) bank stabilization c) diversion modification d) barrier removal e) culvert replacement f) installation of fish screens g) Pool development h) spawning habitat enhancement, i) other
2) **Riparian** a) riparian restoration b) riparian fencing
3) **Upslope** a) Increased recruitment of Large Woody debris, slope stabilization, road decommissioning
4) **Regulations/Public outreach** a) Education efforts at site (Interpretative site), b) Special Angling Regulations, c) Land-use mitigation direction and requirements d) Forest Plan direction agency requirements.
5) **Water lease/In-stream flow enhancement** Increase irrigation efficiency
6) **Other**

Results and Discussion

The assessment team held eight workshops in three states that included 157 professional fish biologists as participants. To date, we have assessed 49,865 square miles or approximately 13 million hectares. Workshop locations are shown in Figure 2. The following sections summarize findings from both pre-workshop data gathering and the information gathered in workshops.

Observations and Current Distribution, Intrinsic Potential, Barriers and other attributes.

Observation data and CCT Distribution

Throughout the geographic range of CCT, we have gathered 102,002 records that describe a field survey where CCT were surveyed (incidental or otherwise). Of the 102,002 surveys, no CCT were observed at 27,736 locations, leaving 74,266 positive observations of CCT. Of the positive observations, 342 are professional judgement observations gathered at workshops. The observations by state or provence follow: CA: 4,839 (none observed 198); OR 48,231 (none observed 25,154); WA 3,790 (none observed 667); BC: 15,231 (all positive observations); AK 2,175 (none observed 1,717). The disparity in numbers we report generally reflect sample effort within jurisdiction. The survey records are gathered from 52 state and federal agencies, universities, tribal nations, and NGO's. Data can be viewed here: http://www.coastalcutthroattrout.org. To better understand the relationship of land ownership and survey data, land ownership can be viewed as a layer in the CCT map viewer. (See Figure 3 for an example.) These observation data coupled with professional judgement data provided the baseline for CCT distribution. An example of the traced CCT distribution from these data can be seen in Figure 3.

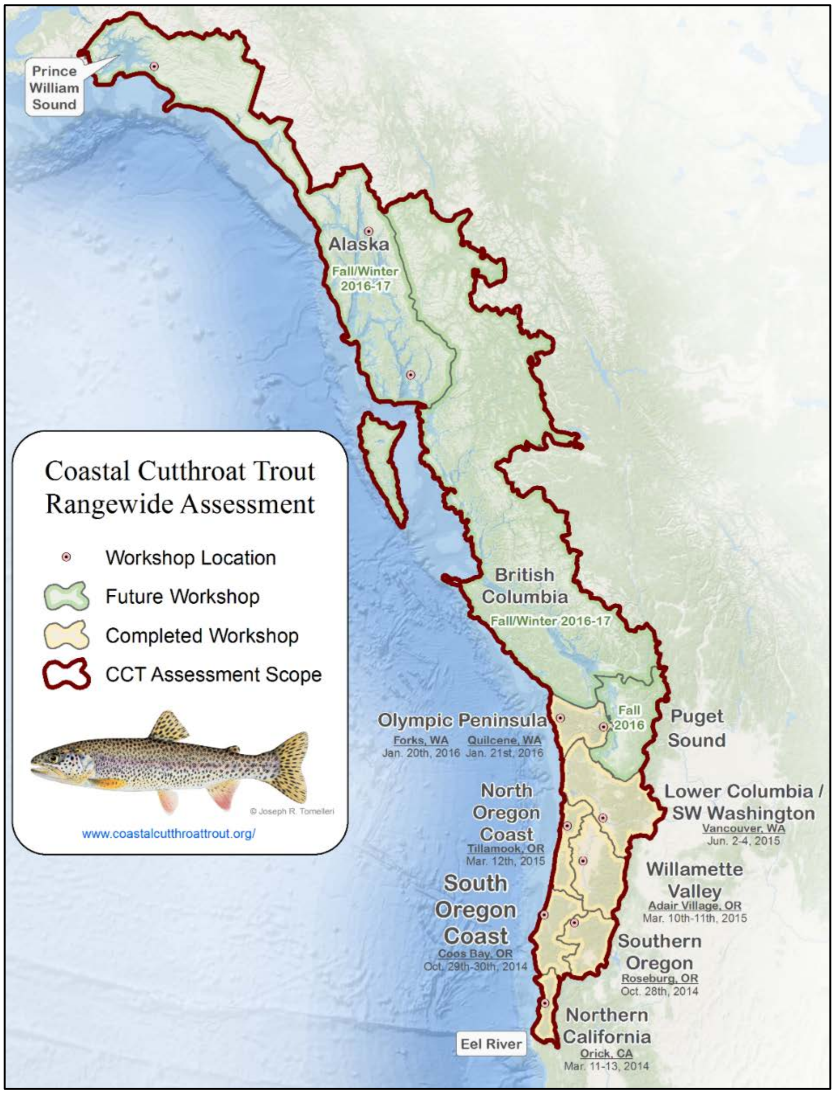

Figure 2. Completed workshops California, Oregon, and a small section of Washington are shown. Locations and workshop dates are shown. Workshops in Puget Sound in Washington State and Alaska will held in 2016-2017.

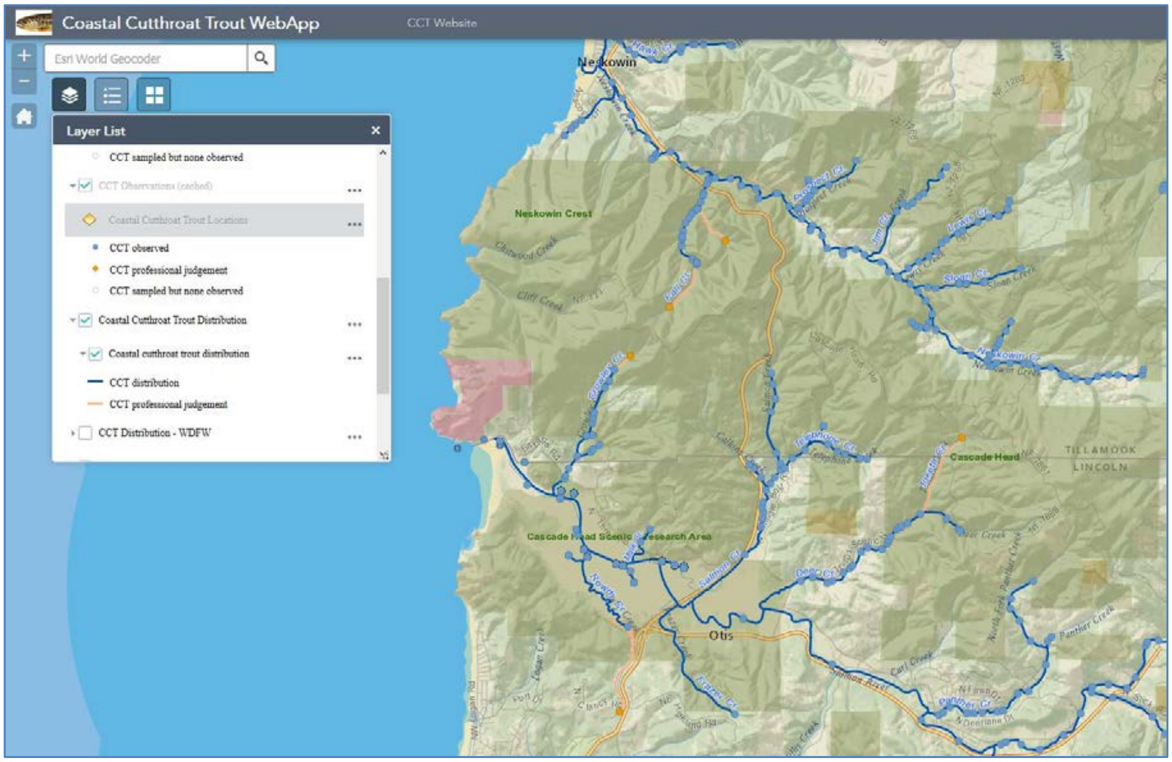

Figure 3. A screen shot of the Coastal Cutthroat Trout (CCT) map viewer depicts an example of observation data resulting from agency field sampling data (blue circles) in Oregon. Blue lines represent CCT draft distribution traced downstream from the uppermost observation. Professional judgement observations are depicted with orange circles and traced downstream with an orange line (until it intercepts a field observation). The landownership layer is enabled in this example. Draft distribution data can be viewed on the online web map at http://www.coastalcutthroattrout.org/

Intrinsic Potential

During the morning sessions while reviewing distribution data, the GIS analysts would display the CCT IP layers for feedback. The suitability curves were also available for review. In general, the feedback from experts regarding the CCT Intrinsic Potential model was favorable. The benefit of the CCT IP was that it was successful in identifying potential habitat, in general, upstream from the existing CCT distribution. This provided a useful reference point for biologists to determine the upstream extent of distribution of CCT and compare to their known sampling framework. There were 23 MapNotes recorded that provided feedback on IP. Approximately half of the responses noted that areas with CCT IP of 0.05 and above was a reasonable approximation for potential habitat for CCT (Figure 5). In addition, a number of comments from Oregon biologists noted that the IP layer was a useful tool to compare with

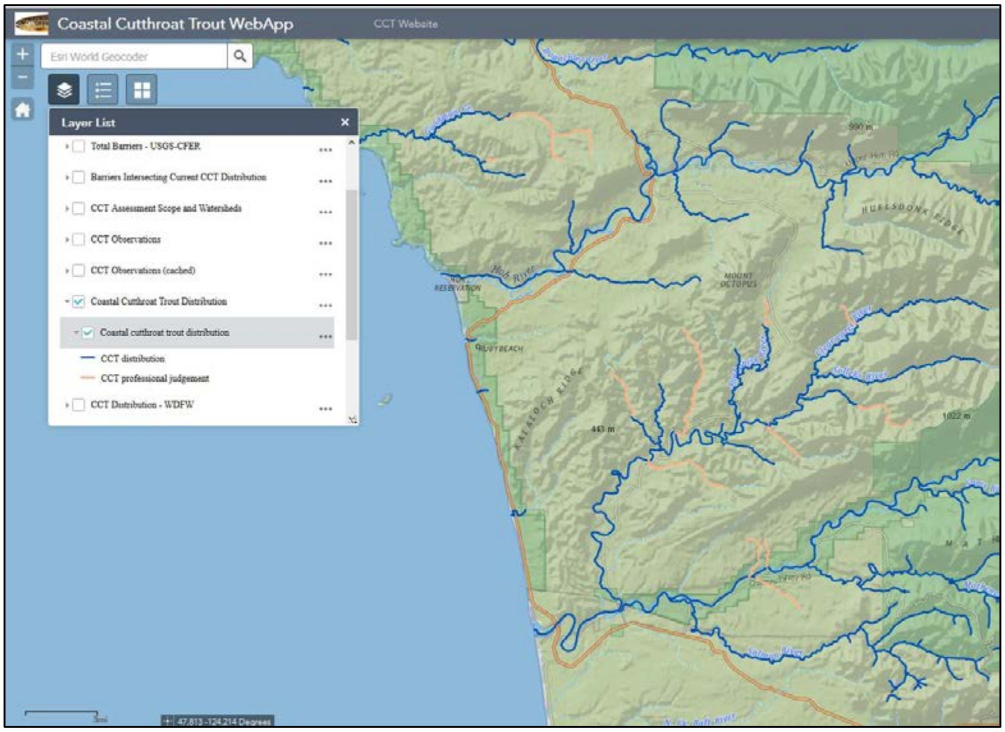

Figure 4. A screen shot taken of the online viewer of Coastal Cutthroat Trout (CCT) data depicts the draft distribution of CCT in a selected area of the Olympic Peninsula. Blue lines depict distribution derived from positive identification of CCT from field sampling. Orange lines depict professional judgement distribution gathered from biologists at the Olympic Peninsula workshop held in early 2016. The map viewer that depicts the draft results of the current distribution of CCT can be found at http://www.coastalcutthroattrout.org/

existing Oregon Department of Forestry fish presence data. In some localized areas, biologists noted that the model overestimated CCT potential habitat. In some of these cases, biologists noted that a filter that employed a geology mask, namely filtering out basalt-dominated habitat, could improve the CCT IP model. In some workshops or locations within workshops, a heavy workload precluded any review of IP. Clearly, more work to improve the CCT IP models is warranted, but the data appeared to provide a useful framework in some locations for the purposes of our assessment.

Barriers

Barriers from the California Passage Assessment database, Green Diamond corporate database, World Waterfall database, and the Oregon Fish Passage Barriers database that intersected the derived CCT distribution were developed by the PSMFC GIS analyst. In addition to these data total anadromous barriers (N=278) from USGS Headwater stream barrier data were included. In total, 7,129 barriers were identified on the CCT stream distribution. Of these, 1,035 are classified as total barriers, 2,017 are partial barriers, 1,605 are classified as non-barriers, and the passage status of 1,597 non-waterfall barriers is unknown. The majority of barriers (4,392) on the CCT distribution are the result of road crossings. Of the total road crossing barriers, 505 are considered total barriers. An example of barriers located on CCT distribution is shown in Figure 6. An example of CCT resident reaches that were identified above waterfall barriers are shown in Figure 7.

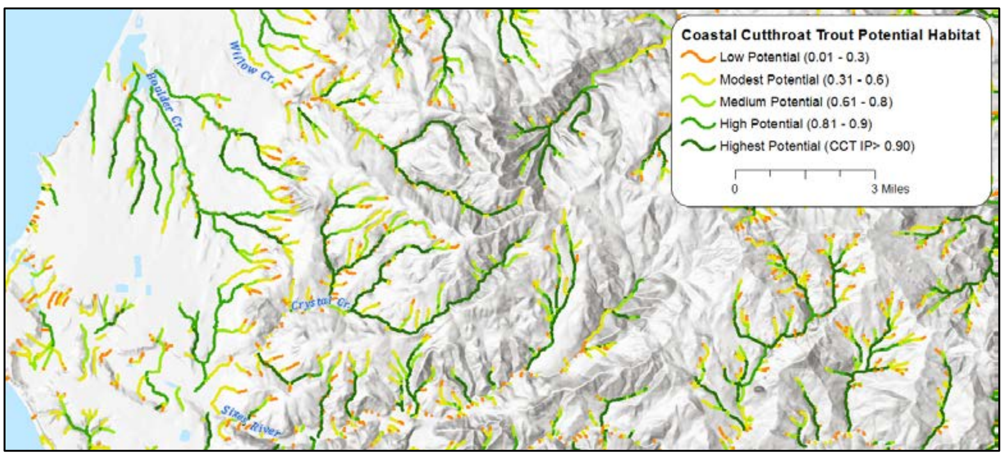

Figure 5. A screen shot of the Coastal Cutthroat Trout (CCT) map viewer (private version) depicts the results of an Intrinsic Potential model developed for juvenile Coastal Cutthroat Trout. Color-coding in inset depicts model fitting ranked from low to high. IP data layers and model input are available upon request.

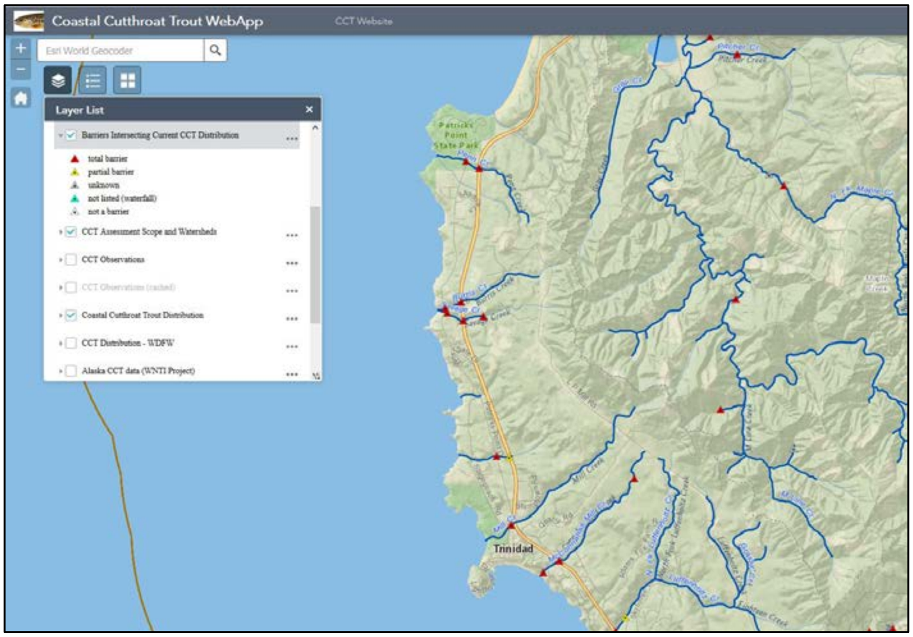

Figure 6. A screen shot taken of the online viewer of Coastal Cutthroat Trout (CCT) data depicts blue line stream distribution of CCT in Northern California/Southern Oregon border with total stream barriers identified. Potential passage status (partial barrier, or non-barrier etc., are shown in the legend, but no examples are depicted in this screenshot). Map viewer with barrier data and passage status can be found at http://www.coastalcutthroattrout.org/

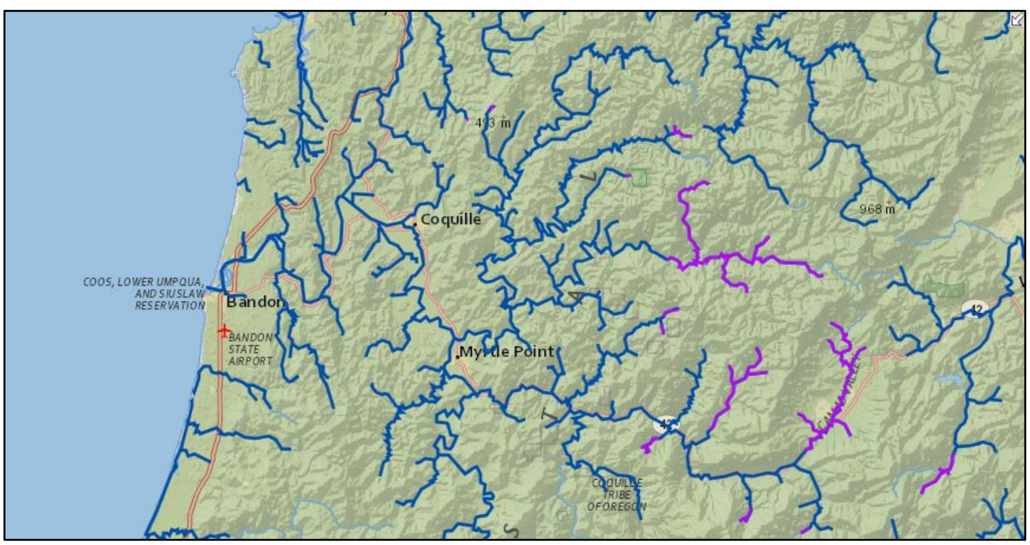

Figure 7. A screen shot of Coastal Cutthroat Trout (CCT) data (private version) shows resident reaches of CCT in the southern Oregon Coast that were identified by biologists in workshops are depicted with purple lines. Blue lines depict the current distribution of CCT below barriers to anadromy.

Watershed assessment, threats, and opportunity

Relative Population and habitat health

Results from this analysis will be presented in future reports and publications. Preliminary results may be requested.

Potential threats and conservation activities

Results on potential threats and conservation activities will be presented in future reports. In general threats or limiting factors varied regionally although potential threats were identified in all watersheds assessed. Threats identified (in no particular order) include: non-native fishes, water quality, water quantity, and over-allocation, barriers leading to fragmentation, loss of habitat from agriculture, timber harvest, or rural encroachment (wineries/agriculture), existing roads, habitat degradation, irrigation diversions, landslide/debris flow potential from past practices in upper reaches, water temperatures in mainstem streams, forestry operations, estuary health, and suction dredging. Future reports will specify threats at the watershed level, or those data may be requested. The most commonly reported conservation activities included dam or other barrier removal, riparian restoration, road decommissioning, and regulations and outreach to the public.

Summary

To our knowledge, this is the first assessment of CCT that is being conducted at the range-wide scale. To date, we have expanded CCT observation and distribution data, developed a potential habitat model for CCT, created a format to share data on CCT with multiple agencies and stakeholders, and developed an assessment protocol that can be applied repeatedly. The outcome of the assessment and the data we have collected may be useful for broad-scale conservation activities.

The results of the assessment may be useful for identifying local-scale conservation opportunities. First, knowing where CCT are found specifically through the observation and distribution data may be useful for planning or developing prioritized restoration. Because we have located barriers on the traced distribution of CCT, there may be opportunities for further analysis to prioritize barrier modification or removal. In addition, the potential habitat model in combination with the distribution data may help plan for future uncertainty in water allocation, flow, and water quality related to climate change.

Our next task is to complete the assessment throughout the rest of the geographic range of CCT. We have tentatively scheduled meetings in Puget Sound, Washington, and Alaska, leaving British Columbia remaining. In addition to completing the assessment and analyzing the data from the assessment, we have additional data types that were provided to us during workshops including abundance and run timing data from smolt traps as well as density estimates. These data may be useful at the broad scale to better understand the range of variability of CCT as well as provide meaningful insight to CCT populations at the local level. Future reports will discuss these and other data from the assessment that were not addressed in this report.

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