The California Salmon Stronghold Initiative

Prepared for

California Department of Fish and Game

by

Wild Salmon Center on behalf of the California Stronghold Team

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Introduction

The following report summarizes progress in developing and advancing the “salmon stronghold approach” in California. The stronghold approach is a wild salmon conservation strategy that seeks to complement ongoing salmon recovery efforts by identifying and conserving the healthiest remaining wild salmon populations and the high value habitats they utilize. The process, which is being managed in California by a team of state, federal, and NGO partners, is part of a broader effort underway by the North American Salmon Stronghold Partnership to advance the stronghold approach throughout the Pacific salmon bearing regions of North America. The stronghold approach relies on sound science, effective local and regional planning, and the increased availability of financial and technical resources to support prevention-based strategies in and across stronghold watersheds. Participation in the stronghold effort is voluntary and incentive driven, and the Stronghold Partnership has no regulatory or enforcement authorities.

This document describes the efforts undertaken to date by the North American Salmon Stronghold Partnership (Stronghold Partnership) in developing the stronghold approach, and California partners in implementing it at the state level. The report is divided into two sections. Section I defines: 1) the “salmon stronghold approach”; 2) the composition, goals, and progress of the Stronghold Partnership; 3) the science of stronghold identification; and 4) the institutionalization of support for prevention-based conservation efforts in and across strongholds. Section II details the implementation of the stronghold approach in California.

Section I
The Salmon Stronghold Approach

Wild salmon are a keystone species and indicator of ecosystem health in freshwater and marine systems across the North Pacific Rim. In North America, the ongoing declines – and more recently, sudden crashes – in systems that historically boasted extraordinary abundance like the Sacramento, Klamath, and Fraser Rivers signal an alarming erosion in watershed health, while highlighting significant management challenges. Because these and other salmon-bearing watersheds generate services that coastal and inland communities rely heavily on (clean water, flood storage, biodiversity, commerce, carbon sequestration, recreation etc.), declines in salmon populations have broad implications for ecological, economic, and human health.

> *"It is a matter of serious regret that our choicest and most valued fish, the ... salmon, is annually decreasing and the supply for exportation and home consumption is diminishing. Unless salmon that now home in our waters are protected and fostered as a nucleus for increase, our rivers will become barren of this most desired fish."*
>
> - *Commissioners of Fisheries of the State of California, 1866* (Beissinger 2008)

In California, the rates of decline in the state's wild salmon populations are alarming. In a recent paper published in Environmental Biology of Fishes, Katz et al. (2012) concluded that if salmonid population trends continue, 25 (or 78%) of the 32 Pacific salmon taxa native to California may be extinct or extirpated within the next century. The drivers of these declines have been well documented in the scientific literature. While habitat loss due to extreme development pressures is the primary cause of declines statewide (Moyle et al. 2008), dozens of additional factors have been identified as contributors to the continued declines (Brown et al. 1994, Lackey 2006) . Climate change impacts across both terrestrial and marine habitats can exacerbate the impacts of many of these contributing factors (Hauri 2009, Siemann and Tillmann 2011).

Although perhaps most pronounced in California, declines in wild salmon populations are, of course, not limited there. Gustafson et al. (2007) found that 29% of the nearly 1,400 populations that once spawned and reared in the watersheds of California and the Pacific Northwest have been extirpated, while an additional one third of the populations across this region are now listed as threatened or endangered under the Endangered Species Act (ESA).

These dramatic declines and the associated losses in habitat quality and availability have triggered a major conservation effort in recent decades, focused largely on halting the continued declines and recovering ESA-listed populations. Since the 1970s, regulatory mechanisms contained in federal laws like the Clean Water Act and ESA have provided conservation interests with legal authorities to stop activities that further threaten wild salmon populations and/or degrade the habitats they rely on. More recently, amendments to these laws and other federal responses like the Pacific Salmon Recovery Fund (established in 2000) began promoting the recovery of listed species by funding extensive habitat restoration and other conservation efforts. The federal government now spends hundreds of millions of dollars annually to fix the mistakes of the past through extensive watershed restoration efforts and the production of hatchery-reared salmon.

Although policies and programs arising from these and other federal initiatives have promoted widespread investment in salmon recovery and watershed restoration, to date no populations of Pacific salmon have been removed from federal ESA protection, while some, like two populations of California coho, are faced with "imminent extinction" (Katz 2012). Consequently, after almost three decades of advancing wild salmon conservation strategies rooted in triage and crisis management, elected officials, policy makers, and resource managers increasingly recognize the importance of preventing harm to the remaining core areas of abundance and productivity. In 2006 a diverse consortium of public and private partners representing federal, state, tribal, and NGO stakeholders convened to describe and advance a broad conservation strategy to secure the health of wild salmon strongholds as a complement to and foundation for ongoing recovery efforts.

The North American Salmon Stronghold Partnership and the "Stronghold Approach"

In the fall of 2006, the Stronghold Partnership convened to explore the feasibility of developing and formalizing an approach to salmon conservation which identifies and protects the health of key centers of productivity, abundance, and diversity (species, run-timing, and life histories). Participating agencies, which now comprise the Stronghold Partnership Board, included:

> *The Stronghold Partnership a is a voluntary, incentive-based, public private partnership whose mission is to identify and protect the healthiest remaining ecosystems in North America to ensure the long-term survival of salmon, steelhead, and the many species that depend on them.*

- US Fish and Wildlife Service (USFWS)
- National Oceanic and Atmospheric Administration (NOAA)
- Bonneville Power Administration (BPA)
- Northwest Power Conservation Council (NWPCC)
- Environmental Protection Agency (EPA)
- US Forest Service (USFS)
- Columbia River Inter-Tribal Fish Commission (CRITFC)
- Alaska Department of Fish and Game (ADFG)
- Washington Department of Fish and Wildlife (WDFW)
- Washington Governor's Salmon Recovery Office (GSRO)
- Oregon Department of Fish and Wildlife (ODFW)

- Oregon Governor's Natural Resources Office (NRO)
- Idaho Office of Species Conservation (IOSC)
- California Department of Fish and Game (CDFG)
- Trout Unlimited (TU)
- The Nature Conservancy (TNC)
- Wild Salmon Center (WSC)

With financial support provided by NOAA, BPA, USFS, private foundations, and other partners, WSC has managed and administered the Stronghold Partnership since its inception.

Guiding Principles. In 2009 the Stronghold Partnership finalized a Charter that described the initiative as a complement to ongoing recovery efforts, providing a foundation for a range-wide conservation strategy spanning the numerous Evolutionary Significant Units (ESU) and populations addressed in recovery plans. The strategy called for "a network of core centers of wild salmon abundance and diversity intended to complement, not substitute for, work in impacted systems. [This network] will maintain and can increase long-term resilience by securing [the health of] genetically diverse source populations of wild Pacific salmon that may also help re-populate or provide other ecological benefits to adjoining areas" (NASSP 2008).

The Stronghold Partnership Charter also established a set of principles upon which to develop and advance the initiative, including the following (NASSP 2008):

- The Stronghold Partnership is a voluntary public-private partnership entity promoting cooperative conservation.
- During periods of rapid environmental change like that anticipated over the next 50 years, maintaining key ecosystem processes and functions is vital to ensuring healthy wild salmon populations and the ecological and economic benefits they provide.
- Extensive efforts are underway to identify causes for decline and promote recovery of listed salmon and steelhead throughout much of North America; the Stronghold Partnership will support and build on these efforts. The Stronghold Partnership will employ a science-based approach to salmon ecosystems, informed by and using the best available science. Management within strongholds will be encouraged to rely on natural processes rather than engineered approaches to increase biological diversity.
- Stronghold partners will work closely with local communities and their elected representatives to ensure that actions taken [i.e. funded] under this initiative are locally supported and, where appropriate, are led by local groups or individuals. The Partnership recognizes and supports the role of working lands in the culture and economy of rural areas, and is counting on the participation of landowners and managers in this effort.

- Where possible, the Stronghold Partnership will seek to streamline existing conservation delivery mechanisms in salmon strongholds.
- Long-term monitoring and assessment is essential to understanding ecosystem trends and identifying limiting factors/threats. Stronghold partners will work to support monitoring and assessment through enhanced coordination, information sharing, and funding.

> *The "stronghold approach"* is a wild salmon conservation strategy designed to complement ongoing salmon recovery efforts. It recognizes a portfolio of watersheds that supports "wild, diverse, and abundant" salmon populations that make the greatest contribution towards regional conservation targets (often those described in recovery plans). The approach seeks to institutionalize support for the conservation of strongholds and to increase and sustain the resources available to advance stronghold conservation strategies. The Stronghold Partnership Board seeks to focus funding on projects in strongholds that: 1) emphasize prevention and innovation; 2) address the systemic forces driving limiting factors; 3) address threats across multiple strongholds, and 4) advance solutions that integrate habitat, hatchery, hydro, and harvest management.*

Goals and Strategies. Following completion of its Charter, the Stronghold Partnership developed its Strategic Plan, which began to define the "stronghold approach" and establish the major goals of the initiative, including: 1) scientific identification of a network of salmon strongholds; 2) support for the development and implementation of innovative, prevention-based strategies to protect strongholds and their wild populations; and 3) the reduction and elimination of factors currently limiting the viability of wild salmon in strongholds, with an emphasis on addressing the larger, systemic forces giving rise to those limiting factors.

Today, the Stronghold Partnership Board pursues these goals under a sequential set of strategies:

1. Develop and oversee a scientific approach to the identification of strongholds;
2. Review and consider draft stronghold maps and confer stronghold status to watersheds or groups of watersheds identified through state-based collaborative processes;
3. Identify conservation priorities and provide technical and financial support for implementation;
4. Institutionalize the stronghold approach by establishing support for stronghold conservation within new and existing policies and programs; and
5. Continue to refine the "Stronghold Approach".

The following describes these concepts generally before detailing progress to date in California.

The Science of Identifying Strongholds

Following completion of the Charter and Strategic Plan, a team of Stronghold Partnership participants began to establish a methodology for identifying strong populations and stronghold watersheds. After numerous refinements, the team arrived at a methodology that could be applied consistently across the region, yet be tailored to meet the needs of each state, which would initiate and convene the process. This methodology can be summarized as follows:

> *<u>What is a Salmon Stronghold</u>?*
>
> *The term "stronghold" refers to a watershed, multiple watersheds, or other defined spatial units where populations are strong and diverse, and habitats have a high intrinsic potential to support a particular species, or suite of species. Salmon Strongholds represent watersheds that have high anadromous salmonid abundance, productivity, and diversity (life history and run timing), as well as habitat quality or other biological attributes important to sustaining viable populations of wild Pacific salmon throughout their range.*

1. Assess ("score") wild populations within the study area based on three criteria: percent of natural origin spawners, life history diversity, and viability (productivity and/or abundance);
2. Identify populations that meet or exceed the threshold for "strong, diverse, and wild";
3. Identify and map salmon stronghold design alternatives, based foremost on the strong population data;
4. Convene a team of regional conservation partners to review stronghold alternatives and agree upon a recommended set of salmon strongholds; and
5. Present the recommended strongholds to the Stronghold Partnership Board for review and approval.

This process is complete in California and nearing completion in Oregon, while Idaho and Washington are in different stages across their ecoregions. The following highlights the major elements of the stronghold identification process that are common across all of the states, including the use of ecoregions, consistent population assessment criteria, and a consistent approach to evaluating criteria. The use of decision support tools vary by state. California made extensive use of cutting edge decision support tools, which is discussed in Section II of this report.

<u>Ecoregions</u>. The Stronghold Partnership selected ecoregions as the desired scale of analysis for Washington, Oregon, Idaho, and California. (Partners in Alaska are evaluating the applicability of this approach across its ecoregions, which boast consistently strong populations.) The Stronghold Partnership adopted an ecoregional approach to reduce bias towards identifying strongholds in coastal and northern watersheds, where abundance tends to be greater than inland and southern watersheds. This bias to areas of greater abundance would under-recognize the genetic and life history diversity that exists across the range of Pacific salmon and is vital to promoting population resilience in the face of changing environmental conditions.

The Stronghold Partnership selected an approach developed by Augerot (2005), which identified and established a series of spatial units called "salmon ecoregions." This approach parses the Pacific Rim into a series of ecosystems that salmon use from rivers to coastal areas, to semi enclosed seas, to straits, to areas of strong and weak upwelling etc. When states initiate the stronghold identification process, planning teams may make minor modifications to the salmon ecoregion boundaries. As a general rule, states are encouraged – though not required – to recognize one stronghold per ecoregion. (See Appendix 1 for additional information on the establishment of ecoregions.)

Populations and Evaluation. The stronghold identification methodology does not use a new population delineation approach, but relies on population identification efforts undertaken by technical recovery teams, state agencies, and tribes. Although different population identification sources were used to delineate populations, all of the population identification efforts used similar or identical concepts and definitions of independent populations as described by McElhany et al. (2000).

Characterization and assessment of populations relies on three metrics and associated criteria, including percent natural origin spawners, viability (as represented by abundance and productivity), and life history diversity. The rationale for these metrics is similar to that described for the VSP parameters (McElhaney et al. 2000) and by NOAA Technical Recovery Teams. This rationale is summarized below.

- Proportion Natural Origin Spawners. Salmon populations develop local adaptation and unique genetic characteristics due to their tendency for strong homing to their place of birth. The interbreeding of hatchery fish with natural fish is one of the major factors that can disrupt the natural rate of gene flow within and between natural populations as well as alter natural genetic evolutionary processes. The genetic impact of hatchery fish spawning naturally varies considerably based on a number of factors including the proportion of spawners, hatchery fish origin, as well as the reproductive success of the hatchery fish. While at the scale of the entire Pacific Northwest/California regions there is a lack of consistent genetics data and historic reference data to allow the use of molecular genetics information as a basis for assessing stronghold potential, there is considerable information and knowledge available at the population scale about the proportion of hatchery fish spawning naturally. Accordingly, there are a variety of specific metrics that could be used to assess genetic integrity. 'Natural origin spawners' was chosen because of its importance to natural population genetic structure and the availability of information.

- Viability (as represented by Abundance/Productivity). Individual population extinction risk is directly related to the combination of abundance and productivity (recruits per spawner) demonstrated by the population. Populations that have high abundance and productivity have greater capacity to persist in the face of substantial environmental variation. High levels of intrinsic productivity provide the resilience needed to rebound quickly following environmental and anthropogenic disturbances that drive abundance to low levels. Population sub-structure is important to long term persistence. Populations that demonstrate consistent high abundance are capable of supporting important population sub-structure.
- Life History Diversity. Life history diversity is critical to long term persistence and for maintaining natural evolutionary processes. Habitat conditions continually change and over the long term major habitat areas are lost and others created. Populations that exhibit broad diversity have greater adaptability and resilience to environmental change. Diversity also allows populations to exploit a broader range of environmental conditions across all life stages. The ability of a population to sustain high survival throughout the life cycle under variable environmental conditions is closely linked to the degree of life history diversity.

Population Scoring: Metrics and Criteria. Because of the inconsistency in population data available across the states and regions occupied by salmon and steelhead, the Stronghold Partnership opted to use an expert opinion survey process to obtain metric ratings for individual populations. This process asked experts to score populations on a scale of 0 to 5 based on individual knowledge of the three criteria discussed above. In addition, experts were asked to characterize their level certainty, also on a 0 to 5 point scale. (See Appendix 2 for details on scoring and instructions to experts.)

In 2008 and 2009, the Stronghold Partnership hosted three workshops where a substantial number of scientists with population specific information and knowledge of spawner origin, abundance/productivity, and life history diversity attended. Two expert workshops were held in Portland, Oregon, the first focused on populations in the Interior Columbia River Basin and the second focused on Western Washington, Puget Sound, and the Lower Columbia River Basin. The third workshop was held in Medford, Oregon to collect data for Southwestern Oregon and Northern California populations.

At each of the workshops, the experts were oriented to the project objectives, survey process, and the metrics and criteria detailed in Appendix 2. Worksheets were provided with lists of all the populations for the geographic area experts were being requested to rate. The sources of information used by the experts varied significantly. In many cases the experts had extensive datasets and viability status reports that had been completed as part of the TRTs viability assessments. At the other extreme no data sources were in hand, and the ratings were developed based strictly on the knowledge and experience of the expert with the subject populations.

Although data were obtained for many populations at the workshops, there remained a significant number of populations within certain geographic areas that were unrated. Numerous online, phone, and in-person contacts were made to fill data gaps. There were also many follow-up contacts with workshop participants to error check data and review expert ratings to ensure consistency and completeness. Additionally, each state committed to augmenting the 2008 and 2009 data with state-convened meetings to ensure the accuracy of the final stronghold network. Section II describes the California-led process, which advanced a more sophisticated methodology and engaged far more participants than the initial effort described here.

Prioritizing Prevention and Institutionalizing Support

Once salmon strongholds are identified and approved by the Stronghold Partnership, the next two steps in the stronghold approach are implemented concurrently. These include: 1) prioritizing preventative conservation strategies in and across strongholds, while 2) working to institutionalize long term support for their implementation.

Threats, Prevention, and Local Needs. All of the strongholds have undergone some degree of assessment and characterization through recovery planning, limiting factors analyses, and other watershed planning exercises. Most of these planning processes have focused heavily on the identification of watershed restoration priorities and related needs like monitoring and research. Although investments in these activities have led to extensive habitat protection/restoration and improved management throughout many salmon-bearing watersheds – including strongholds – forces beyond the reach of local partnerships continue to threaten the health of wild salmon ecosystems. Unfortunately, groups that work strictly at the watershed level, where recovery funds are often invested, often lack the capacity to address the complex legal, cultural, and economic drivers of ongoing habitat loss or new and emerging threats. Examples of these drivers include land and water use policies, market inefficiencies, fish management policies, and large scale ecological threats (climate change, invasive species proliferation etc). These conditions set the stage for the continued erosion of ecosystem health in strongholds and inevitable declines in the wild salmon populations that now anchor recovery efforts.

The stronghold approach seeks to highlight critical prevention-based strategies contained in existing plans, while engaging local partnerships to prioritize the emerging threats and systemic challenges that undermine the effectiveness of ongoing implementation. This phase of work begins with outreach to the conservation partnerships operating in the strongholds. In forums that will vary across the states, the Stronghold Partnership will engage local partners to prioritize not only the key prevention strategies from existing watershed plans, but also identify the common challenges faced across strongholds that undermine the achievement of long term goals. The Stronghold Partnership will capture these issues and the local needs to address them in a *Stronghold Investment Portfolio (Portfolio)*. The Portfolio will be a marketing tool that the Stronghold Partnership and its local partners can use to highlight the critical prevention strategies in and across strongholds, including specific policy measures that stakeholders can advance collaboratively to engage broader systemic challenges. In effect, this Portfolio will provide the road map to major institutional funders on how partners can prevent further harm to California's strongholds and secure the health of its strongest populations.

Institutionalizing Support for Prevention Based Strategies. Because salmon conservation efforts have been driven largely by policies that focus available resources on the recovery of populations listed under the Endangered Species Act, a disproportionately high investment of conservation funds has been dedicated to recovery strategies, while far less has been spent to ensure the continued performance of viable populations and the healthy habitats they rely on. The Stronghold Partnership seeks to institutionalize support for stronghold conservation by ensuring the availability of resources to implement locally-driven strategies like those contained in the Stronghold Investment Portfolios.

The most promising effort to institutionalize the stronghold approach is contained in federal legislation called "The Pacific Salmon Stronghold Conservation Act." The Stronghold Act establishes the conservation of strongholds as a federal priority alongside recovery, while establishing a grants program to support stronghold conservation. The legislation has gained considerable momentum with the support of the full west coast Senate delegation and (in 2011) over 40 co-sponsors in the House of Representatives. In 2011, the bill passed the Senate Commerce Committee and was included in an Omnibus package of natural resource bills that did not reach the floor for a vote.

Status Across the States. Additional efforts to support prevention-based strategies and institutionalize the stronghold approach are underway across the states. Like stronghold identification, these efforts are in different stages of completion across the Pacific Northwest and California. While the Stronghold Partnership has leveraged funds for demonstration projects in Oregon's North Fork John Day stronghold and the Wenatchee and Quinault River strongholds in Washington, a formal process to identify and prioritize projects opportunities and capacity needs across the strongholds has not yet been undertaken, although it has begun in California (see Section II). Similarly, efforts to institutionalize the approach have gained traction. The inclusion of the stronghold approach in the NWPPC's Columbia Basin Plan and inclusion as project selection criteria in the Oregon Governor's Fund for the Environment are two examples.

Section II
The Stronghold Approach in California: Progress and Next Steps

In the last two years a public-private partnership has emerged in California that is committed to advancing the stronghold concept. Through a collaborative process, the "California Stronghold Team" (CA Team) – which includes WSC, TU, CalTrout, TNC, and CDFG – has identified the state's strongholds, highlighted key threats, and begun promoting the approach with key agency partners. With support increasing for the stronghold approach and a committed partnership in place to advance it, California is uniquely positioned to integrate stronghold strategies within its current resource management systems. Integrating the stronghold approach can promote much-needed investment in stronghold conservation, providing partners with the technical and financial support they need to engage both emerging threats and the broader, systemic challenges described in Section 1. The following section describes how partners in California have begun to advance the stronghold approach statewide.

In 2008, the CA Team convened to initiate a multi-phase process to implement the stronghold approach. Phase I focused on the first element of the stronghold approach by initiating a collaborative and science based process to identify the state's strongest wild salmon populations and formally recognize its salmon strongholds. Currently underway, Phase II focuses on identifying the needs of partners working in strongholds that limit or undermine their capacity to sustain the health of strong populations. These needs are being captured in the "California Stronghold Investment Portfolio." Finally, Phase III will focus on increasing the resources available to partners working in strongholds by institutionalizing principles of proactive, prevention-based conservation within existing state and federal resource management programs. This final phase will engage policymakers and private institutions capable of supporting the strategies described in the Stronghold Investment Portfolio.

Phase I: Stronghold Identification in California

As described in Section I of this report, delineation of strongholds is based on spatial and empirical data, decision support tools, and expert judgment. In 2009, the CA Team initiated a formal process to identify the state's wild salmon strongholds. The following details the methodology used in the identification of California's six salmon strongholds.

Defining Ecoregions. The stronghold identification process in California began with the CA Team plus two federal partners (USFWS and NOAA) approving ecoregional boundaries, reviewing the stronghold identification methodology, and establishing a working list of CA salmon experts to engage in an evaluation of the state's wild populations. California was divided into the following ecoregions: Strong Upwelling Year Round (referred to in Figure 1 as North Coast Ecoregion), Klamath River, Sacramento-San Joaquin Rivers, Weak Upwelling Cline (South Coast Ecoregion), and California Undercurrent (Southern California Ecoregion).

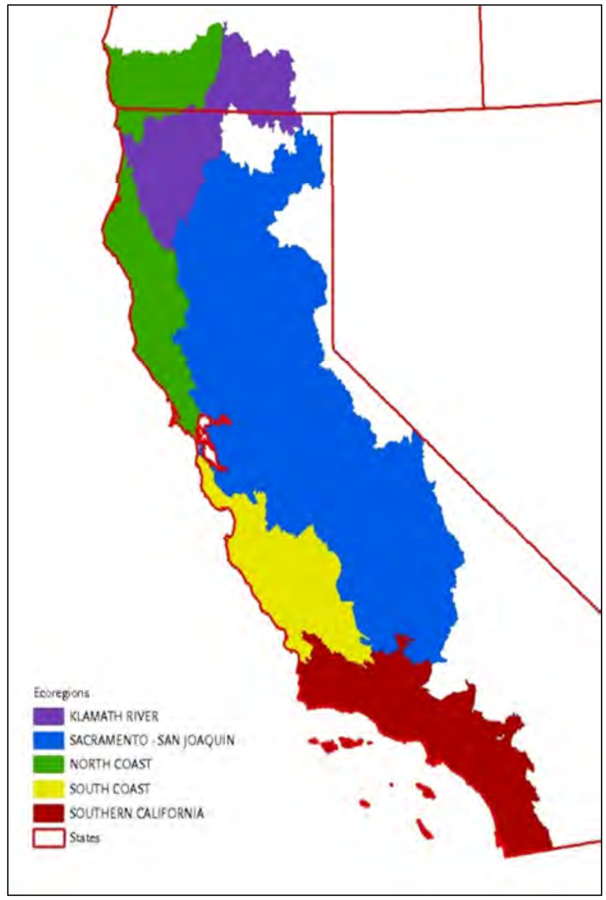

Figure 1. California Salmon Ecoregions. There are five salmon ecoregions in California, with stretching into Oregon.

Populations Scoring. In 2009, CDFG and the Stronghold Partnership began the stronghold identification process by co-hosting a series of workshops throughout CA for salmon and steelhead experts from federal and state agencies, NGOs, and tribal governments. As described in Section I of this report, the purpose was to engage experts on the goals and methodology of the project, and to score the state's wild populations. Experts assessed the status of 507 populations of salmon and steelhead in the context of the five established ecoregions. Experts scored populations on a 0-5 scale based on percent of natural origin spawners, life history diversity, and viability (productivity and/or abundance). They also identified their level of certainty for each population score, and were encouraged to provide any relevant supporting documentation/comments. (See Appendix 3 for reviewer scores and resulting maps by species/run timing.)

Once the population scores were compiled and quality checked, the project team determined which of these populations were "strong, diverse, and wild". For this purpose the team developed a Decision Support Model (DSM) that aggregated the three different scores, as well as the expert certainty scores. The team used the NetWeaver DSM[1] system, which is a tool capable of considering the degree of support for recognizing a population as wild and strong. Populations with at least moderate support for being strong were included for further analysis. From the 507 populations in CA, the NetWeaver DSM assisted the team in identifying 121 populations that could be considered strong, diverse, and wild (Figure 2).

Figure 2. Strong Populations. The highlighted watersheds include 121 populations considered strong by the NetWeaver DSM.

<u>Identifying the "Irreplaceable".</u> The next step in identifying strongholds is to identify the watersheds that represent the highest conservation value for protecting strong wild salmon and steelhead populations within each ecoregion. The team used Marxan software to examine the 121 identified strong populations and highlighted areas that consistently offer the highest conservation value within an ecoregion. Marxan is an optimization algorithm that requires an amount or a quantifiable goal to optimize for. In this case, the project team optimized Marxan to select watersheds with the highest number of the strongest populations and the most suitable habitat within the smallest possible area.

Marxan requires users to input a metric of "suitability cost" to optimize conservation networks at the lowest cost. Watershed condition was used in this analysis to identify a network of strongholds in the best condition. Watersheds that had more degraded habitat have a lower suitability, thus a higher cost, in protecting key ecological processes. Conversely, more pristine watersheds have a lower cost. Marxan optimizes for the lowest cost scenario.

For Marxan's suitability cost requirement, the CA Team used TU's Conservation Success Index (CSI) as the metric for watershed condition. CSI is an index of several different indicators of

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[1] The NetWeaver DSM system is a commonly used decision support system that has been used by the U.S. Forest Service Aquatic and Riparian Effectiveness Monitoring Program (AREMP) of the U.S. Forest Service, as well as other watershed and salmon applications. Available at: http://www.fs.fed.us/biology/fishecology/emp/ (October 2010).

both current watershed condition and future security. Habitat integrity indicators use publicly available spatial data sets to characterize in-stream and watershed conditions. (See Appendix 4 for additional information on CSI.)

Through Marxan, the team produced maps of network design alternatives that identified "irreplaceable" areas that would conserve the highest number of the strongest populations in the most suitable watersheds. A "Population Scoring Index" (PSI), which added the average values of life history diversity, percent natural origin, and twice the viability score for each of the species/run timings, was used to weight the stream miles. This weighting ensured that Marxan focused on subwatersheds with more stream length occupied by the strongest populations (see Appendix 5 for PSI maps by species/run timings). Over 30 different analyses were preformed, with certain watersheds consistently being selected as having high conservation value (see Appendix 6 for selected "sensitivity analyses" that highlight different cost parameters and HUC scales.) All of the network design results were reviewed by the CA Team, which noted the following in developing the stronghold map:

- The Smith River and sections of the Mid-Klamath were almost always selected as irreplaceable by Marxan across all different network design alternatives.
- The Mattole and Eel watersheds were among the most frequently selected watersheds.
- The Big Sur region (not hydrologically connected), when spatially aggregated by Marxan, was also very strong.
- In the Southern Ecoregion, there was no clear "best" between the Santa Maria and Santa Clara watersheds. In the end, the team applied the CSI "Future Security" measure to provide decision support. Future security indicates the long term viability of the watershed to support populations based upon indicators of climate change resiliency, land use conversion, and resource extraction. The Santa Clara showed greater future security than the Santa Maria.

Stronghold Selection. The decision support tools described above did not decide the "final" selection of CA strongholds (shown in Figure 3). Overall, the final selection recognizes those areas that were typically selected as having high conservation value across numerous Marxan analyses; however, there were key decisions made regarding stronghold selection that were beyond the analytical framework provided by Marxan. Additional variables that were considered in the final analysis included the following:

Spatial Distribution. Spatial conservation planning provides a process for investigating alternative spatial arrangements of strongholds. In this analysis, the team developed stronghold alternatives where watersheds were: a) hydrologically connected, b) adjacent, but not hydrologically connected, and c) not connected or adjacent. In the end, the hydrologically connected alternatives provided the most meaningful results because high conservation value

Figure 3. June 2010 Assessment of California Salmon & Steelhead Strongholds.

watersheds were clustered together. The adjacent, but not hydrologically connected solutions were also valuable for highlighting the importance of the Big Sur group of HUC 6 watersheds. While not connected hydrologically, this group of small rivers forms an irreplaceable area for strong steelhead populations.

California's strongholds represent less than five percent of the state, ten percent of salmon bearing streams, and roughly 70 percent of the diversity of salmon and steelhead populations in California. These strongholds include a total of 69 populations of which 29 were rated as strong, diverse, and wild.

Suitability Cost. Suitability cost refers to the relative intactness of watersheds. More intact watersheds will cost less to restore. Since a core component of the stronghold strategy is to protect the best population and watersheds, the suitability cost is a key measure in the stronghold selection process. Multiple suitability cost indicators (habitat integrity, road density, future security etc) were used from the Conservation Success Index. The CSI proved to be a valuable tool for augmenting the expert opinion scores with more quantitative watershed health data.

Scale of the Planning Unit. The results of the analysis were presented across multiple scales in the watershed hierarchy[2] (HUC 4, HUC 5, and HUC 6). Often times, HUC 6 units were too fine as meaningful strongholds since they often covered only a tributary to a significant salmon ecosystem. HUC 4 units encompassed multiple drainages and appeared too large to be "actionable." The project team found HUC 5 units to often be an appropriate scale to encompass the entire population boundary of interest.

Protected Areas. The team agreed that strongholds can build from other protected areas, such as National Parks, Wilderness Areas, and U.S. Forest Service Key Watersheds if they have strong populations and are highlighted by Marxan.

Recommendations to Update and Revise the Map. The work undertaken in CA represents the Stronghold Partnership's most comprehensive and technically rigorous stronghold identification process to date. In designing the methodology, the Stronghold Partnership emphasized the importance of sound science and engaging the broadest possible participation of wild salmon experts. In June 2010, the CA Team presented the California Stronghold map to the Stronghold Partnership Board. During its presentation, Team members underscored that, while participation was robust, inevitably not all of the state's experts (and other interested parties) could be engaged in the scoring process. In addition, the Team also highlighted their consensus that the state's wild salmon populations will inevitably change over time, and a stronghold today may not be one years from now. As a result, the CA Team and Stronghold Partnership

[2] The United States is divided and sub-divided into successively smaller hydrologic units which are classified into four levels: regions, subregions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system. Available at: http://water.usgs.gov/GIS/huc.html (October 2010).

agreed that stronghold maps should be flexible and iterative, and the identification process should accommodate revisions to the map as new information becomes available and improved analytical approaches are developed. Accordingly, the Stronghold Partnership approved the California stronghold map as the "NASSP California Strongholds - June 2010 Assessment."

The CA Team and Stronghold Partnership also agreed on several additional recommendations, including:

1. The State of California (CDFG) should maintain and make publically available all of the data developed during the stronghold identification process, including subsequent data collection and analyses undertaken to evaluate threats in and across the strongholds (discussed below). As a first step, the delivery of this report to CDFG has been accompanied by digital copies of the population data (expert scores) and the GIS layers/analyses contained in Appendices 3 – 6.
2. In partnership with the CA Team, CDFG should convene salmon experts statewide to review and refine as needed the stronghold map every ten years. While a process in 2020 will inevitably vary somewhat to the one used in 2010, the three criteria should remain consistent unless improved and spatially consistent genetic data become available, eliminating the need to apply 'percent natural origin' as a metric for genetic integrity.
3. In the short term, the CA Team should continue to vet the map across the state and report any consistent feedback or recommended modifications to CDFG. In February 2011, members of the CA Team presented the CA stronghold map to the California Fish and Wildlife Commission, which voiced support for the stronghold strategy and the map presented. In March, the CA Team re-convened to present a half day panel on the stronghold effort at California's largest watershed restoration conference, the Salmonid Restoration Federation conference held in San Luis Obispo. The stronghold concept was extremely well received.

During the CA Team's outreach, the only consistent feedback received to date has regarded the boundaries of the Upper Sacramento stronghold. Specifically, stakeholders in this region have questioned the inclusion of Antelope Creek and Pine Creek/Angel Slough within the stronghold boundaries. As the CA Team initiates Phase II of its work (discussed below), members should work with local entities to determine whether the Upper Sacramento boundaries should be refined.

Additional Products. Following the California stronghold identification process, the CA Team sought to characterize major threats in and across the state's strongholds. Trout Unlimited initiated this task by merging information from California Trout's (CalTrout) *Salmon, Steelhead, and Trout in California: Status of an Emblematic Fauna* report (the "SOS Report") with its CSI. As described above, the CSI is a watershed scale collection of information related to a species' distribution, habitat features, and future threats. The SOS Report is a comprehensive account of the status of California's native salmonids, providing detailed information on life history, habitat requirements, abundance, factors affecting status, conservation, and trends for each species. Through the refinement and merger of these resources, the CA Team developed two products to assess threats across California strongholds.

First, the *California Strongholds: Threats and Vulnerabilities Assessment* (see Appendix 4) provides a narrative account of 17 species-specific factors affecting salmonid survival and persistence. These are organized into four thematic groups (range-wide conditions, population integrity, habitat integrity, and future security) and summed for the current distribution of each species/run found within the strongholds. In addition, the document includes a quantitative assessment and map of habitat and landscape data to characterize limiting factors and threats to each stronghold.

Second, led by CalTrout, the California Team developed a Watershed Information System that combines the technologies of Google Earth and GIS to visually portray the information compiled in the assessment described above. The California Stronghold Watershed Information System (CSWIS) is an interactive Google Earth-based system that describes current conditions and identifies threats and primary vulnerabilities in each identified stronghold. The tool is designed to both educate the lay public about the state's strongholds, and highlight for managers priority restoration and protection opportunities.

Layers shown on each map include: stronghold boundaries; base hydrography; fish distribution; water temperature and flow; satellite imagery and aerial photos; water diversions; road density; and the locations of fish passage barriers. The CSWIS also summarizes key threats and provides "Intrinsic Potential" (IP) layers, which show the potential of streams to provide high-quality rearing habitat for coho salmon, Chinook salmon, and steelhead. The CSWIS is designed to be a 'living' database that allows users to update and add information. The site will represent the first of its kind and provide a template to assist other states in communicating the vulnerabilities of and threats to strongholds. Version one of this model is available at California Strongholds.

Phase II: Local Needs and the Stronghold Investment Portfolio

As described previously in this report, the next steps in the stronghold approach following creation of the stronghold map are to:

1. identify both the highest priority prevention strategies necessary to secure the health of strongholds and highlight common systemic challenges faced by local conservation partners, and

2. institutionalize support for prevention-based conservation strategies and those that address broad systemic challenges.

This phase of the stronghold approach in California will begin with the CA Team engaging local partners in the stronghold effort by making presentations to the major partnerships active in each stronghold. WSC will lead this effort with members of the CA Team participating in meetings as their capacities and connections to each stronghold allow. Presentations to the stronghold partners will cover the major elements of the stronghold effort, including the science behind stronghold identification, function of the Stronghold Partnership, opportunities presented by stronghold recognition, progress to date, and the purpose and status of the Pacific Salmon Stronghold Conservation Act.

The Stronghold Investment Portfolio. An important short term result from this outreach will be the appointment of one or more "basin liaison(s)" from each partnership to participate in a one-day meeting focused on development of the *California Stronghold Investment Portfolio* (Portfolio). Scheduled for completion at the end of 2012, the Portfolio will identify the highest priority in-basin prevention strategies as well as the common conservation challenges faced by partners across California's strongholds. WSC will lead development of the Portfolio document with editorial support from the CA Team. Some funding is available to support members of the CA Team and the participation of basin liaisons in Portfolio development.

As described in Section I of this report, the purpose of the California Portfolio will be to highlight the critical prevention strategies and local capacities necessary to secure the health of strongholds over the long term. Specific elements of the report will include the following:

- A statement of conservation objectives in California's strongholds. These will be derived from existing watershed plans, including NOAA Recovery Plans. The Nature Conservancy is also developing a pilot approach for determining desired future conditions; the results of this work may be used in one or more strongholds.
- Prioritized strategies to minimize threats across multiple strongholds. On behalf of the CA Team, WSC will reviewing existing plans and meet with conservation leaders in the strongholds to summarize the highest priority preventative strategies needed to engage ongoing and emerging threats. These strategies may range from a habitat protection project in a single stronghold to new policy measures that foster prevention across multiple strongholds.
- Common conservation challenges faced by local partnerships and the types of support they need to address them. As partners consider preventative strategies, the Portfolio will highlight common impediments to stronghold conservation encountered by partners in strongholds, including the key legal, economic, and cultural drivers of ongoing threats.

In short, the outreach and Portfolio development process will seek to better understand from stronghold partners their highest priority prevention strategies, and the common challenges they face that undermine their ability to secure stronghold health. From this, we hope to highlight both the capacity these partners need to engage critical issues and the specific policy measures that the Stronghold Partnership can advance to support local conservation efforts.

Institutional Outreach. As described in Section I, the CA Team will undertake outreach to institutional partners in California concurrently with outreach to the strongholds. The purpose will be to begin developing the institutional support necessary to ensure the resources are available for local and regional partnerships to advance prevention-based strategies. The CA Team will focus on the creation of new resources, rather than the reallocation of existing salmon conservation resources.

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Appendix 1

Ecoregional Approach and the NASSP Prioritization Process

Ecoregional Approach and the NASSP Prioritization Process

Ecoregions are incorporated into the NASSP prioritization process to account for ecological diversity throughout the planning area. Ecoregions cover large areas of relatively homogenous climatic patterns, geomorphological characteristics, and biotic communities. Ecoregions are commonly used by conservation organizations (TNC, WWF) for planning purposes.

The utility of using ecoregions for salmon planning is to provide an accounting of the genetic and habitat diversity throughout the region. Evolutionary Significant Units (ESUs) provide a more detailed approach. However, ESU boundaries vary among species, creating excessive complexity for delineating "core" and "contributing" strongholds. We will include ESUs in the analytical approach, which will rely on Marxan. Marxan can efficiently deal with the complexity of multiple ESU boundaries. For the spatial template for delineating core and contributing strongholds, we advocate the use of ecoregions.

Several different ecoregion maps have been developed. These include:

- Omernik's ecoregions, EPA.
- Bailey's ecoregions, Forest Service.
- TNC Freshwater ecoregions
- WWF Freshwater ecoregions
- WSC/SoS Salmon Ecoregions

We chose the WSC/SoS Salmon Ecoregions as our base spatial template for prioritization (Map 1). Salmon Ecoregions were developed through an international workshop in Corvallis, OR (1999)[i]. Maps showing the Salmon Ecoregions with Bailey's and Omernik's ecoregions are in Maps 2 and 3.

Salmon Ecoregions represent spatial units that are meaningful for salmon. These were developed in the following way:

- First, by major oceanic divisions, Pacific vs. Arctic Oceans.
- Further delineations were based upon semi-enclosed seas and primary circulation systems with distinct bathymetric characteristics and associated freshwater drainages.
- Final delineations were based upon finer-scale coastal discontinuities within each semi-enclosed sea or major circulation system, including fjords, straits, and areas with distinct production processes (e.g., upwelling and downwelling areas).

Since this is a North Pacific scale ecoregional delineation, it is occasionally necessary to merge, alter, or divide the Salmon Ecoregion boundaries. For example, the Columbia River is treated as one polygon in the Salmon Ecoregions. For planning at the scale of NASSP, it was necessary to split it into finer units based upon sub-watersheds (lower, middle, upper Columbia).

In California, there are 5 ecoregions (Map below): Strong Upwelling Year-round, Klamath River, Sacramento-San Joaquin River, Weak Upwelling Cline, and California Undercurrent. Ecoregion names are from Augerot (2005). We propose merging the Weak Upwelling Cline and California Undercurrent into one ecoregion.

WSC/SoS Salmon Ecoregions

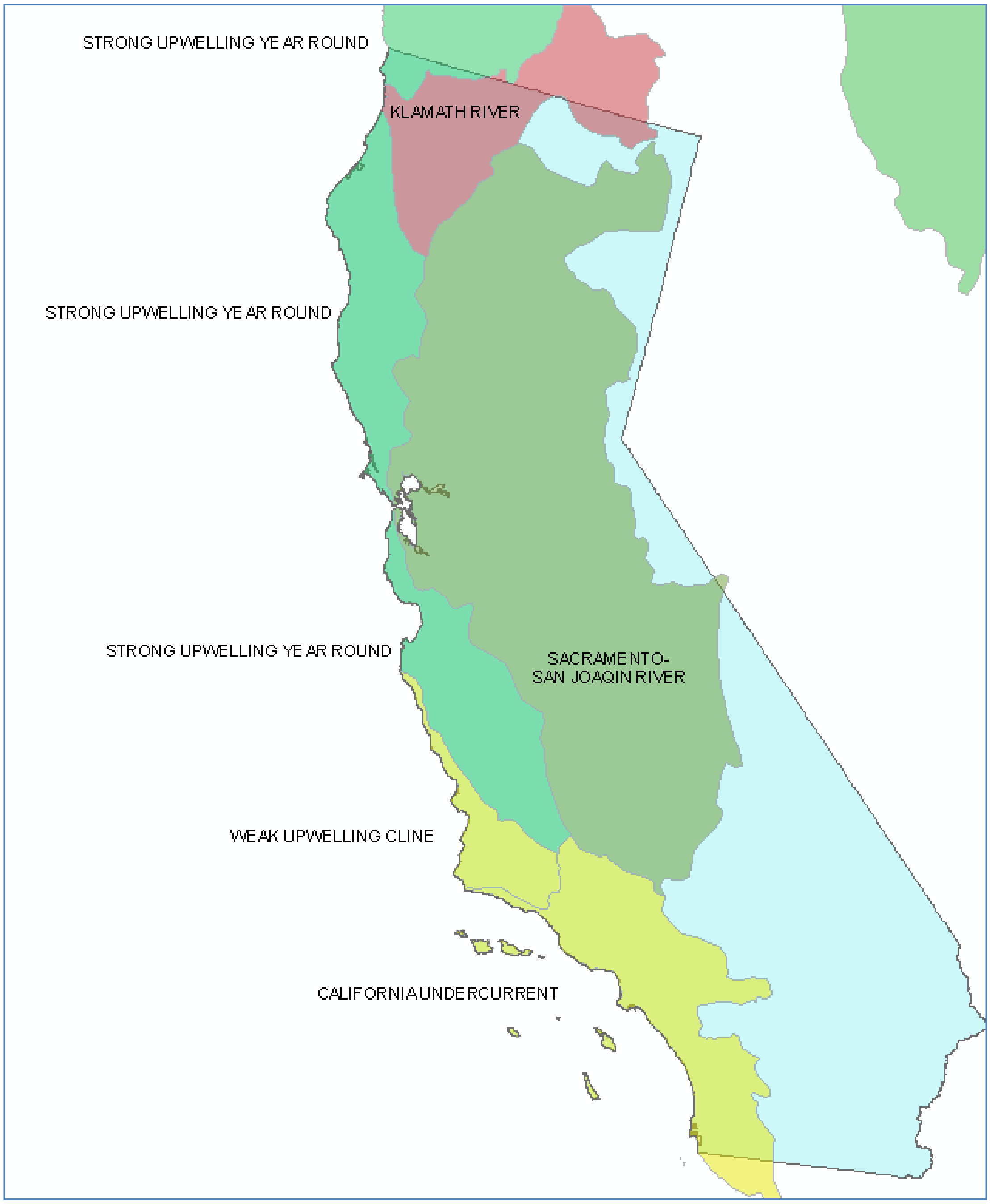
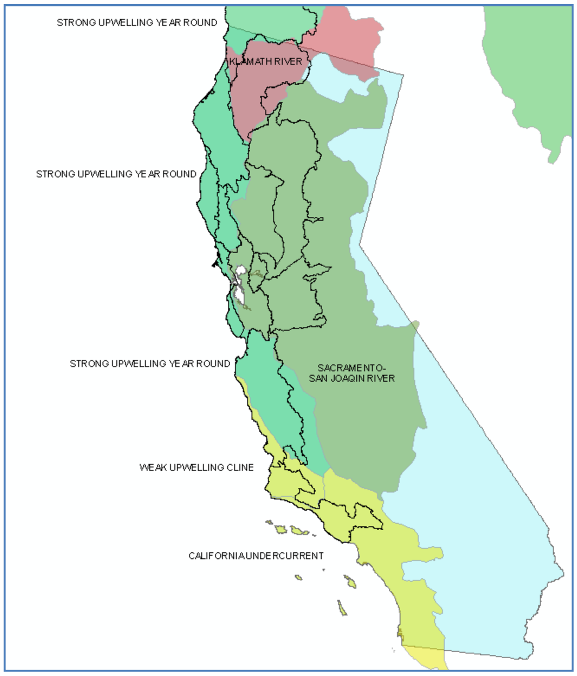


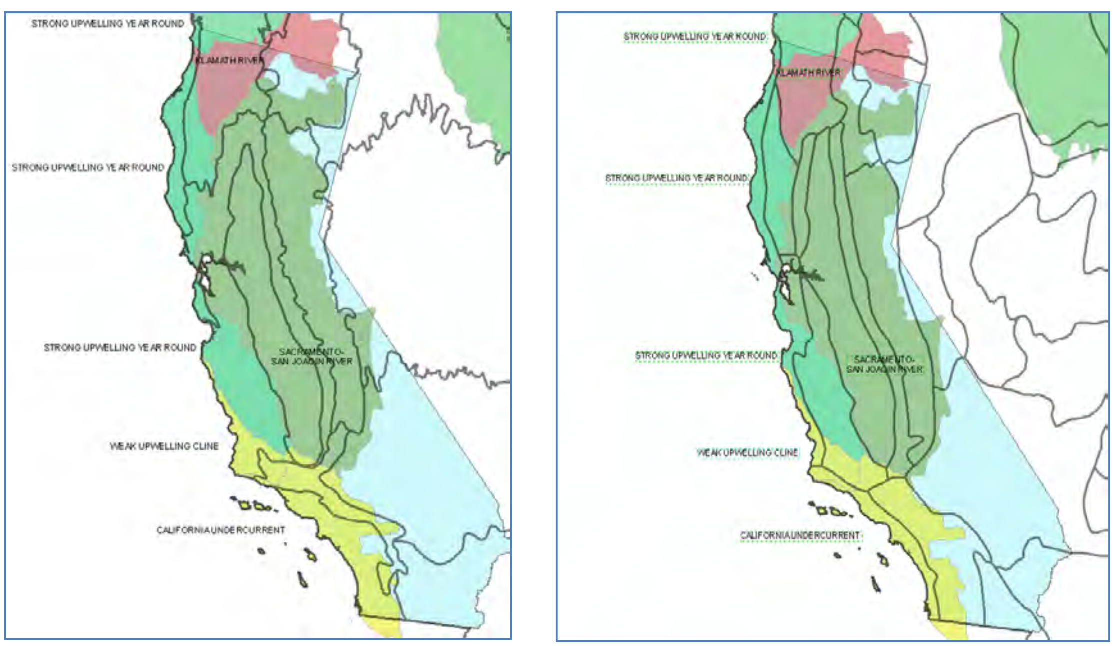
Figure 1. Salmon Ecoregions from Augerot (2005).



Map 2. Salmon Ecoregions (in color) with ESU boundaries (black lines) for chinook, steelhead, and coho.

Ecoregion Alternatives

The following approaches were also considered to determine eco-regions:



Map 3. Salmon Ecoregions, in color. Left: Omerniks Level III ecoregions in grey. Right: Bailey's ecoregions with grey borders.

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[i] Augerot, X., 2005. “Atlas of Pacific Salmon”, Berekeley: University of California Press, 150 pp.

Appendix 2

Population Scoring – Instructions, Guidelines, and Criteria

NASSP Scoring - Instructions and Guidelines

The purpose of this document is to provide general guidance in filling out the population worksheet.

General Guidelines for Scoring:

- When rating a population, try to consider condition over *the most recent ~10 years, or several generations*
- When scoring, try to achieve a balance of absolute and relative (to the ecoregion) condition.
- When rating viability of a population, *consider it within the context of the ecoregion or the ESU/DPS*. The score should be relative to other populations of the same species within the ecoregion or the ESU/DPS (e.g., do not compare to the status of populations in other ecoregions). As a general rule, try to consider the population within the ecoregional boundaries provided in maps. If you feel this is not valid, please make a note of what geography you are considering the population and why.
- Although viability ratings are considered in their ecoregional context, it is still important to try to evaluate the viability of the population, using surrogates like recruits per spawner, or absolute abundance as indirect indicators of viability. A population could be highly viable at low abundance levels, especially if compared to historical abundance. Thus, rating a population's viability should be done in context to its current habitat capacity.
- Score only the populations that you are familiar with or have empirical data to support a score.
- Provide sources and comments to the extent that is possible. Please be sure to add comments on scores of 4 or 5 for viability or life history diversity.
- Keep in mind that you are scoring an aggregate of wild and hatchery fish for each population.

Certainty Criteria:

5 = Excellent – expert is highly certain of rating. High level of confidence based upon multiple years of data, personal involvement in multiple years of surveys or data analysis.

4 = Good – expert is fairly certain of rating. A few years of data, little involvement in surveys or data analysis.

3 = Moderate level of confidence– expert is moderately certain of rating. Based upon limited data sets, data from adjacent (or nearby) areas, sporadic field observations,

2 = Below average confidence – expert has little knowledge or information and little certainty. Limited (e.g., presence/absence) data, some personal knowledge of the area.

1 = Low level of confidence - based on very limited data, little or no fish data balanced with knowledge of habitat data, correlations with nearby rivers, anecdotal evidence.

Viability:

Please provide a rationale for the viability score, particularly for scores of 4 or 5. Please provide an abundance estimate (average over the most recent generations) and a data source. If there is no data source to reference, please provide a range of returning fish (e.g., 500 – 1000; 5,000 – 10,0000; or any range that you feel comfortable with) based upon expert opinion.

5 = Highly viable population that could be exhibiting high productivity or high abundance

Things to consider when rating populations a "5". One or more of these may apply.

- Populations receiving a score of 5 are considered to be "highly viable". A population can be "highly viable" at an abundance that is well below historical levels.
- Simply being more abundant, relatively, than nearby populations in an ecoregion does not, in itself, qualify a population for the status of "highly viable".
- A population that is not considered "viable" in the **absolute sense**[1] should not be scored a "5". If it is one of the strongest populations for that species within the ecoregion, consider a score of "3" or "4" and make a comment.
- Within its ecoregion, the population contributes a **significant** amount to overall abundance in the ecoregion or ESU. (e.g., population x contributes 30% to the overall Central Coast Chinook)
- The population may be a source of colonizers to smaller, less productive populations during times of high abundance
- Consistently have abundance levels that are within the upper percentage (10-25%) for that species and ecoregion (or ESU).
- The recent trend is towards maintaining or improving recent and current abundance and productivity.
- This population has high abundance/productivity relative to its habitat capacity. For a watershed of its size, this population has returns that consistently are within the range of natural variation.
- Any other reason? Please put in the "comments" field.

4 = above average viability (productivity or abundance are likely to be above average for these populations).

- The population contributes a significant amount to overall abundance within the ecoregion, but not the most.
- For some years, will have higher than average abundance and/or productivity levels, but generally not the highest.
- The recent trend for this population abundance may have been stable, increasing, or decreasing; overall, however, the population is thought to be "<u>on the high-side of moderately viable.</u>

3 = moderate productivity and moderate abundance

- Periodically may have high abundance or has moderate levels of production relative to habitat capacity.
- Has abundance levels that are average within the ecoregion for that species.
- The intent of a 3-score is to identify a population that is "middle-of-the-road, moderately viable".
- If a population is not viable in the absolute sense, but is still one of the strongest of a particular species/ecoregion, then a 3 might be the highest possible.

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[1] For example, NOAA TRT viability standards

2 = below average viability (relatively low productivity and low abundance, relative to current habitat capacity)

1 = critically low viability. These are obviously not viable populations, usually displaying critically low abundance, although productivity may be low or high, there simply are not enough spawners to allow the population to be considered viable, on a species-by-species basis.

Percent Natural Origin Spawners (PN):

Percent of adult fish (*within "recent" generations*) on the spawning grounds in recent generations that are natural origin fish.

Criteria:

5 = 95+% natural origin spawners (no hatchery releases within the recent several generations and generally less than 5% stray hatchery fish on spawning grounds).
4 = 75-95% natural origin spawners
3 = 50-74% natural origin spawners
2 = 25-49% natural origin spawners
1 = 0-25% natural origin spawners

Life History Diversity (LHD):

Diversity of life history types expressed within the population relative to the historical range as well as the range expressed across all populations within the species/race.

For example: A Steelhead population would have a high score because of characteristics such as protracted river entry timing, protracted spawning timing, diverse ages at first maturity, diverse ages at smolting, significant percentages and multiple ages of repeat spawners, diverse in-river strategies for selecting overwintering locations by juveniles, and the like. Additional characteristics could include half-pounder life history pattern and contributions to anadromous populations from residents.

Criteria:

5 = all historical life history strategies present.
4 = robust, multiple, and/or rare life history strategies, with majority of historical life strategies present
3 = few life history strategies present and modest representation of life history strategies.
2 = few life history strategies present and significantly simplified from historical
1 = extremely simplified or single life history strategy.

Guidelines for sources:

Provide sources to any relevant information that backs up your score. These can be agency reports, published articles or documents, unpublished reports, web-based data.

If there is no documented information to support the score, please make sure that your level of certainty is captured in the "Expert Certainty" score.

Guidelines for comments:

Please provide any comments that you think are necessary to clarify the scores. These are important. If you need more space, please put comments in a Word document, noting the population that it refers to.

Using the Worksheet:

- There are 4 worksheets within the Excel spreadsheet, divided based upon ecoregion.
- Fill out information for each population under the Viability, Percent Natural, and Life History Diversity headings and provide certainty scores for each heading.
- When you click in a cell for scoring, a drop down box provides the appropriate choices.
- If you want to add a population that is not in the database, scroll down to the bottom of the page and add the population name as indicated.
- Add a source for information in the sources column.
- Provide any comments you can in the "comments" column.
- There are notes regarding the previous population scoring process.
- Ancillary information is provided in the last columns of the worksheet:
    - Area of the population unit
    - The HUC4 level watershed that the population unit falls in.
    - The ESU that the population falls in.

- Don't try to print this worksheet without adjusting to an appropriate page size. It could be a 100 page plus document!

Appendix 3

Population Scores and Maps of Species/Run Timing by Criteria

	Reviewers	Viability				Life History Diversity				Percent Natural				Certainty		
Population		**Min**	**Max**	**Ave**	**Range**	**Min**	**Max**	**Ave**	**Range**	**Min**	**Max**	**Ave**	**Range**	**Viabilit**	**LHD**	**PN**
Alameda Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0			0.0		0.0	0.0	0.0
Alameda Creek Steelhead	2	1	1	1.0	0	2	2	2.0	0	4	5	4.5	1	5.0	3.0	2.5
Albion River Fall Chinook	3	1	2	1.3	1	4	4	4.0	0	5	5	5.0	0	3.0	2.0	4.0
Albion River Fall Coho	3	2	3	2.7	1	3	4	3.7	1	5	5	5.0	0	3.0	2.7	3.7
Albion River Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Alder Creek Fall Chinook	1	3	3	0.0	0	4	4	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Alder Creek Fall Coho	2	0	1	0.5	1	4	4	0.0	0	5	5	0.0	0	3.0	0.0	0.0
Alder Creek Steelhead	2	0	0	0.0	0	4	4	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Alders Creek Steelhead	2	1	4	2.5	3	3	4	3.5	1	5	5	5.0	0	4.0	2.5	4.5
Americano Creek Fall Chinook	1	1	4	0.0	3	3	4	0.0	1	5	5	0.0	0	0.0	0.0	0.0
Americano Creek Fall Coho	1	1	1	1.0	0	3	4	0.0	1	5	5	0.0	0	0.0	0.0	0.0
Antelope Creek Fall Chinook	3	2	2	2.0	0	2	4	3.0	2	2	5	3.0	3	3.7	3.0	3.3
Antelope Creek Spring Chinook	5	1	3	2.2	2	3	4	3.6	1	5	5	5.0	0	4.6	4.6	4.8
Antelope Creek Steelhead	4	2	4	3.5	2	2	5	4.3	3	3	5	4.5	2	3.8	4.3	3.8
Aptos Creek Fall Coho	2	1	1	1.0	0	3	3	3.0	0	1	1	1.0	0	4.5	4.0	5.0
Aptos Creek Steelhead	2	2	2	2.0	0	3	5	4.0	2	4	5	4.5	1	3.5	3.0	3.0
Arroyo Burro Steelhead	2	1	1	1.0	0	3	3	3.0	0	5	5	5.0	0	3.0	3.0	4.5
Arroyo Grande Creek Steelhead	4	1	3	2.5	2	3	4	3.5	1	5	5	5.0	0	2.8	3.0	4.3
Arroyo Hondo Steelhead	3	2	3	2.3	1	4	5	4.7	1	5	5	5.0	0	3.7	4.0	4.3
Arroyo Paredon Steelhead	1	2	2	2.0	0	5	5	5.0	0	5	5	5.0	0	3.0	3.0	4.0
Arroyo Quemado Steelhead	1	1	1	1.0	0	3	3	3.0	0	5	5	5.0	0	3.0	3.0	4.0
Arroyo Seco Steelhead	3	3	4	3.3	1	3	4	3.7	1	5	5	5.0	0	3.0	3.0	4.0
Arroyo Sequit Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Arroyo de la Cruz Steelhead	4	4	4	4.0	0	5	5	5.0	0	5	5	5.0	0	3.7	3.5	4.5
Ash Creek Fall Chinook	3	1	1	1.0	0	2	2	2.0	0	1	5	2.3	4	3.7	3.5	4.0
Ash Creek Steelhead	2	1	3	2.0	2	2	3	2.5	1	3	5	4.0	2	2.5	2.5	4.0
Auburn Ravine Fall Chinook	1	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	3.0	3.0	3.0
Auburn Ravine Steelhead	1	2	2	2.0	0	3	3	3.0	0	2	2	2.0	0	2.0	3.0	2.0
Austin Creek Steelhead	1	4	4	4.0	0	5	5	5.0	0	3	3	3.0	0	4.0	0.0	3.0
Battle Creek Fall Chinook	3	3	5	4.0	2	3	4	3.7	1	1	1	1.0	0	5.0	4.3	5.0
Battle Creek Spring Chinook	1	1	1	1.0	0	3	3	3.0	0	5	5	5.0	0	3.0	3.0	5.0
Battle Creek Steelhead	2	3	3	3.0	0	3	4	3.5	1	3	4	3.5	1	4.0	3.5	4.5
Battle Creek late-fall Chinook	1	3	3	0.0	0	3	4	0.0	1	3	4	0.0	1	0.0	0.0	0.0
Bear Creek Fall Chinook	2	2	2	2.0	0	3	3	3.0	0	3	5	4.0	2	3.5	3.5	3.0
Bear Creek Steelhead	2	1	3	2.0	2	2	3	2.5	1	3	5	4.0	2	2.5	3.5	3.5
Bear River Fall Chinook	2	1	1	1.0	0	1	2	1.5	1	1	5	3.0	4	3.0	3.0	3.0
Bear River Fall Chinook	2	1	1	1.0	0	3	3	3.0	0	4	4	4.0	0	3.5	3.0	4.0
Bear River Fall Coho	3	0	1	0.3	1	3	3	0.0	0	4	4	0.0	0	2.0	0.0	0.0
Bear River Steelhead	5	1	4	2.8	3	2	4	3.0	2	1	5	3.5	4	3.0	3.5	3.5
Bears River Fall Chinook	1	1	1	1.0	0	2	4	0.0	2	1	5	0.0	4	4.0	0.0	0.0
Beegum/ Cottonwood Creek Spring Chinook	3	1	3	2.3	2	3	4	3.3	1	5	5	5.0	0	4.7	4.3	5.0
Bell Canyon Steelhead	1	1	1	1.0	0	3	3	3.0	0	5	5	5.0	0	3.0	3.0	4.0
Big Chico Creek Fall Chinook	2	2	2	2.0	0	4	4	4.0	0	0	1	0.5	1	3.5	0.0	3.0
Big Chico Creek Spring Chinook	2	1	2	1.5	1	5	5	5.0	0	1	5	3.0	4	3.5	5.0	5.0
Big Chico Creek Steelhead	2	2	2	2.0	0	2	5	3.5	3	3	4	3.5	1	2.5	3.0	2.5
Big Creek Steelhead	3	3	4	3.7	1	4	5	4.7	1	5	5	5.0	0	3.0	3.3	4.3
Big River Fall Chinook	2	1	2	1.5	1	1	1	1.0	0	5	5	5.0	0	2.5	1.0	4.0
Big River Fall Coho	3	1	3	2.0	2	1	3	2.0	2	5	5	5.0	0	2.3	1.7	4.0
Big River Steelhead	2	3	3	3.0	0	1	3	2.0	2	5	5	5.0	0	1.5	1.0	4.0
Big Salmon Creek Fall Chinook	1	3	3	0.0	0	1	3	0.0	2	5	5	0.0	0	0.0	0.0	0.0
Big Salmon Creek Fall Coho	2	3	3	3.0	0	3	4	3.5	1	5	5	5.0	0	2.0	2.0	3.5
Big Salmon Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Big Sur River Steelhead	4	4	5	4.3	1	5	5	5.0	0	5	5	5.0	0	3.3	2.3	4.5
Big Sycamore Canyon Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Bixby Creek Steelhead	2	3	4	3.5	1	5	5	5.0	0	5	5	5.0	0	3.0	2.5	4.5
Brush Creek Fall Chinook	1	3	4	0.0	1	5	5	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Brush Creek Fall Coho	2	1	2	1.5	1	0	2	1.0	2	5	5	5.0	0	2.0	0.5	3.0
Brush Creek Steelhead	1	2	2	2.0	0	0	0	0.0	0	5	5	5.0	0	2.0	1.0	4.0
Butte Creek Fall Chinook	2	2	3	2.5	1	4	4	4.0	0	2	2	2.0	0	5.0	3.5	3.5
Butte Creek Spring Chinook	3	5	5	5.0	0	5	5	5.0	0	5	5	5.0	0	4.7	5.0	5.0
Butte Creek Steelhead	2	2	2	2.0	0	2	5	3.5	3	3	4	3.5	1	2.5	3.0	3.0
Calaveras River Fall Chinook	3	1	2	1.7	1	0	2	0.7	2	1	5	3.0	4	2.7	1.0	2.3
Calaveras River Steelhead	2	2	3	2.5	1	0	2	1.0	2	2	2	2.0	0	2.5	1.5	1.0
Carmel River Steelhead	3	4	4	4.0	0	4	5	4.7	1	5	5	5.0	0	4.0	4.3	4.3
Carpinteria Salt Marsh Complex Steelhead	2	1	2	1.5	1	3	3	3.0	0	5	5	5.0	0	3.0	3.0	4.0
Caspar Creek Fall Chinook	1	1	2	0.0	1	3	3	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Caspar Creek Fall Coho	3	2	3	2.7	1	3	4	3.7	1	5	5	5.0	0	3.7	3.3	4.0
Caspar Creek Steelhead	2	2	3	2.5	1	3	4	3.5	1	5	5	5.0	0	3.5	3.0	4.0
Cayucos Creek Steelhead	2	1	2	1.5	1	3	3	3.0	0	5	5	5.0	0	3.0	3.0	4.5
Cañada San Onofre Steelhead	1	2	2	2.0	0	3	3	3.0	0	5	5	5.0	0	3.0	3.0	4.0
Cañada de Santa Anita Steelhead	3	1	2	1.3	1	2	5	3.3	3	5	5	5.0	0	3.0	3.3	4.3
Cañada de la Gaviota Steelhead	3	2	3	2.5	1	4	5	4.3	1	5	5	5.0	0	3.0	3.7	4.3
Cañada del Capitan Steelhead	2	1	2	1.5	1	2	4	3.0	2	5	5	5.0	0	2.5	3.0	4.0
Cañada del Corral Steelhead	2	1	1	1.0	0	2	3	2.5	1	5	5	5.0	0	2.5	3.0	4.0
Cañada del Refugio Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	4.0
Cañada del Venadito Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0

	Reviewers	Viability				Life History Diversity				Percent Natural				Certainty		
Population		**Min**	**Max**	**Ave**	**Range**	**Min**	**Max**	**Ave**	**Range**	**Min**	**Max**	**Ave**	**Range**	**Viabilit**	**LHD**	**PN**
Chorro Creek Steelhead	3	2	3	2.7	1	4	5	4.5	1	5	5	5.0	0	3.0	3.5	4.7
Churn Creek Fall Chinook	2	1	3	2.0	2	2	2	2.0	0	1	5	3.0	4	3.0	3.5	4.0
Churn Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	4.0
Clear Creek Fall Chinook	4	4	5	4.8	1	3	5	3.8	2	2	5	2.8	3	5.0	5.0	4.8
Clear Creek Late-Fall Chinook	2	3	5	4.0	2	3	5	4.0	2	1	5	3.0	4	4.5	4.5	5.0
Clear Creek Spring Chinook	4	1	4	3.0	3	3	5	4.5	2	3	5	4.3	2	4.8	4.8	4.5
Clear Creek Steelhead	4	4	4	4.0	0	4	5	4.8	1	4	5	4.8	1	4.8	4.5	3.5
Coon Creek Fall Chinook	1	2	2	2.0	0	2	2	2.0	0	1	1	1.0	0	2.0	2.0	2.0
Coon Creek Steelhead	3	1	3	2.0	2	2	5	3.5	3	1	5	3.7	4	2.3	3.0	4.0
Corte Madera Creek Fall Coho	2	1	1	1.0	0	0	2	1.0	2	5	5	5.0	0	3.0	3.0	4.0
Cosumnes River Fall Chinook	3	2	2	2.0	0	0	2	0.7	2	2	5	3.5	3	2.7	1.0	2.7
Cosumnes River Steelhead	2	1	2	1.5	1	0	2	1.0	2	1	1	1.0	0	1.5	1.5	1.5
Cottaneva Creek Fall Chinook	2	2	2	2.0	0	0	0	0.0	0	0	0	0.0	0	2.0	2.0	3.0
Cottaneva Creek Fall Coho	3	1	2	1.7	1	1	4	3.0	3	5	5	5.0	0	2.7	2.3	4.0
Cottaneva Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	3.0
Cottonwood Creek Fall Chinook	3	2	4	3.3	2	3	4	3.3	1	2	5	3.0	3	4.0	3.7	3.3
Cottonwood Creek Steelhead	2	1	3	2.0	2	2	4	3.0	2	3	4	3.5	1	2.5	2.5	2.5
Cow Creek Fall Chinook	3	3	4	3.7	1	3	3	3.0	0	2	5	3.0	3	4.0	3.7	3.3
Cow Creek Steelhead	2	2	3	2.5	1	2	4	3.0	2	3	5	4.0	2	2.5	2.0	3.5
Coyote Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	3	5	0.0	2	0.0	0.0	0.0
Coyote Creek/ Oat Creek Fall Chinook	2	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	4.0	4.0	4.0
DeHaven Creek Fall Chinook	2	0	0	0.0	0	1	1	1.0	0	1	1	0.0	0	1.0	0.0	0.0
DeHaven Creek Fall Coho	2	0	1	0.5	1	1	1	1.0	0	5	5	5.0	0	2.0	0.0	4.0
DeHaven Creek Steelhead	2	0	0	0.0	0	1	1	1.0	0	5	5	5.0	0	1.0	0.0	4.0
Deer Creek Fall Chinook	3	2	3	2.7	1	3	4	3.3	1	2	3	2.3	1	4.7	3.7	4.3
Deer Creek Spring Chinook	6	4	5	4.8	1	4	5	4.5	1	5	5	5.0	0	4.8	4.8	4.8
Deer Creek Steelhead	5	3	4	3.8	1	4	5	4.8	1	4	5	4.8	1	3.4	4.0	3.0
Denniston Creek Steelhead	1	1	1	1.0	0	4	5	0.0	1	5	5	5.0	0	4.0	0.0	5.0
Diablo Canyon Steelhead	2	1	2	1.5	1	4	4	4.0	0	5	5	5.0	0	3.0	3.0	4.5
Dillon & Clear Creek Summer Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	4.0	4.0	4.0
Dos Pueblos Canyon Steelhead	3	1	1	1.0	0	2	3	2.3	1	5	5	5.0	0	2.5	2.7	3.7
Doyle Creek Fall Coho	1	1	1	0.0	0	2	3	0.0	1	5	5	0.0	0	0.0	0.0	0.0
Dry Creek Fall Chinook	1	2	2	2.0	0	2	2	2.0	0	1	1	1.0	0	3.0	2.0	2.0
Dry Creek Steelhead	2	1	4	2.5	3	2	3	2.5	1	2	2	2.0	0	3.5	3.0	2.0
Dry River Steelhead	1	3	3	3.0	0	3	3	3.0	0	1	1	1.0	0	4.0	4.0	4.0
Dutch Bill Creek Steelhead	1	3	3	0.0	0	3	3	0.0	0	1	1	0.0	0	0.0	0.0	0.0
Dye Creek Fall Chinook	3	1	1	1.0	0	1	2	1.3	1	1	1	1.0	0	4.0	4.0	4.0
Dye Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	3	3	3.0	0	2.0	2.0	2.0
Eagle Canyon Steelhead	1	0	0	0.0	0	1	1	1.0	0	5	5	5.0	0	3.0	1.0	4.0
Elder Creek Fall Chinook	1	1	1	1.0	0	1	1	0.0	0	0	0	0.0	0	3.0	0.0	0.0
Elder Creek Fall Steelhead	1	1	1	1.0	0	1	1	0.0	0	0	0	0.0	0	3.0	0.0	0.0
Elder Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	3	3	3.0	0	2.0	2.0	2.0
Elk Creek Fall Chinook	1	1	1	0.0	0	2	2	0.0	0	3	3	0.0	0	0.0	0.0	0.0
Elk Creek Fall Coho	2	1	1	1.0	0	2	2	0.0	0	3	3	0.0	0	3.0	0.0	0.0
Elk Creek Steelhead	1	0	0	0.0	0	0	0	0.0	0	5	5	5.0	0	1.0	1.0	4.0
Elks Creek Fall Coho	1	0	0	0.0	0	0	0	0.0	0	5	5	5.0	0	0.0	0.0	4.0
Frenchmans Creek Steelhead	1	2	2	2.0	0	0	0	0.0	0	5	5	5.0	0	3.0	0.0	5.0
Gabilan Creek Steelhead	2	1	1	1.0	0	2	3	2.5	1	5	5	5.0	0	2.0	2.5	4.5
Garcia River Fall Chinook	3	1	2	1.5	1	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Garcia River Fall Coho	3	1	3	1.7	2	1	4	2.3	3	5	5	5.0	0	2.7	2.0	3.3
Garcia River Steelhead	2	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	2.5	3.0	4.0
Garrapata Creek Steelhead	3	3	4	3.3	1	4	5	4.7	1	5	5	5.0	0	3.3	3.3	3.7
Gato Canyon Steelhead	1	0	0	0.0	0	1	1	1.0	0	5	5	5.0	0	3.0	1.0	4.0
Gazos Creek Fall Coho	2	1	1	1.0	0	3	3	3.0	0	1	1	1.0	0	4.5	4.0	5.0
Gazos Creek Steelhead	2	2	2	2.0	0	3	5	4.0	2	4	5	4.5	1	3.5	3.0	3.0
Goleta Slough Complex Steelhead	2	2	2	2.0	0	4	5	4.5	1	5	5	5.0	0	3.0	3.5	4.0
Greenwood Creek Fall Chinook	1	2	2	0.0	0	4	5	0.0	1	5	5	0.0	0	0.0	0.0	0.0
Greenwood Creek Fall Coho	2	1	2	1.5	1	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Greenwood Creek Steelhead	2	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Guadalupe River Fall Coho	1	1	1	1.0	0	0	0	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Gualala River Fall Chinook	2	0	1	0.5	1	1	1	1.0	0	0	0	0.0	0	3.5	4.0	4.0
Gualala River Fall Coho	2	1	2	1.5	1	1	2	1.5	1	5	5	5.0	0	3.5	3.5	3.0
Gualala River Steelhead	3	3	4	3.3	1	3	4	3.3	1	5	5	5.0	0	4.0	3.3	3.3
Guthrie Creek Fall Coho	2	1	1	1.0	0	0	0	0.0	0	5	5	5.0	0	3.0	0.0	5.0
Guthrie Creek Steelhead	1	2	2	2.0	0	0	0	0.0	0	5	5	5.0	0	2.0	0.0	5.0
Hardy Creek Fall Coho	2	1	2	1.5	1	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Hardy Creek Steelhead	2	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Hare Creek Fall Coho	2	2	2	2.0	0	2	4	3.0	2	5	5	5.0	0	3.5	3.0	4.0
Hare Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	4.0
Howard Creek Fall Coho	2	0	1	0.5	1	1	1	1.0	0	5	5	5.0	0	2.0	0.0	4.0
Howard Creek Steelhead	2	0	0	0.0	0	1	1	1.0	0	5	5	5.0	0	0.0	0.0	4.0
Humboldt Bay Creeks Fall Coho	5	3	4	3.4	1	3	5	3.8	2	4	5	4.4	1	3.2	3.4	4.2
Humboldt Bay Fall Chinook	5	1	3	1.8	2	3	5	3.4	2	3	5	4.6	2	3.0	3.0	4.2
Humboldt Bay Steelhead	5	2	3	2.8	1	3	5	3.7	2	4	5	4.6	1	3.2	3.0	3.8
Inks Creek Fall Chinook	4	1	1	1.0	0	2	2	2.0	0	1	5	2.0	4	3.8	3.5	3.5
Islay Creek Steelhead	2	2	4	3.0	2	5	5	5.0	0	5	5	5.0	0	3.0	3.0	4.5

	Reviewers	Viability				Life History Diversity				Percent Natural				Certainty		
Population		Min	Max	Ave	Range	Min	Max	Ave	Range	Min	Max	Ave	Range	Viabilit	LHD	PN
Jalama Creek Steelhead	3	1	2	1.5	1	2	3	2.7	1	5	5	5.0	0	2.0	3.0	3.7
Juan Creek Fall Coho	2	0	1	0.5	1	1	1	1.0	0	5	5	0.0	0	1.5	0.0	0.0
Juan Creek Steelhead	2	0	0	0.0	0	1	1	1.0	0	5	5	5.0	0	2.0	0.0	4.0
Jug Handle Creek Fall Coho	1	1	1	1.0	0	1	1	1.0	0	5	5	5.0	0	1.0	1.0	4.0
Jug Handle Creek Steelhead	2	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Laguna Creek Fall Coho	2	1	1	1.0	0	3	3	3.0	0	1	1	1.0	0	4.0	4.0	3.0
Laguna Creek Steelhead	2	2	2	2.0	0	0	5	2.5	5	4	5	4.5	1	3.0	2.5	3.0
Lagunitas Creek Fall Coho	3	3	4	3.3	1	3	4	3.7	1	5	5	5.0	0	4.3	3.0	4.7
Lagunitas Creek Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Limekiln Creek Steelhead	3	2	4	2.7	2	3	5	4.3	2	5	5	5.0	0	3.3	3.0	4.3
Little Pico Creek Steelhead	3	2	4	3.0	2	5	5	5.0	0	5	5	5.0	0	3.0	3.0	4.7
Little River (H) Fall Chinook	4	2	3	2.8	1	2	4	3.0	2	4	5	4.5	1	3.0	3.0	3.5
Little River (H) Steelhead	3	3	3	3.0	0	3	4	3.3	1	4	5	4.3	1	3.3	4.0	4.0
Little River (Me) Fall Coho	2	2	3	2.5	1	3	4	3.5	1	5	5	5.0	0	3.0	2.5	4.0
Little River (Me) Steelhead	2	1	2	1.5	1	2	4	3.0	2	5	5	5.0	0	3.0	2.5	4.0
Little River Fall Coho	3	3	3	3.0	0	3	4	3.3	1	4	5	4.3	1	3.3	4.0	4.0
Little Sacramento River Chinook	2	3	3	0.0	0	3	4	0.0	1	1	1	1.0	0	0.0	0.0	0.0
Little Sacramento River Fall Chinook	2	3	3	0.0	0	3	4	0.0	1	1	1	1.0	0	0.0	0.0	0.0
Little Sacramento River Spring Chinook	2	3	3	0.0	0	3	4	0.0	1	1	1	1.0	0	0.0	0.0	0.0
Little Sacramento River Steelhead	2	3	3	0.0	0	3	4	0.0	1	1	1	1.0	0	0.0	0.0	0.0
Little Sur River Steelhead	2	4	5	4.5	1	5	5	5.0	0	5	5	5.0	0	3.0	2.5	4.5
Lobitos Creek Steelhead	1	2	2	2.0	0	5	5	0.0	0	5	5	5.0	0	4.0	0.0	5.0
Los Angeles River Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Los Osos Creek Steelhead	2	2	2	2.0	0	5	5	5.0	0	5	5	5.0	0	3.0	4.0	4.5
Lower American River Fall Chinook	2	3	4	3.5	1	2	3	2.5	1	2	4	3.0	2	4.5	4.0	4.5
Lower American River Steelhead	1	3	3	3.0	0	3	3	3.0	0	1	1	1.0	0	4.0	4.0	4.0
Lower Eel River Fall Chinook	8	2	4	3.0	2	3	4	3.3	1	4	5	4.3	1	3.9	3.3	4.0
Lower Eel and Van Duzen Rivers Fall Coho	5	1	2	1.8	1	1	3	2.5	2	4	5	4.5	1	3.5	3.0	3.5
Lower Feather River Fall Chinook	1	5	5	5.0	0	3	3	3.0	0	1	1	1.0	0	5.0	5.0	4.0
Lower Feather River Spring Chinook	1	4	4	4.0	0	3	3	3.0	0	1	1	0.0	0	4.0	4.0	5.0
Lower Feather River Steelhead	1	3	3	3.0	0	3	3	3.0	0	1	1	1.0	0	4.0	4.0	4.0
Lower Klamath River Fall Chinook	2	3	3	3.0	0	4	5	4.5	1	5	5	5.0	0	3.5	3.5	4.0
Lower Klamath River Fall Coho	2	3	4	3.5	1	3	4	3.5	1	4	5	4.5	1	3.0	3.0	3.0
Lower Klamath River Steelhead	1	4	4	4.0	0	4	4	4.0	0	5	5	5.0	0	3.0	4.0	4.0
Lower Mainstem Eel River Steelhead	4	3	3	3.0	0	3	3	3.0	0	4	4	4.0	0	3.5	3.0	3.0
Lower Middle Mainstem Eel River Steelhead	1	4	4	4.0	0	4	4	4.0	0	4	4	4.0	0	3.0	4.0	4.0
Lower Russian River Steelhead	1	2	2	2.0	0	5	5	5.0	0	1	1	1.0	0	4.0	0.0	3.0
Lower Trinity River Fall Chinook	2	2	3	2.5	1	4	4	4.0	0	4	5	4.5	1	3.5	3.0	3.0
Lower Trinity River Fall Coho	2	2	3	2.5	1	2	4	3.0	2	1	4	2.5	3	3.0	2.5	3.5
Lower Trinity River Spring Chinook	1	2	2	2.0	0	4	4	4.0	0	3	3	3.0	0	4.0	3.0	3.0
Lower Trinity River Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	3.0
Mad River Fall Chinook	4	2	3	2.5	1	3	4	3.3	1	4	5	4.3	1	3.0	3.0	2.8
Mad River Fall Coho	4	2	4	2.5	2	2	4	3.0	2	4	5	4.3	1	3.0	3.0	2.8
Mad River Spring Chinook	2	1	1	1.0	0	1	1	1.0	0	5	5	5.0	0	4.0	2.0	4.0
Mad River Steelhead	4	3	4	3.8	1	2	4	3.0	2	2	4	2.5	2	2.8	3.3	3.0
Mad River Summer Steelhead	4	3	3	3.0	0	3	4	3.3	1	4	5	4.5	1	3.8	3.3	3.8
Mainstem Eel River Fall Coho	3	1	1	1.0	0	3	3	3.0	0	4	4	4.0	0	3.3	3.0	4.0
Malibu Creek Steelhead	3	1	3	2.0	2	3	4	3.7	1	5	5	5.0	0	3.0	3.7	4.3
Malpaso Creek Steelhead	2	1	4	2.5	3	3	5	4.0	2	5	5	5.0	0	4.0	3.0	4.5
Maple Creek Steelhead	1	3	3	3.0	0	5	5	5.0	0	5	5	5.0	0	3.0	4.0	5.0
Mattole River Fall Chinook	6	1	3	2.0	2	3	5	3.4	2	4	5	4.7	1	3.2	3.2	4.0
Mattole River Fall Coho	6	1	3	2.0	2	3	4	3.2	1	4	5	4.7	1	3.3	3.2	4.2
Mattole River Steelhead	5	3	3	3.0	0	3	5	3.5	2	4	5	4.6	1	3.2	3.3	4.4
Mattole River Summer Steelhead	6	1	2	1.5	1	1	5	2.6	4	4	5	4.7	1	3.8	2.6	4.2
McCloud River Chinook	2	1	2	0.0	1	1	5	0.0	4	1	1	1.0	0	0.0	0.0	0.0
McCloud River Fall Chinook	2	1	2	0.0	1	1	5	0.0	4	1	1	1.0	0	0.0	0.0	5.0
McCloud River Spring Chinook	2	1	2	0.0	1	1	5	0.0	4	1	1	1.0	0	0.0	0.0	0.0
McDonald Creek Fall Coho	2	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	5.0
McNutt Gulch Fall Coho	1	2	2	0.0	0	4	4	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Merced River Fall Chinook	1	1	1	1.0	0	2	2	2.0	0	3	3	3.0	0	4.0	3.0	3.0
Mid Klamath River Fall Chinook	2	2	5	3.5	3	3	4	3.5	1	5	5	5.0	0	3.5	3.0	3.0
Mid Klamath River Fall Coho	2	1	3	2.0	2	2	5	3.5	3	3	5	4.0	2	3.0	3.0	3.0
Mid Klamath River Steelhead	1	3	3	3.0	0	5	5	5.0	0	5	5	5.0	0	3.0	4.0	4.0
Middle Creek Fall Chinook	1	1	1	1.0	0	1	1	1.0	0	1	1	1.0	0	4.0	3.0	3.0
Middle Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	4.0	3.0	3.0
Middle Fork Eel River Fall Coho	1	1	1	1.0	0	1	1	1.0	0	0	0	0.0	0	4.0	4.0	4.0
Middle Fork Eel River Spring Chinook	3	1	1	1.0	0	1	1	0.0	0	0	0	0.0	0	4.0	0.0	0.0
Middle Fork Eel River Steelhead	1	3	3	3.0	0	1	1	0.0	0	0	0	0.0	0	0.0	0.0	0.0
Middle Fork Eel River Summer Steelhead	3	3	4	3.3	1	4	4	4.0	0	5	5	5.0	0	4.3	4.0	4.3
Mill Creek Fall Chinook	2	4	4	4.0	0	4	4	4.0	0	2	4	3.0	2	5.0	4.0	5.0
Mill Creek Spring Chinook	6	4	5	4.8	1	4	5	4.6	1	5	5	5.0	0	4.8	5.0	4.8
Mill Creek Steelhead	7	1	4	3.4	3	3	5	4.4	2	4	5	4.9	1	3.7	3.9	3.4
Miller Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	4	5	0.0	1	0.0	0.0	0.0
Mills Creek Fall Chinook	1	2	2	2.0	0	4	4	4.0	0	3	3	3.0	0	4.0	4.0	3.0
Mission Creek Steelhead	3	2	2	2.0	0	3	5	3.7	2	5	5	5.0	0	3.7	3.7	4.3
Mokelumne River Fall Chinook	3	2	3	2.7	1	2	5	3.7	3	1	2	1.3	1	4.0	4.0	4.3

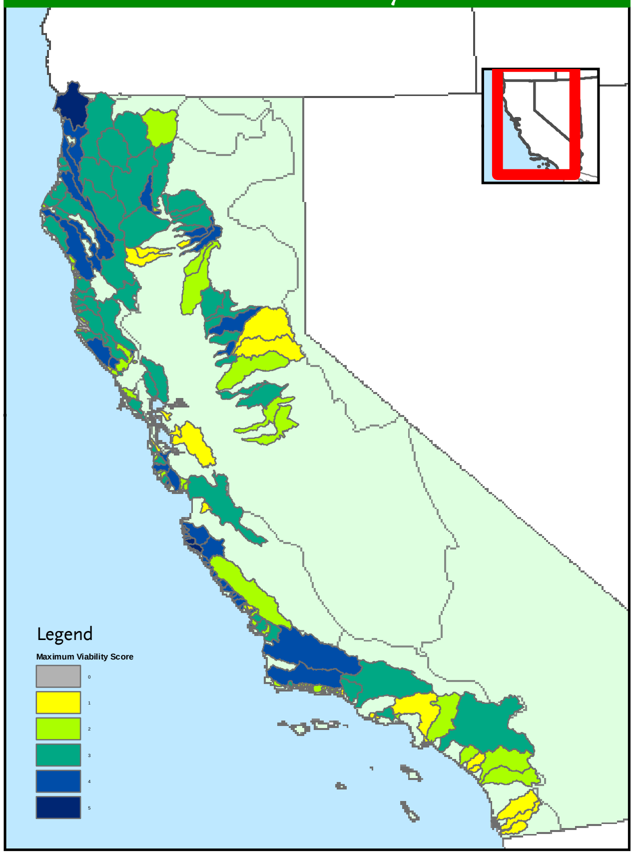
	Revie wers	Viability				Life History Diversity				Percent Natural				Certainty		
Population		Min	Max	Ave	Range	Min	Max	Ave	Range	Min	Max	Ave	Range	Viabilit	LHD	PN
Mokelumne River Spring Chinook	2	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	3.5	4.0	4.0
Mokelumne River Steelhead	2	1	3	2.0	2	2	4	3.0	2	1	1	1.0	0	3.0	4.0	4.0
Montecito Creek Steelhead	3	1	2	1.5	1	2	5	3.3	3	5	5	5.0	0	3.0	3.7	4.3
Morro Creek Steelhead	2	2	2	2.0	0	5	5	5.0	0	5	5	5.0	0	3.0	4.0	4.5
Nacimiento, San Antonio and Upper Salinas Ri	3	1	2	1.3	1	2	3	2.5	1	4	5	4.7	1	3.3	2.5	3.3
Napa River Fall Coho	1	1	1	1.0	0	0	0	0.0	0	4	5	0.0	1	0.0	0.0	0.0
Napa River Steelhead	1	3	3	3.0	0	4	4	4.0	0	3	3	3.0	0	3.0	4.0	3.0
Navarro River Fall Chinook	2	1	2	1.5	1	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Navarro River Fall Coho	3	2	3	2.3	1	2	4	3.0	2	5	5	5.0	0	2.5	2.3	3.7
Navarro River Steelhead	2	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	2.5	3.0	4.0
New River Spring Chinook	1	4	4	4.0	0	5	5	5.0	0	5	5	5.0	0	5.0	5.0	5.0
New River Steelhead	1	3	3	3.0	0	5	5	5.0	0	5	5	5.0	0	4.0	5.0	5.0
New River Steelhead	1	5	5	5.0	0	4	4	4.0	0	5	5	5.0	0	5.0	4.0	4.0
New River Summer Steelhead	1	5	5	5.0	0	5	5	5.0	0	5	5	5.0	0	5.0	5.0	5.0
Nork Fork Trinity River Summer Steelhead	2	3	4	3.5	1	5	5	5.0	0	5	5	5.0	0	4.0	4.0	4.0
North Fork Eel River Fall Chinook	1	1	1	1.0	0	5	5	0.0	0	5	5	0.0	0	4.0	0.0	0.0
North Fork Eel River Fall Coho	2	1	1	1.0	0	5	5	0.0	0	5	5	0.0	0	4.0	0.0	0.0
North Fork Eel River Spring Chinook	3	1	1	1.0	0	5	5	0.0	0	5	5	0.0	0	4.0	0.0	0.0
North Fork Eel River Steelhead	1	4	4	4.0	0	4	4	4.0	0	5	5	5.0	0	4.0	4.0	4.0
North Fork Eel River Summer Steelhead	2	1	2	1.5	1	4	4	0.0	0	5	5	0.0	0	4.0	0.0	0.0
North and Middle Fork American River Fall Chi	1	1	1	1.0	0	4	4	0.0	0	5	5	0.0	0	5.0	0.0	5.0
North and Middle Fork American River Spring C	1	1	1	1.0	0	4	4	0.0	0	5	5	0.0	0	5.0	0.0	5.0
North and Middle Fork American River Steelhe	1	1	1	1.0	0	4	4	0.0	0	5	5	0.0	0	5.0	0.0	5.0
Norton/ Widow White Creek Fall Coho	1	1	1	0.0	0	4	4	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Novato Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Noyo River Fall Chinook	3	1	2	1.3	1	4	4	4.0	0	5	5	5.0	0	3.0	2.0	4.0
Noyo River Fall Coho	3	2	3	2.7	1	3	4	3.3	1	3	5	4.0	2	3.0	2.3	3.7
Noyo River Steelhead	2	3	3	3.0	0	3	4	3.5	1	5	5	5.0	0	3.5	2.5	4.0
Oak Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Old Creek Steelhead	3	1	1	1.0	0	2	3	2.5	1	5	5	5.0	0	3.7	3.5	4.7
Olney Creek Fall Chinook	3	1	1	1.0	0	2	3	2.3	1	1	5	2.3	4	4.0	3.3	3.7
Olney Creek Steelhead	3	1	2	1.7	1	2	2	2.0	0	1	5	3.0	4	2.7	3.3	3.7
Otay River Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Pajaro River Steelhead	2	2	3	2.5	1	4	5	4.5	1	5	5	5.0	0	2.0	3.0	4.5
Partington Creek Steelhead	2	2	4	3.0	2	4	5	4.5	1	5	5	5.0	0	4.0	3.0	4.5
Paynes Creek Fall Chinook	4	1	2	1.5	1	2	3	2.3	1	1	5	2.0	4	3.8	3.8	4.3
Paynes Creek Steelhead	3	1	3	2.0	2	2	4	3.0	2	3	5	4.3	2	3.0	3.0	3.7
Pescadero Creek Fall Coho	2	1	1	1.0	0	1	3	2.0	2	1	1	1.0	0	4.0	4.0	2.5
Pescadero Creek Steelhead	3	2	4	3.0	2	3	5	4.0	2	4	5	4.7	1	3.0	3.3	3.3
Petaluma River Fall Coho	1	1	1	1.0	0	0	0	0.0	0	4	5	0.0	1	0.0	0.0	0.0
Pico Creek Steelhead	3	2	4	3.0	2	5	5	5.0	0	5	5	5.0	0	3.0	3.0	4.7
Pilarcitos Creek Fall Coho	1	1	1	1.0	0	5	5	0.0	0	5	5	0.0	0	2.0	0.0	0.0
Pilarcitos Creek Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	3.0	4.0	5.0
Pismo Creek Steelhead	4	2	2	2.0	0	3	5	4.0	2	5	5	5.0	0	2.3	3.0	4.5
Pit, Fall, Hat Rivers Chinook	2	2	2	0.0	0	3	5	0.0	2	1	1	1.0	0	0.0	0.0	0.0
Pit, Fall, Hat Rivers Fall Chinook	2	2	2	0.0	0	3	5	0.0	2	1	1	1.0	0	0.0	0.0	0.0
Pit, Fall, Hat Rivers Spring Chinook	2	2	2	0.0	0	3	5	0.0	2	1	1	1.0	0	0.0	0.0	0.0
Plaskett Creek Steelhead	2	1	4	2.5	3	3	5	4.0	2	5	5	5.0	0	4.0	3.5	4.5
Pomponio Creek Steelhead	1	2	2	2.0	0	3	5	0.0	2	5	5	5.0	0	4.0	0.0	5.0
Prewitt Creek Steelhead	2	3	4	3.5	1	5	5	5.0	0	5	5	5.0	0	4.0	3.5	4.5
Pudding Creek Fall Chinook	2	1	1	1.0	0	5	5	0.0	0	5	5	0.0	0	2.0	0.0	0.0
Pudding Creek Fall Coho	3	3	4	3.7	1	4	5	4.3	1	5	5	5.0	0	3.3	3.0	4.0
Pudding Creek Steelhead	2	2	3	2.5	1	3	4	3.5	1	5	5	5.0	0	3.0	2.5	4.0
Redwood Creek (H) Fall Chinook	4	3	4	3.3	1	3	5	4.0	2	5	5	5.0	0	3.5	3.5	4.5
Redwood Creek (H) Spring Chinook	2	1	1	1.0	0	0	0	0.0	0	0	0	0.0	0	4.0	2.0	2.0
Redwood Creek (H) Steelhead	3	3	4	3.3	1	4	4	4.0	0	5	5	5.0	0	3.3	3.3	4.0
Redwood Creek (H) Summer Steelhead	5	1	2	1.6	1	1	4	2.8	3	4	5	4.6	1	3.4	3.0	3.6
Redwood Creek (Ma) Fall Coho	2	1	2	1.5	1	1	3	2.0	2	5	5	5.0	0	4.0	3.0	3.5
Redwood Creek (Ma) Steelhead	2	3	3	3.0	0	3	3	3.0	0	5	5	5.0	0	2.0	3.0	5.0
Redwood Creek Fall Coho	4	2	4	3.3	2	3	5	4.0	2	5	5	5.0	0	3.5	3.8	4.0
Rincon Creek Steelhead	3	1	1	1.0	0	2	3	2.7	1	5	5	5.0	0	3.0	3.0	4.3
Rocky Creek Steelhead	2	2	4	3.0	2	5	5	5.0	0	5	5	5.0	0	3.0	2.5	4.5
Romero Creek Steelhead	2	1	2	1.5	1	2	4	3.0	2	5	5	5.0	0	3.0	3.0	4.0
Russian Gulch (Me) Fall Coho	2	1	1	1.0	0	1	1	1.0	0	5	5	5.0	0	3.0	0.0	4.0
Russian Gulch (Me) Steelhead	1	2	2	2.0	0	1	1	1.0	0	5	5	5.0	0	3.0	0.0	4.0
Russian Gulch (S) Fall Coho	1	1	1	1.0	0	1	1	1.0	0	4	4	4.0	0	2.0	2.0	1.0
Russian Gulch (S) Steelhead	1	1	1	0.0	0	1	1	0.0	0	4	4	0.0	0	0.0	0.0	0.0
Russian River Fall Chinook	2	3	5	4.0	2	3	3	3.0	0	5	5	5.0	0	4.0	3.0	3.5
Russian River Fall Coho	2	1	1	1.0	0	1	2	1.5	1	1	1	1.0	0	4.5	4.5	3.5
Sacramento River Fall Chinook	1	4	4	4.0	0	4	4	4.0	0	2	2	2.0	0	5.0	4.0	3.0
Sacramento River Fall Chinook (Keswick Dam	1	4	4	4.0	0	5	5	5.0	0	3	3	3.0	0	4.0	5.0	3.0
Sacramento River Fall Chinook (RBDD to Kesv	2	3	4	3.5	1	3	4	3.5	1	1	3	2.0	2	4.5	4.0	4.0
Sacramento River Late Fall Chinook	1	4	4	4.0	0	4	4	4.0	0	3	3	3.0	0	4.0	3.0	4.0
Sacramento River Late Fall Chinook (Keswick I	1	5	5	5.0	0	5	5	5.0	0	4	4	4.0	0	4.0	5.0	4.0
Sacramento River Late Fall Chinook (RBDD to	1	4	4	4.0	0	3	3	3.0	0	2	2	2.0	0	4.0	4.0	4.0
Sacramento River Spring Chinook	1	2	2	2.0	0	3	3	3.0	0	4	4	4.0	0	3.0	3.0	5.0

	Reviewers	Viability				Life History Diversity				Percent Natural				Certainty		
Population		Min	Max	Ave	Range	Min	Max	Ave	Range	Min	Max	Ave	Range	Viabilit	LHD	PN
Sacramento River Spring Chinook (RBDD to Ke	1	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	5.0	4.0	4.0
Sacramento River Steelhead	1	3	3	3.0	0	3	3	3.0	0	3	3	3.0	0	2.0	2.0	2.0
Sacramento River Steelhead (RBDD to Keswic	2	2	4	3.0	2	1	4	2.5	3	0	3	1.5	3	2.5	4.0	2.5
Sacramento River Winter Chinook	1	5	5	5.0	0	5	5	5.0	0	4	4	4.0	0	5.0	5.0	5.0
Sacramento River Winter Chinook (Keswick Da	1	5	5	5.0	0	5	5	5.0	0	4	4	4.0	0	5.0	5.0	5.0
Salmon Creek (S) Fall Chinook	1	5	5	0.0	0	5	5	0.0	0	4	4	0.0	0	0.0	0.0	0.0
Salmon Creek (S) Fall Coho	2	1	1	1.0	0	1	2	1.5	1	1	1	1.0	0	2.5	2.5	3.0
Salmon Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	4.0	3.0	5.0
Salmon River Fall Chinook	2	3	4	3.5	1	4	4	4.0	0	5	5	5.0	0	4.5	3.5	3.5
Salmon River Fall Coho	2	1	2	1.5	1	2	4	3.0	2	4	5	4.5	1	3.0	2.5	3.0
Salmon River Spring Chinook	2	3	4	3.5	1	5	5	5.0	0	5	5	5.0	0	4.5	4.0	4.5
Salmon River Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	4.0
Salmon River Summer Steelhead	2	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	4.0	3.5	4.0
Salmons Creek Steelhead	1	4	4	4.0	0	4	4	4.0	0	5	5	5.0	0	4.0	3.0	4.0
Salt Creek Fall Chinook	2	1	1	1.0	0	1	2	1.5	1	1	5	3.0	4	3.5	3.5	3.5
Salt Creek Fall Chinook	2	1	2	1.5	1	2	2	2.0	0	1	1	1.0	0	4.0	3.5	3.5
San Carpoforo Creek Steelhead	4	3	4	3.7	1	4	5	4.7	1	5	5	5.0	0	3.3	2.0	4.5
San Diego River Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
San Francisquito Creek Fall Coho	1	1	1	1.0	0	2	2	0.0	0	5	5	0.0	0	2.0	0.0	0.0
San Francisquito Creek Steelhead	3	2	4	3.0	2	1	4	2.5	3	5	5	5.0	0	1.5	3.0	4.5
San Gabriel River Steelhead	1	2	2	2.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
San Gregorio Creek Fall Coho	2	1	1	1.0	0	1	3	2.0	2	1	1	1.0	0	4.0	4.0	2.0
San Gregorio Creek Steelhead	2	2	3	2.5	1	3	4	3.5	1	4	5	4.5	1	3.0	3.0	3.0
San Jose Creek Steelhead	2	3	4	3.5	1	5	5	5.0	0	5	5	5.0	0	4.0	3.5	4.5
San Juan Creek Steelhead	2	1	2	1.5	1	2	3	2.5	1	4	5	4.5	1	3.0	3.5	4.5
San Leandro Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	4	5	0.0	1	0.0	0.0	0.0
San Lorenzo Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	4	5	0.0	1	0.0	0.0	0.0
San Lorenzo Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	4	4	4.0	0	0.0	2.0	1.0
San Lorenzo River Fall Coho	2	1	1	1.0	0	3	3	3.0	0	1	1	1.0	0	3.5	4.0	4.0
San Lorenzo River Steelhead	2	2	4	3.0	2	3	4	3.5	1	2	3	2.5	1	3.0	2.5	3.0
San Luis Obispo Creek Steelhead	4	2	3	2.5	1	3	5	4.0	2	5	5	5.0	0	2.5	3.7	4.5
San Luis Rey River Steelhead	2	1	2	1.5	1	2	3	2.5	1	4	5	4.5	1	3.0	3.5	4.0
San Mateo Creek Fall Coho	1	1	1	1.0	0	2	3	0.0	1	4	5	0.0	1	0.0	0.0	0.0
San Mateo Creek Steelhead	3	1	1	1.0	0	2	3	2.3	1	5	5	5.0	0	3.0	2.7	3.7
San Mateo River Steelhead	1	1	1	1.0	0	1	1	1.0	0	5	5	5.0	0	0.0	5.0	5.0
San Onofre Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
San Pablo Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	5	5	0.0	0	0.0	0.0	0.0
San Pablo Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	4	4	4.0	0	0.0	2.0	1.0
San Pedro Creek Steelhead	1	3	3	3.0	0	2	2	0.0	0	5	5	5.0	0	3.0	0.0	5.0
San Simeon Creek Steelhead	3	3	4	3.3	1	5	5	5.0	0	5	5	5.0	0	3.3	4.0	4.7
San Vicente Creek Fall Coho	3	1	2	1.3	1	1	3	2.3	2	1	5	2.3	4	4.0	3.0	3.3
San Vicente Creek Steelhead	2	3	4	3.5	1	3	5	4.0	2	4	5	4.5	1	3.5	3.5	3.0
San Ysidro Creek Steelhead	2	1	2	1.5	1	2	5	3.5	3	5	5	5.0	0	3.0	3.0	4.0
Santa Ana River Steelhead	1	3	3	3.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Santa Clara River Steelhead	3	2	3	2.7	1	4	4	4.0	0	5	5	5.0	0	3.7	4.0	4.3
Santa Margarita River Steelhead	2	1	2	1.5	1	2	3	2.5	1	5	5	5.0	0	2.5	3.0	3.5
Santa Maria River Steelhead	3	2	4	3.0	2	3	4	3.7	1	5	5	5.0	0	3.7	2.3	4.3
Santa Rosa Creek Steelhead	4	4	4	4.0	0	4	5	4.7	1	5	5	5.0	0	3.8	4.0	4.5
Santa Ynez River Steelhead	3	3	4	3.3	1	4	5	4.7	1	5	5	5.0	0	4.7	3.3	4.3
Sausal Creek Steelhead	1	3	4	0.0	1	4	5	0.0	1	5	5	0.0	0	0.0	0.0	0.0
Scott Creek Fall Coho	3	1	2	1.3	1	2	3	2.3	1	1	3	1.7	2	4.0	4.0	3.3
Scott Creek Steelhead	2	3	3	3.0	0	4	4	4.0	0	2	3	2.5	1	4.0	3.0	3.5
Scott River Fall Chinook	2	3	3	3.0	0	3	4	3.5	1	5	5	5.0	0	4.5	3.5	3.5
Scott River Fall Coho	2	1	3	2.0	2	2	4	3.0	2	4	5	4.5	1	3.5	3.0	3.5
Scott River Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	3.0	4.0	4.0
Scotty Creek Steelhead	1	3	3	0.0	0	4	4	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Shasta River Fall Chinook	2	3	4	3.5	1	3	4	3.5	1	4	4	4.0	0	4.5	3.5	3.5
Shasta River Fall Coho	2	1	3	2.0	2	2	4	3.0	2	3	3	3.0	0	3.5	3.0	3.5
Shasta River Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	4.0	4.0	4.0
Singer Creek Fall Chinook	3	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	4.0	3.7	3.7
Smith River Fall Chinook	4	4	5	4.3	1	4	4	4.0	0	4	5	4.3	1	3.3	3.8	4.3
Smith River Fall Coho	5	2	4	3.4	2	4	4	4.0	0	4	5	4.8	1	3.0	3.6	3.8
Smith River Summer Steelhead	3	1	2	1.3	1	3	4	3.3	1	4	5	4.3	1	3.3	3.3	4.3
Smith River Winter Steelhead	4	4	5	4.3	1	4	4	4.0	0	4	5	4.3	1	3.3	3.3	4.3
Sonoma Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	4	5	0.0	1	0.0	0.0	0.0
Sonoma Creek Steelhead	1	3	3	3.0	0	3	3	3.0	0	5	5	5.0	0	4.0	3.0	4.0
Soquel Creek Fall Coho	2	1	1	1.0	0	0	3	1.5	3	1	1	1.0	0	4.0	2.5	3.5
Soquel Creek Steelhead	2	2	2	2.0	0	3	5	4.0	2	4	5	4.5	1	3.0	3.5	3.0
South Fork American River Fall Chinook	1	1	1	1.0	0	3	5	0.0	2	4	5	0.0	1	5.0	0.0	0.0
South Fork American River Spring Chinook	1	1	1	1.0	0	3	5	0.0	2	4	5	0.0	1	5.0	0.0	0.0
South Fork American River Steelhead	1	1	1	1.0	0	3	5	0.0	2	4	5	0.0	1	5.0	0.0	0.0
South Fork Eel River Fall Chinook	1	4	4	4.0	0	4	4	4.0	0	5	5	5.0	0	4.0	3.0	4.0
South Fork Eel River Fall Coho	4	2	4	3.5	2	1	4	2.8	3	4	5	4.3	1	3.3	3.3	3.8
South Fork Eel River Steelhead	5	3	4	3.2	1	3	4	3.3	1	4	5	4.3	1	3.3	3.3	4.0
South Fork Eel River Summer Steelhead	3	1	2	1.3	1	1	1	1.0	0	0	0	0.0	0	4.0	4.0	4.0
South Fork Eel River Summer Steelhead	1	2	2	2.0	0	1	1	0.0	0	0	0	0.0	0	0.0	0.0	0.0

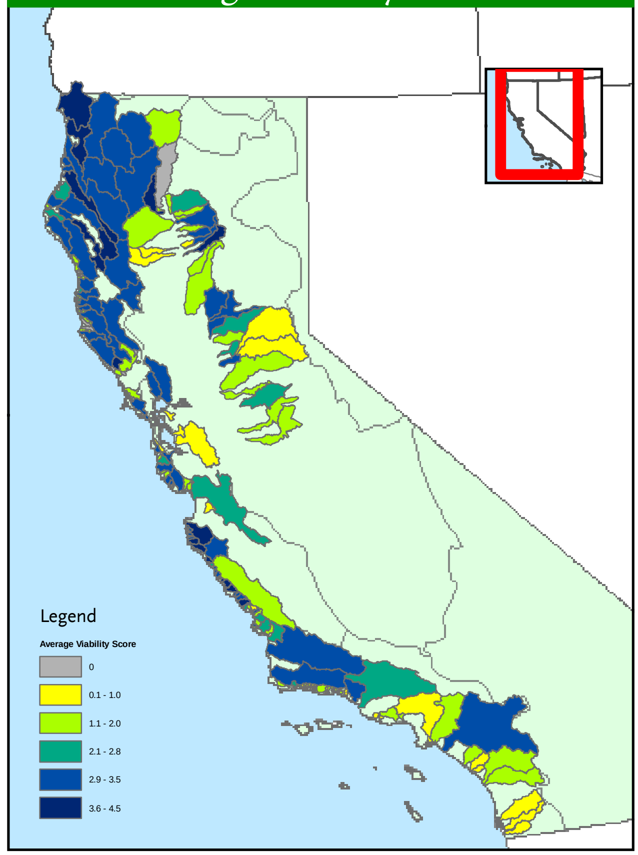
	Reviewers	Viability				Life History Diversity				Percent Natural				Certainty		
Population		Min	Max	Ave	Range	Min	Max	Ave	Range	Min	Max	Ave	Range	Viabilit	LHD	PN
South Fork Trinity River Fall Chinook	2	2	3	2.5	1	3	4	3.5	1	5	5	5.0	0	3.0	3.0	3.0
South Fork Trinity River Fall Coho	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	3.0
South Fork Trinity River Spring Chinook	2	2	2	2.0	0	3	4	3.5	1	5	5	5.0	0	3.5	3.0	3.0
South Fork Trinity River Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	3.0	4.0	4.0
South Fork Trinity River Summer Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	3.0	4.0	4.0
Stanislaus River Fall Chinook	2	2	3	2.5	1	3	3	3.0	0	3	5	4.0	2	4.0	3.5	3.5
Stanislaus River Spring Chinook	1	1	1	1.0	0	0	0	0.0	0	0	0	0.0	0	2.0	0.0	2.0
Stanislaus River Steelhead	2	1	2	1.5	1	0	1	0.5	1	0	5	2.5	5	2.0	0.0	2.0
Stemple Creek Fall Chinook	1	1	2	0.0	1	0	1	0.0	1	0	5	0.0	5	0.0	0.0	0.0
Stemple Creek Fall Coho	1	1	1	1.0	0	0	1	0.0	1	0	5	0.0	5	0.0	0.0	0.0
Stevens Creek Fall Coho	1	1	1	1.0	0	0	0	0.0	0	0	5	0.0	5	0.0	0.0	0.0
Stillwater Creek Fall Chinook	3	1	3	1.7	2	2	3	2.3	1	1	5	2.3	4	3.7	3.7	4.3
Stillwater Creek Steelhead	3	1	3	2.0	2	2	4	2.7	2	2	5	3.7	3	3.0	3.0	3.7
Stony Creek Fall Chinook	1	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	4.0	4.0	4.0
Stony Creek Spring Chinook	1	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	5.0	4.0	2.0
Strawberry Creek Fall Coho	2	2	2	2.0	0	1	1	1.0	0	5	5	5.0	0	2.0	1.0	4.0
Sweetwater River Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Tajiguas Creek Steelhead	1	1	1	1.0	0	3	3	3.0	0	5	5	5.0	0	3.0	3.0	4.0
Tecolote Canyon Steelhead	2	1	1	1.0	0	2	4	3.0	2	5	5	5.0	0	2.5	3.0	4.0
Ten Mile Creek/Ten Mile Lake Steelhead	1	3	3	3.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Ten Mile River Fall Chinook	3	1	2	1.3	1	0	0	0.0	0	5	5	5.0	0	2.5	0.0	2.0
Ten Mile River Fall Coho	3	2	3	2.3	1	2	4	3.0	2	5	5	5.0	0	2.7	2.3	4.0
Ten Mile River Steelhead	1	2	2	2.0	0	3	3	3.0	0	5	5	5.0	0	1.0	2.0	4.0
Thomes Creek Fall Chinook	2	1	1	1.0	0	2	2	2.0	0	1	1	1.0	0	3.5	4.0	3.5
Thomes Creek Spring Chinook	2	1	1	1.0	0	2	3	2.5	1	1	5	3.0	4	4.5	3.5	2.5
Thomes Creek Steelhead	1	1	1	1.0	0	2	2	2.0	0	3	3	3.0	0	2.0	2.0	2.0
Tijuana River Steelhead	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	3.0	3.0	4.0
Tomales Bay/Lagunitas Creek Fall Chinook	1	1	1	1.0	0	1	1	1.0	0	5	5	5.0	0	4.0	1.0	1.0
Topanga Canyon Steelhead	2	1	2	1.5	1	3	4	3.5	1	4	5	4.5	1	3.5	3.5	4.5
Toro Creek Steelhead	2	2	4	3.0	2	5	5	5.0	0	5	5	5.0	0	2.0	3.0	4.5
Tunitas Creek Fall Coho	1	1	1	1.0	0	5	5	0.0	0	5	5	0.0	0	2.0	0.0	0.0
Tunitas Creek Steelhead	2	2	2	2.0	0	5	5	5.0	0	5	5	5.0	0	5.0	4.0	5.0
Tuolumne River Fall Chinook	1	1	1	1.0	0	2	2	2.0	0	5	5	5.0	0	4.0	4.0	5.0
Tuolumne River Spring Chinook	1	0	0	0.0	0	1	1	1.0	0	0	0	0.0	0	0.0	0.0	0.0
Tuolumne River Steelhead	1	2	2	2.0	0	1	1	1.0	0	5	5	5.0	0	1.0	1.0	5.0
Unnamed Trib Inter-dam Sacramento River Fal	1	2	2	0.0	0	1	1	0.0	0	5	5	0.0	0	0.0	0.0	0.0
Upper Eel River Fall Chinook	3	3	3	3.0	0	3	4	3.3	1	4	5	4.7	1	3.3	3.3	3.0
Upper Eel River Fall Coho	1	1	1	1.0	0	1	1	1.0	0	5	5	5.0	0	3.0	4.0	3.0
Upper Klamath River Fall Coho	2	2	2	2.0	0	2	4	3.0	2	1	5	3.0	4	3.5	3.0	4.0
Upper Mainstem Eel River Spring Chinook	1	1	1	1.0	0	2	4	0.0	2	1	5	0.0	4	0.0	0.0	0.0
Upper Mainstem Eel River Steelhead	1	3	3	3.0	0	3	3	3.0	0	3	3	3.0	0	3.0	3.0	2.0
Upper Russian River Steelhead	1	3	3	3.0	0	4	4	4.0	0	2	2	2.0	0	5.0	3.0	3.0
Upper Trinity River Fall Chinook	2	3	4	3.5	1	3	4	3.5	1	2	3	2.5	1	4.5	3.0	3.5
Upper Trinity River Fall Coho	2	2	2	2.0	0	2	4	3.0	2	1	2	1.5	1	3.5	2.5	4.0
Upper Trinity River Spring Chinook	2	3	3	3.0	0	3	4	3.5	1	2	3	2.5	1	4.0	3.0	3.5
Upper Trinity River Steelhead	1	3	3	3.0	0	4	4	4.0	0	3	3	3.0	0	3.0	3.0	3.0
Usal Creek Fall Chinook	2	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0.0	0.0	0.0
Usal Creek Fall Coho	2	1	2	1.5	1	1	4	2.5	3	5	5	5.0	0	2.5	2.5	3.0
Usal Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Van Duzen River Fall Chinook	3	2	3	2.3	1	3	3	3.0	0	4	4	4.0	0	4.0	3.0	4.0
Van Duzen River Spring Chinook	3	1	1	1.0	0	3	3	0.0	0	4	4	0.0	0	4.0	0.0	0.0
Van Duzen River Steelhead	3	3	3	3.0	0	3	3	3.0	0	4	4	4.0	0	3.0	3.0	4.0
Van Duzen River Summer Steelhead	4	1	2	1.3	1	3	3	3.0	0	4	4	4.0	0	3.0	3.0	4.0
Ventura River Steelhead	3	3	3	3.0	0	4	5	4.3	1	5	5	5.0	0	3.7	4.0	4.3
Vicente Creek Steelhead	2	1	4	2.5	3	3	4	3.5	1	5	5	5.0	0	4.0	2.5	4.5
Villa Creek - M Steelhead	2	1	4	2.5	3	3	4	3.5	1	5	5	5.0	0	4.0	2.5	4.5
Villa Creek - SLO Steelhead	2	1	4	2.5	3	5	5	5.0	0	5	5	5.0	0	3.5	3.0	4.5
Waddell Creek Fall Coho	3	1	1	1.0	0	1	3	2.0	2	1	4	2.7	3	4.0	4.0	3.0
Waddell Creek Steelhead	2	2	2	2.0	0	3	5	4.0	2	4	5	4.5	1	3.0	3.0	3.0
Wages Creek Fall Chinook	1	2	2	0.0	0	3	5	0.0	2	4	5	0.0	1	0.0	0.0	0.0
Wages Creek Fall Coho	2	1	2	1.5	1	1	4	2.5	3	5	5	5.0	0	2.5	2.0	4.0
Wages Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	2.0	2.0	4.0
Walker Creek Fall Coho	2	1	1	1.0	0	1	2	1.5	1	1	2	1.5	1	2.5	2.5	2.5
Walker Creek Steelhead	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	0.0	4.0
Whitehouse Creek Steelhead	1	3	3	3.0	0	4	4	0.0	0	5	5	5.0	0	4.0	0.0	5.0
Willow Creek - M Steelhead	3	2	4	3.3	2	3	5	4.3	2	5	5	5.0	0	3.3	3.3	4.3
Wilson Creek Fall Chinook	1	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	5.0
Wilson Creek Fall Coho	2	2	2	2.0	0	4	4	4.0	0	5	5	5.0	0	3.0	3.0	5.0
Yuba River Fall Chinook	1	3	3	3.0	0	3	3	3.0	0	3	3	3.0	0	3.0	4.0	3.0
Yuba River Spring Chinook	1	3	3	3.0	0	3	3	3.0	0	2	2	2.0	0	3.0	3.0	3.0
Yuba River Steelhead	1	3	3	3.0	0	4	4	4.0	0	3	3	3.0	0	3.0	4.0	3.0

California Winter Steelhead Populations

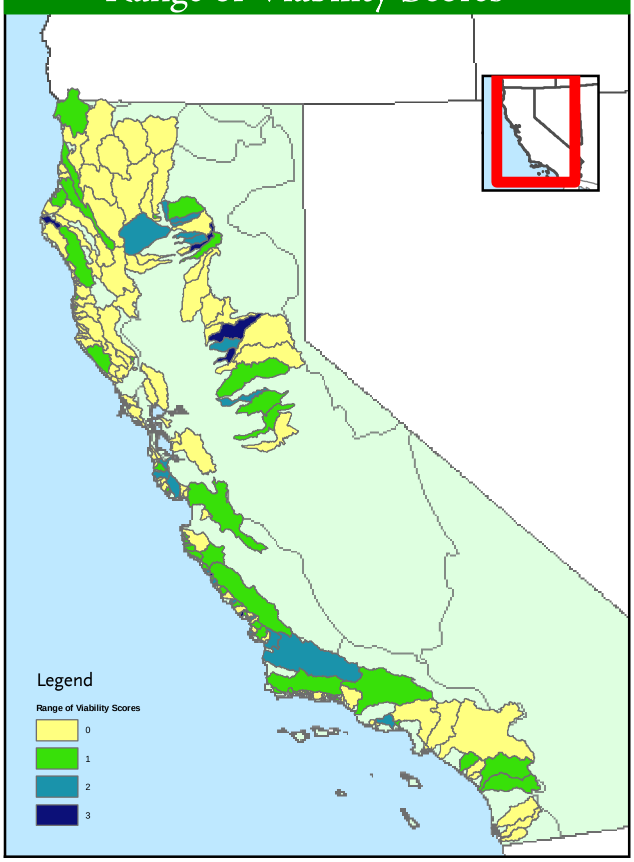
Maximum Viability Score



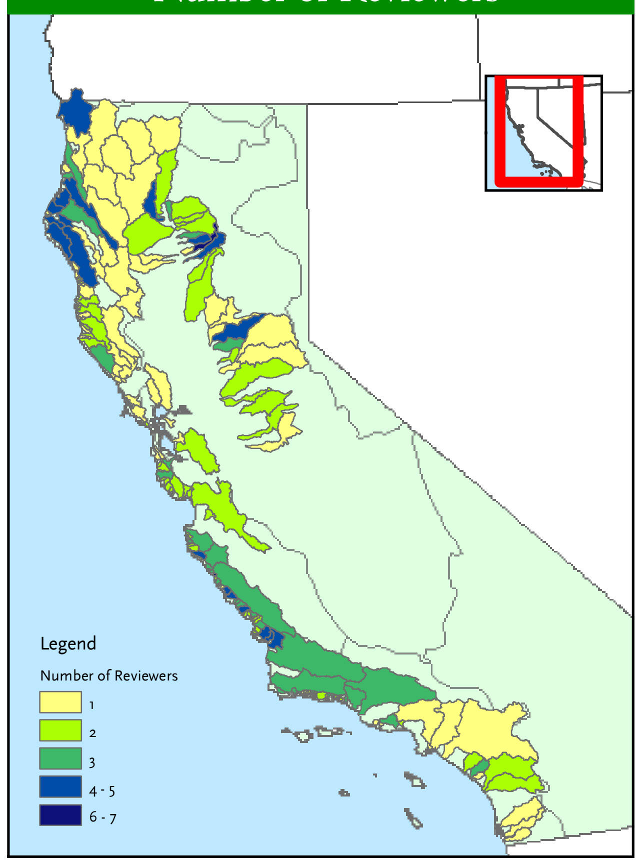
Average Viability Score



Range of Viability Scores

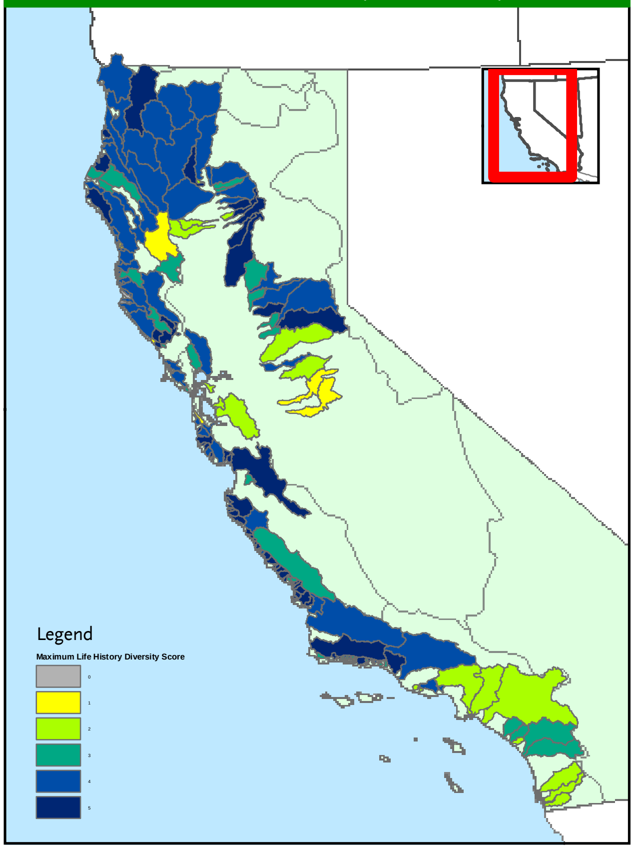


Number of Reviewers



California Winter Steelhead Populations

Maximum Life History Diversity Score



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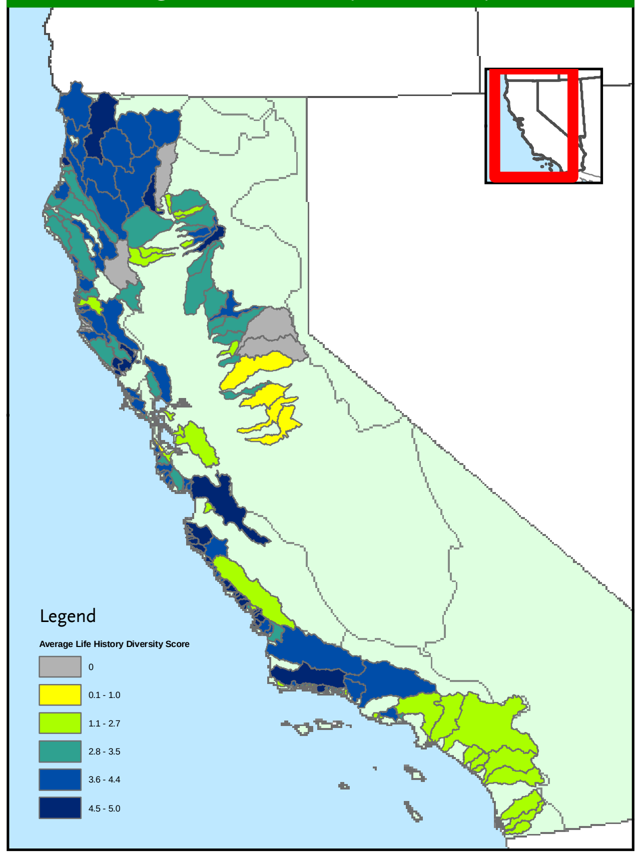
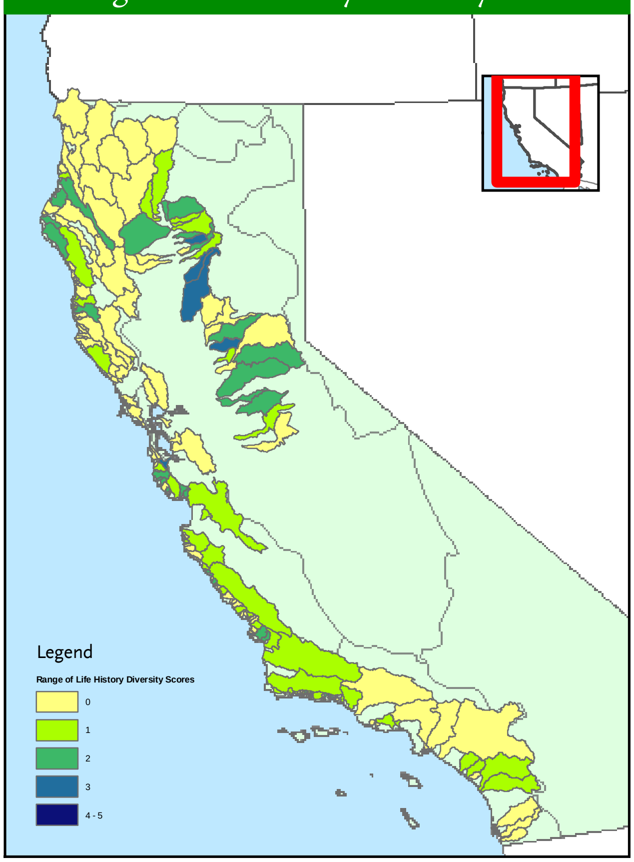


Range of Life History Diversity Scores



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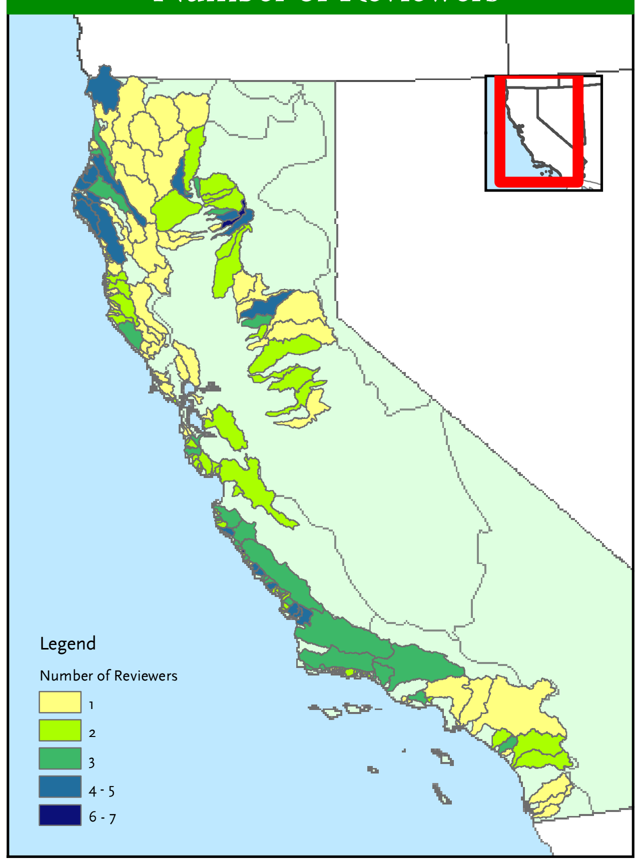
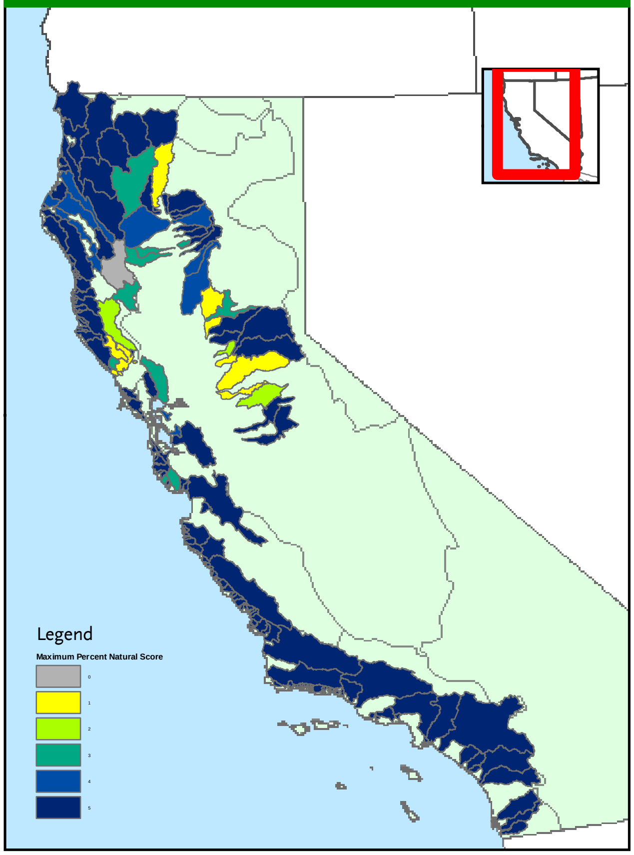


California Winter Steelhead Populations

Maximum Percent Natural Score



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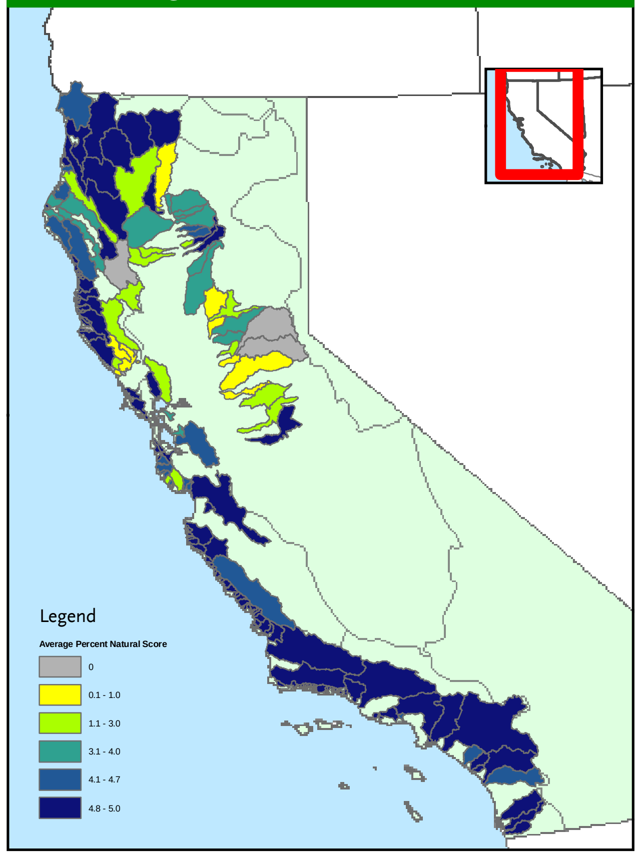
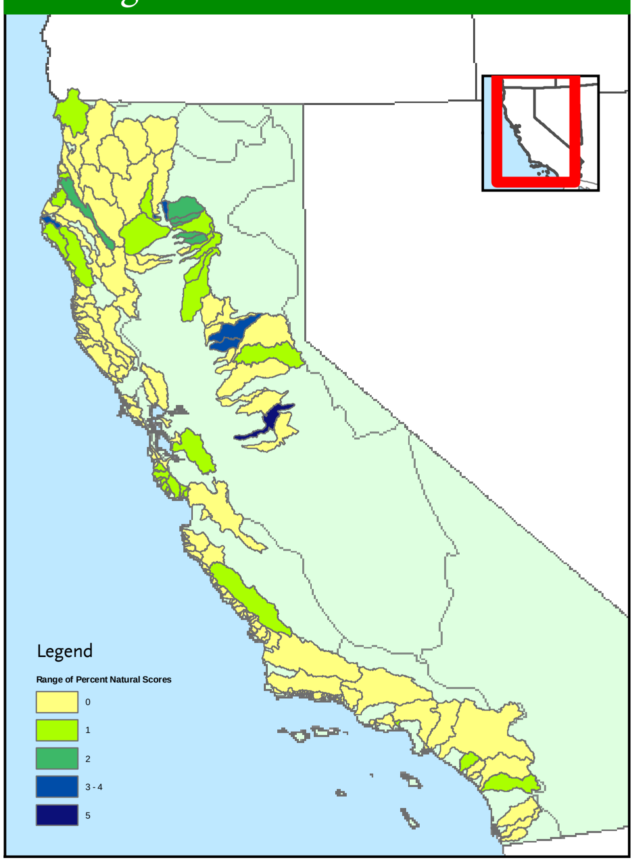


Range of Percent Natural Scores



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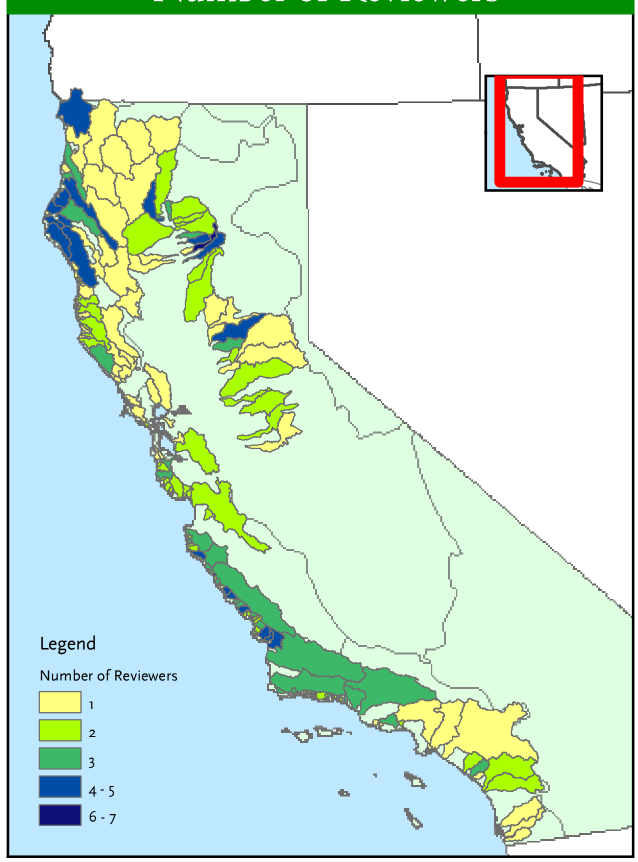
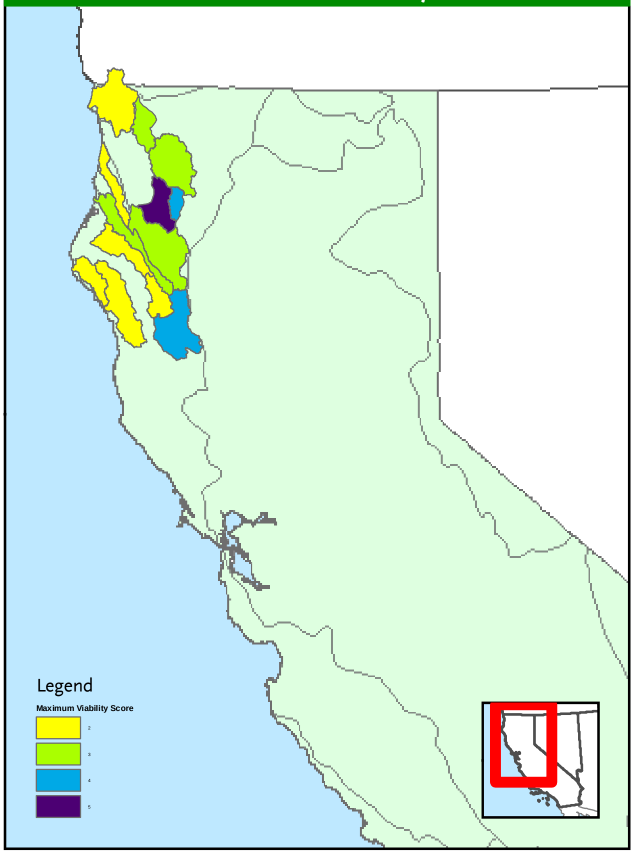
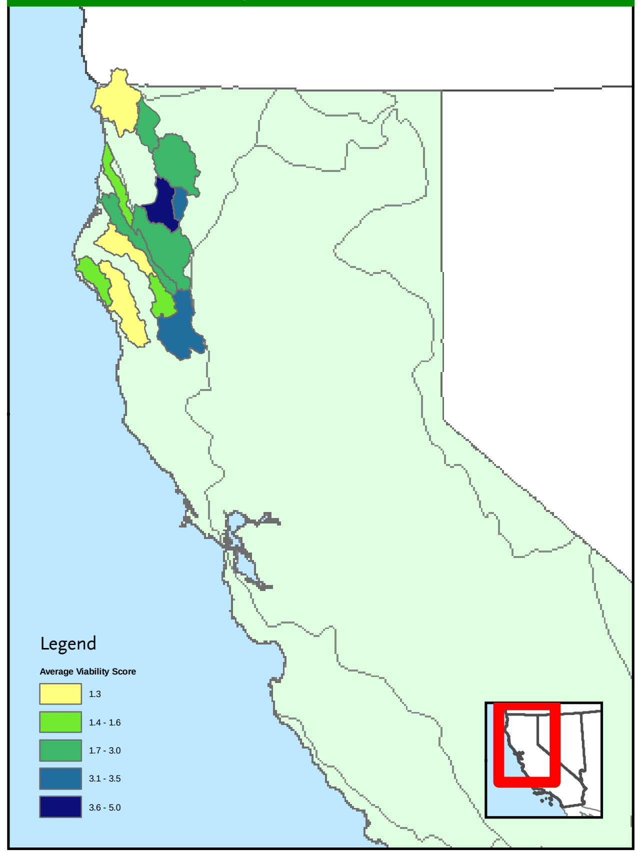


California Summer Steelhead Populations

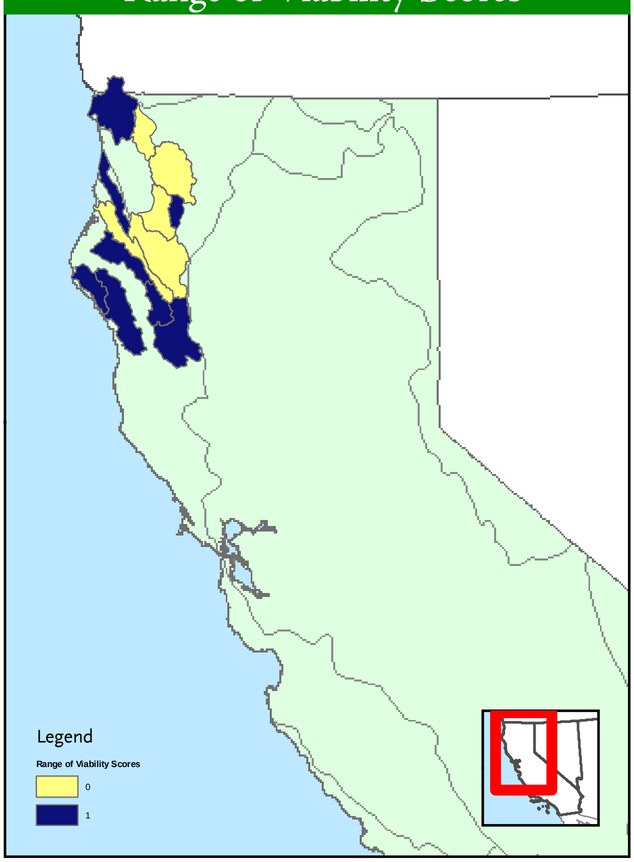
Maximum Viability Score



Average Viability Score



Range of Viability Scores



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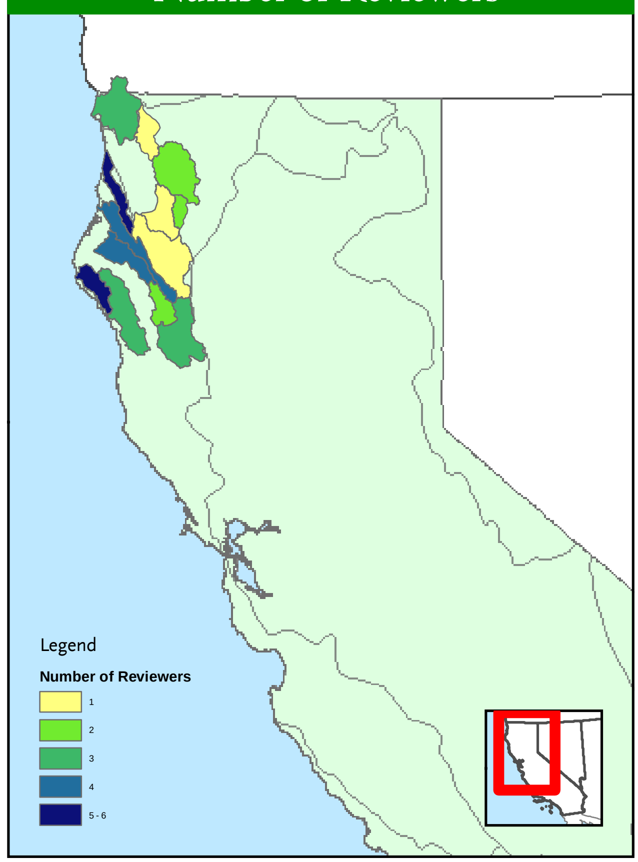
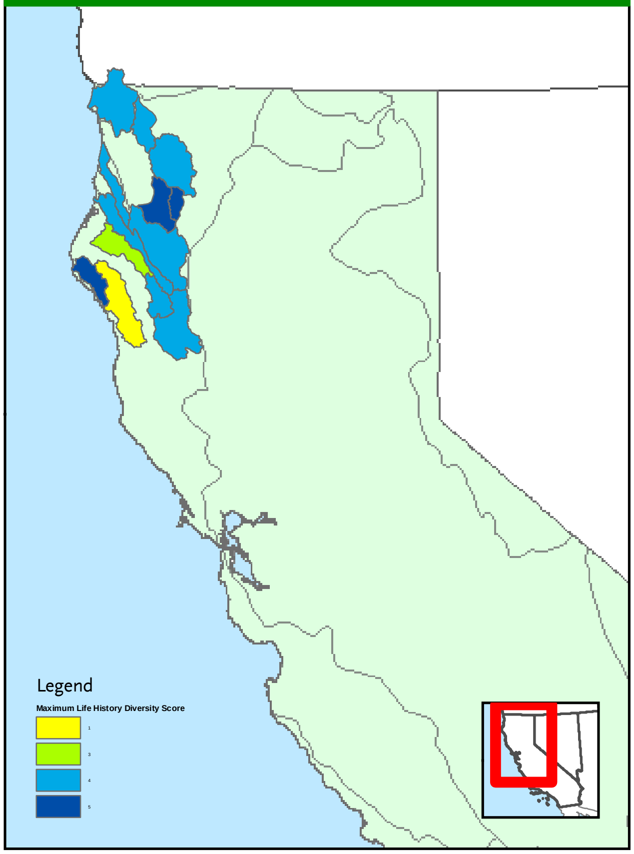


California Summer Steelhead Populations

Maximum Life History Diversity Score



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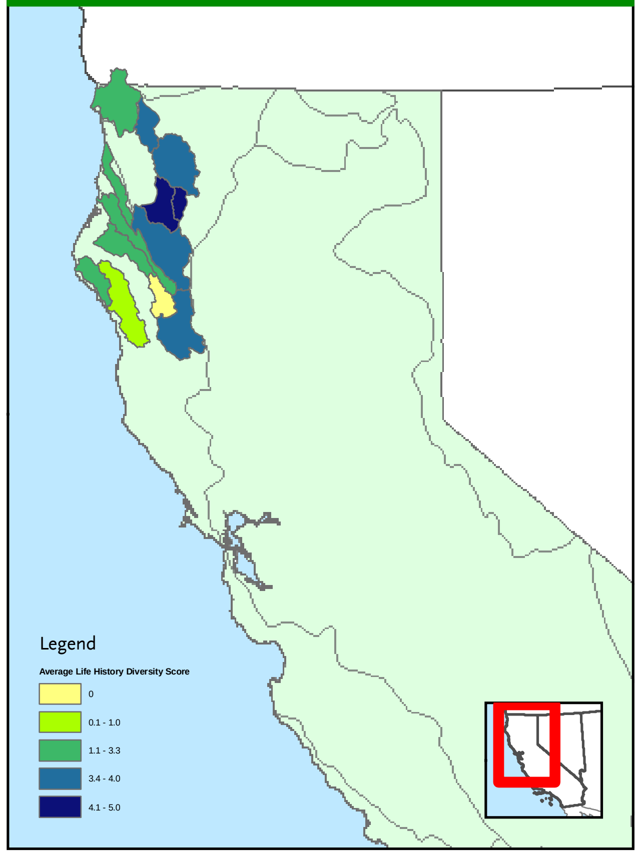
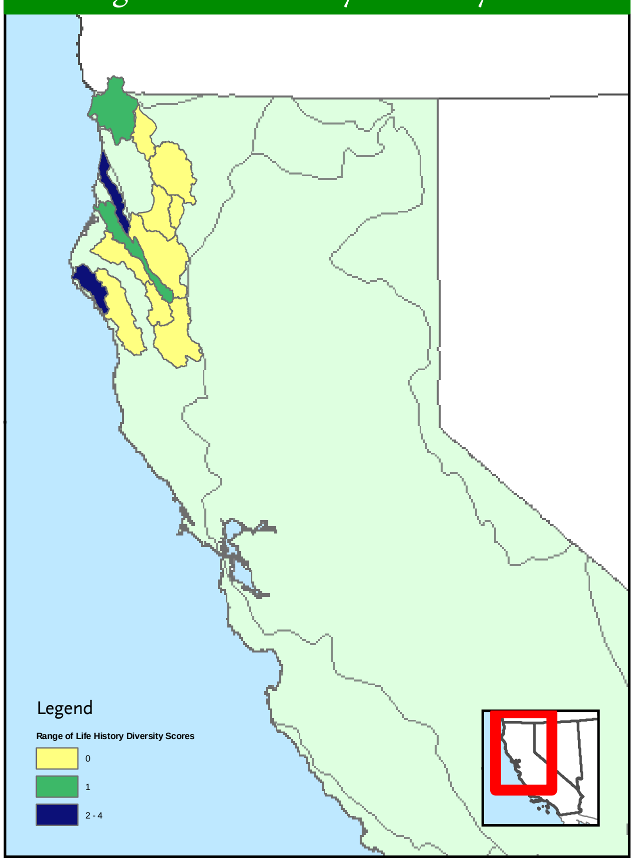
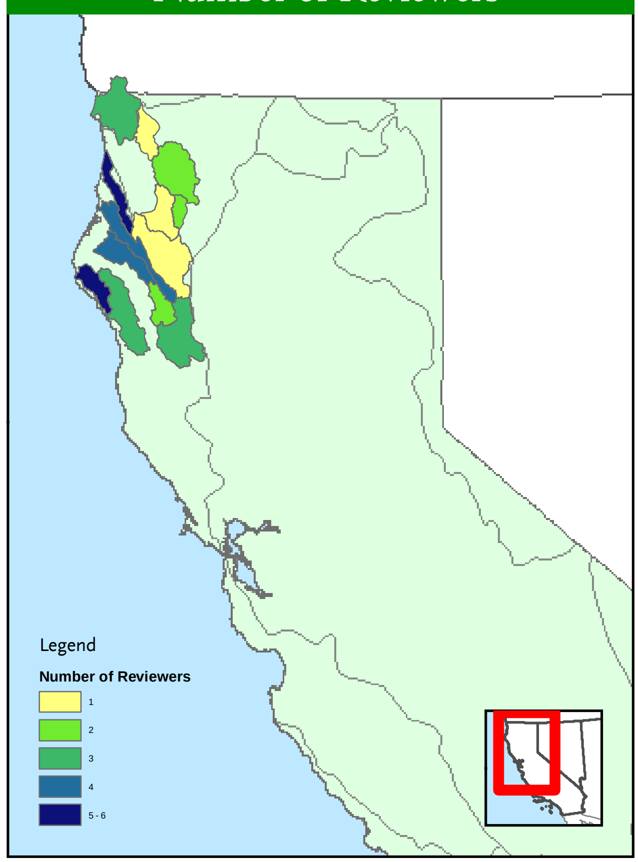


Range of Life History Diversity Scores

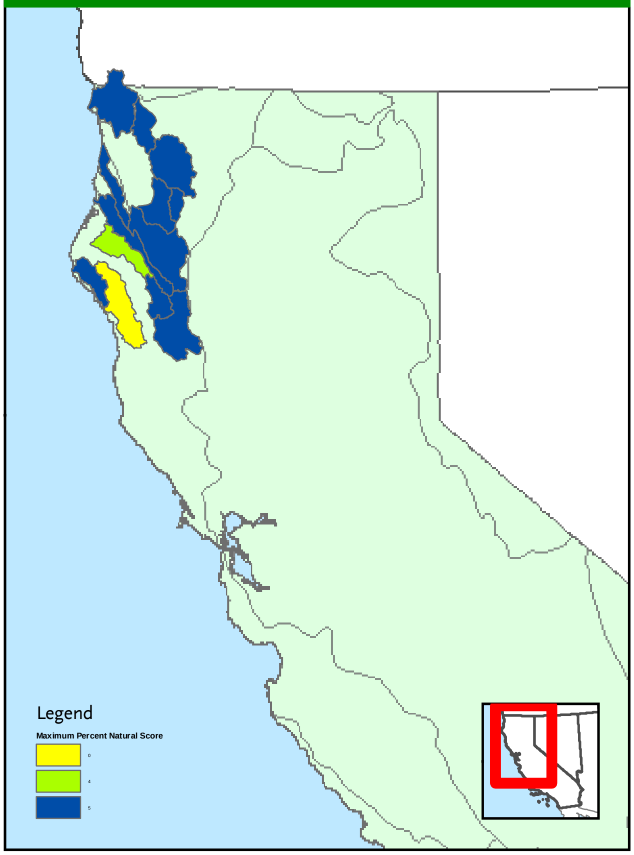


Number of Reviewers

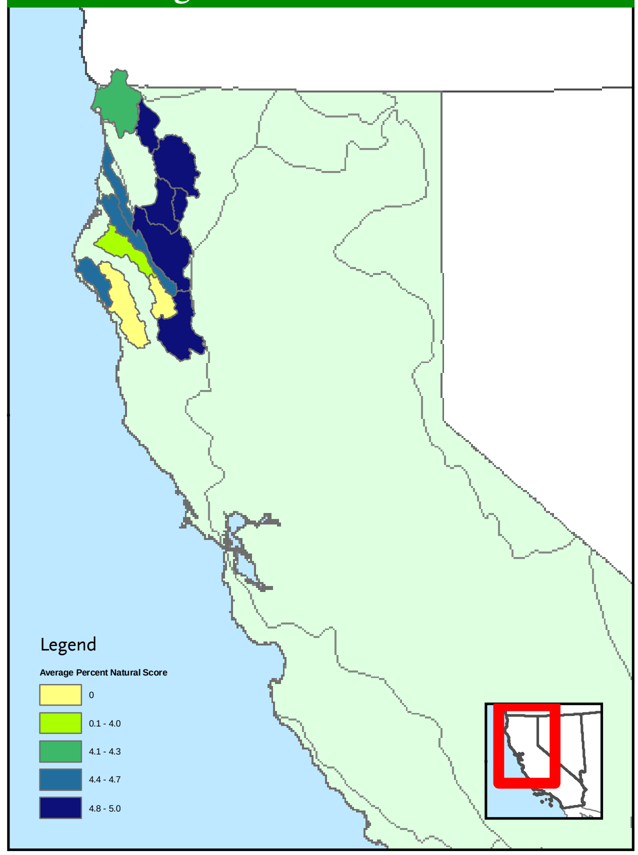


California Summer Steelhead Populations

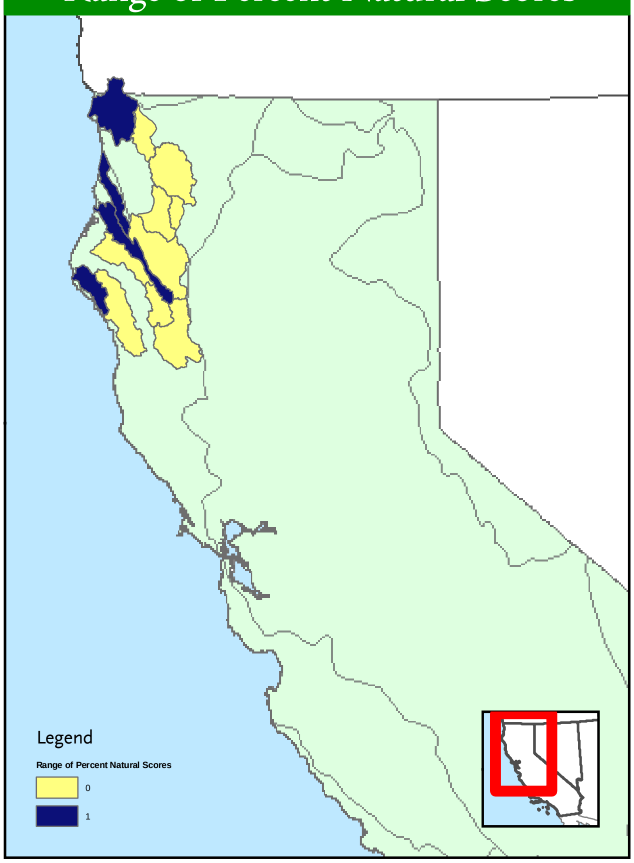
Maximum Percent Natural Score



Average Percent Natural Score



Range of Percent Natural Scores



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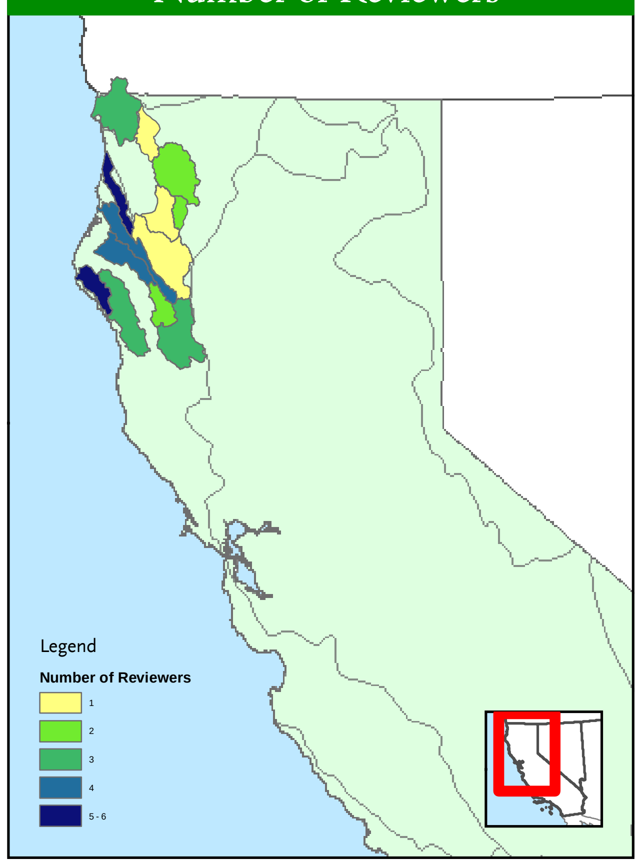
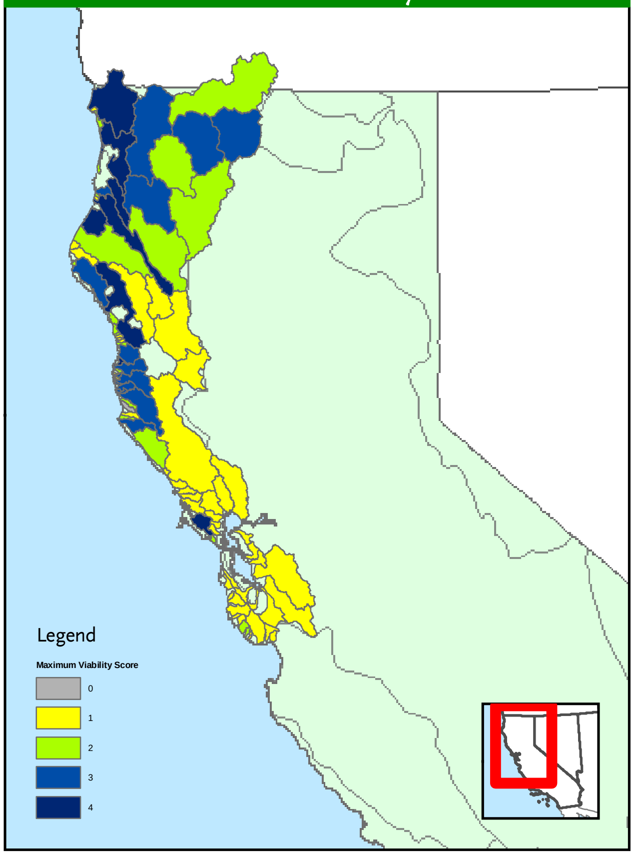


California Coho Populations

Maximum Viability Score



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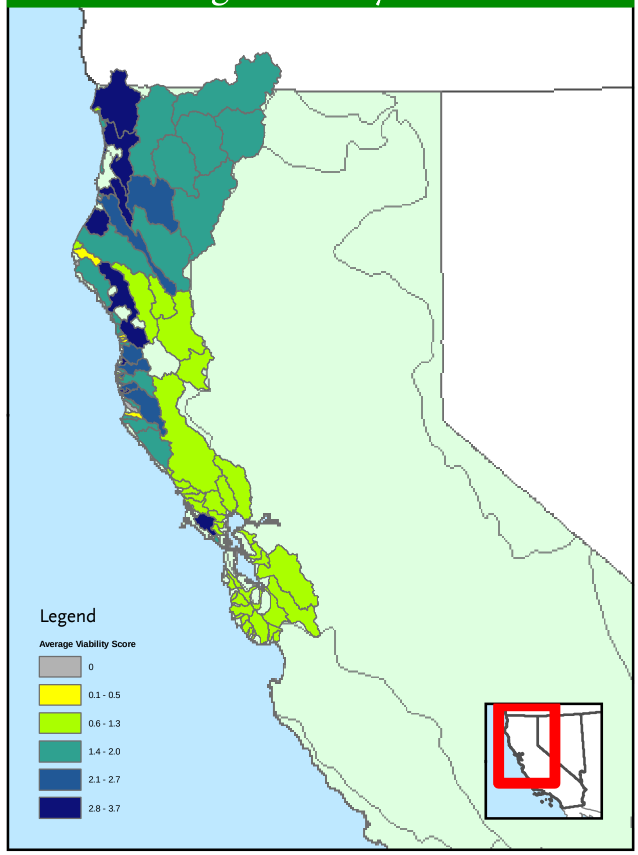
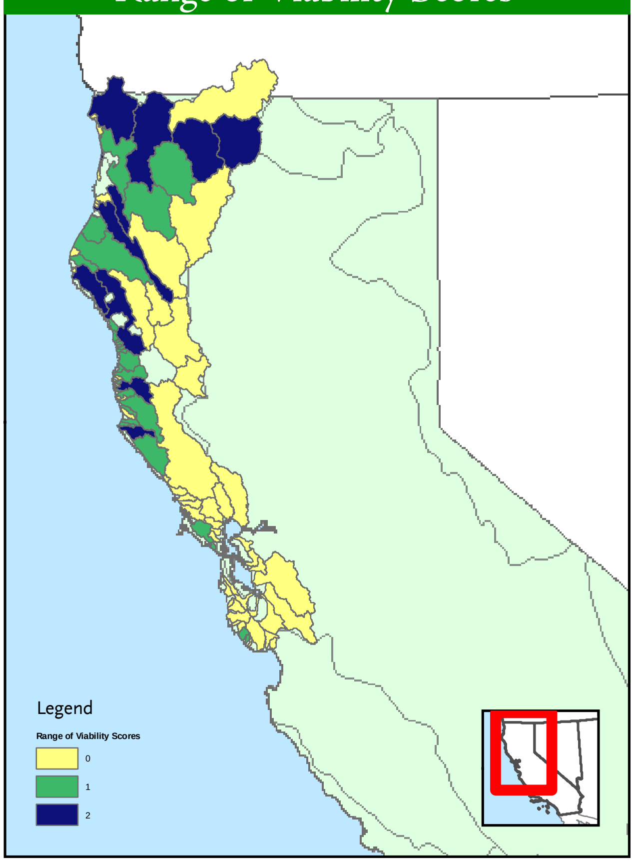


Range of Viability Scores



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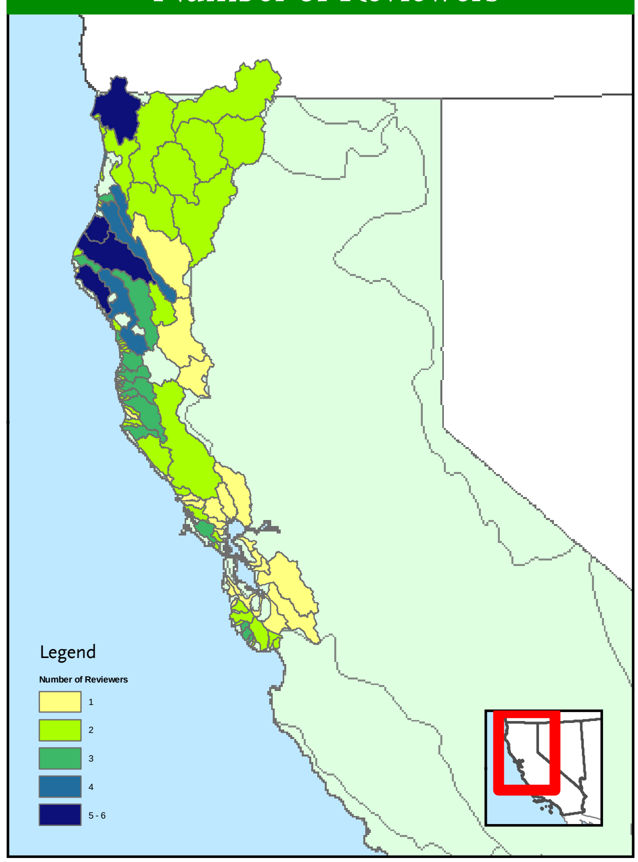
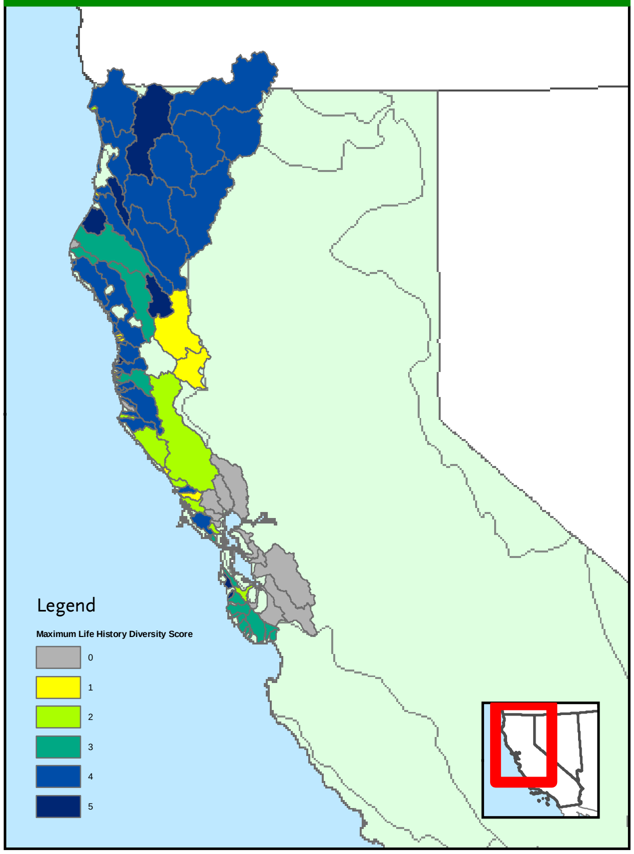


California Coho Populations

Maximum Life History Diversity Score



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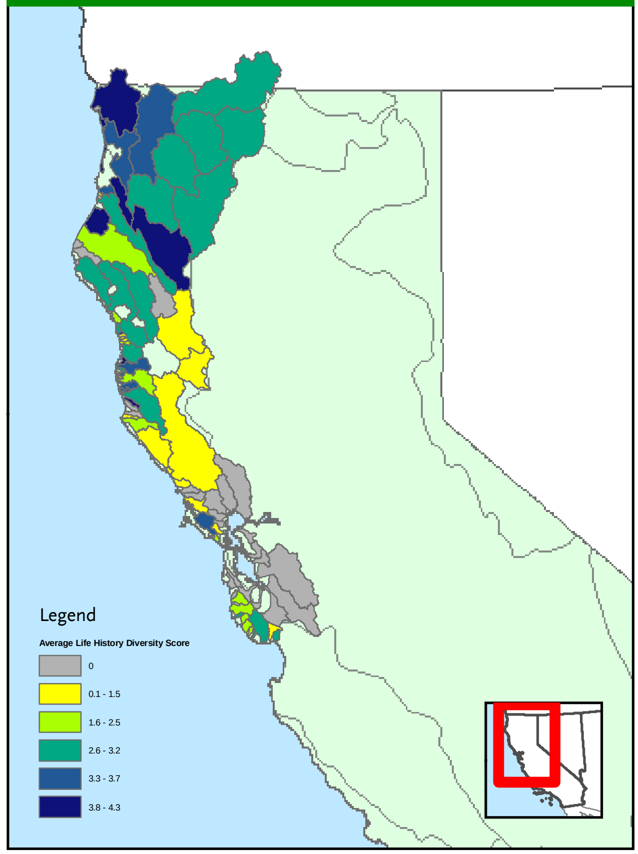

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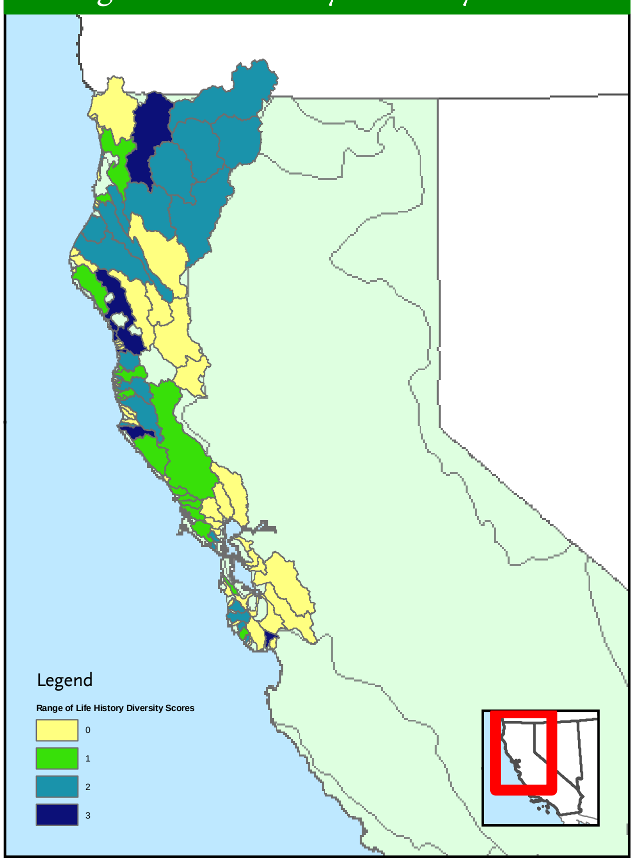

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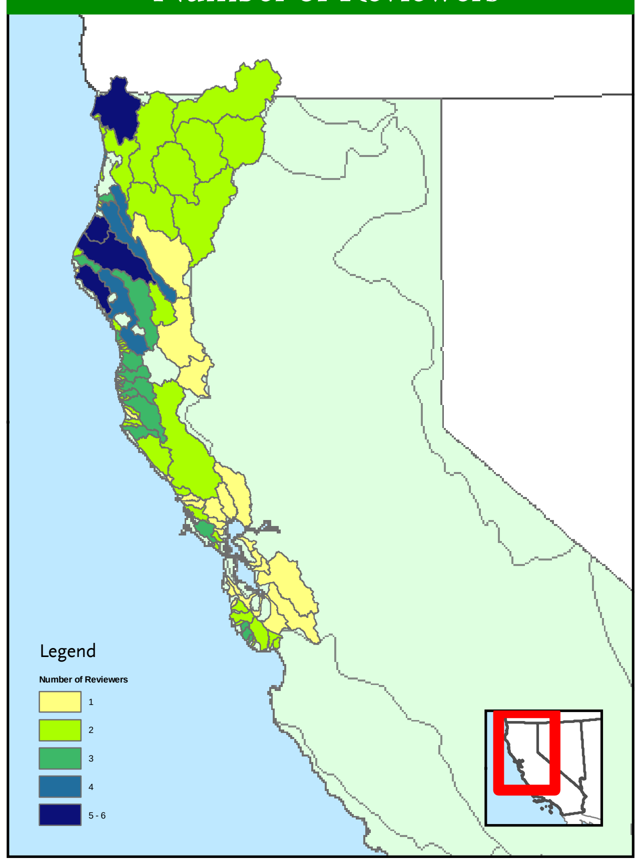

California Coho Populations

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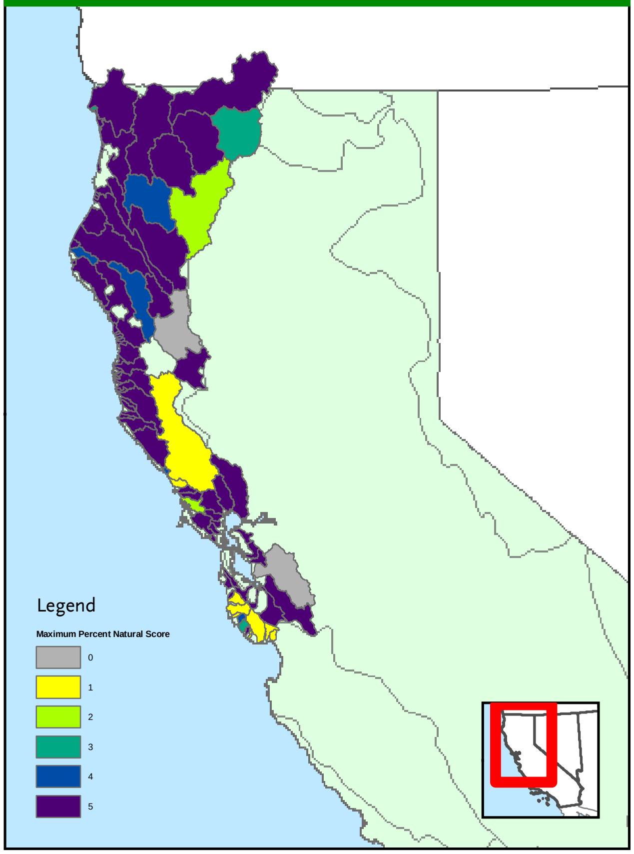

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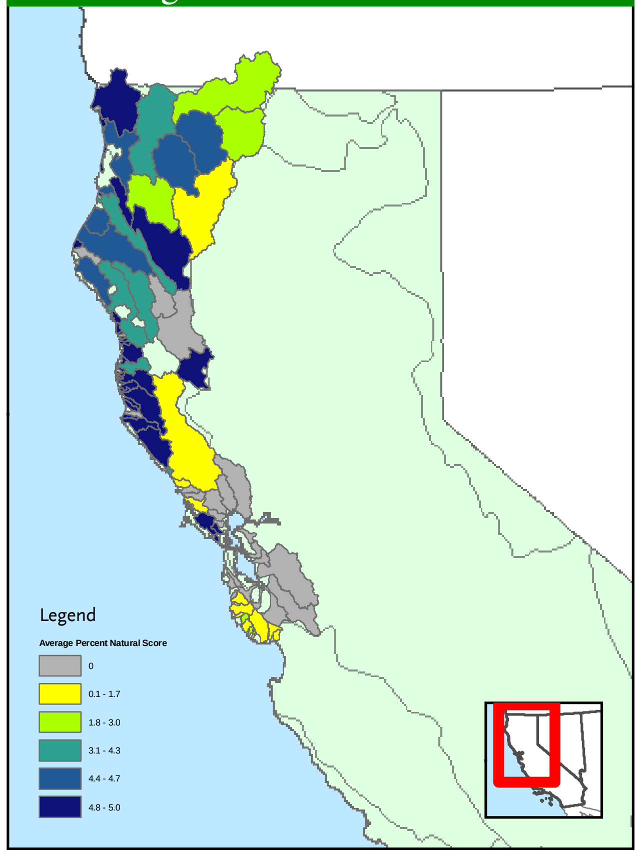

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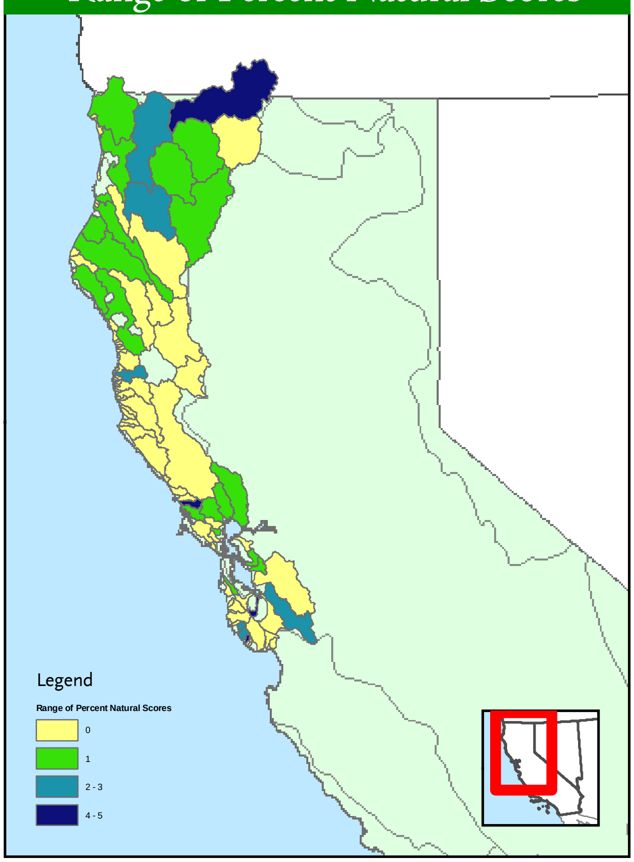

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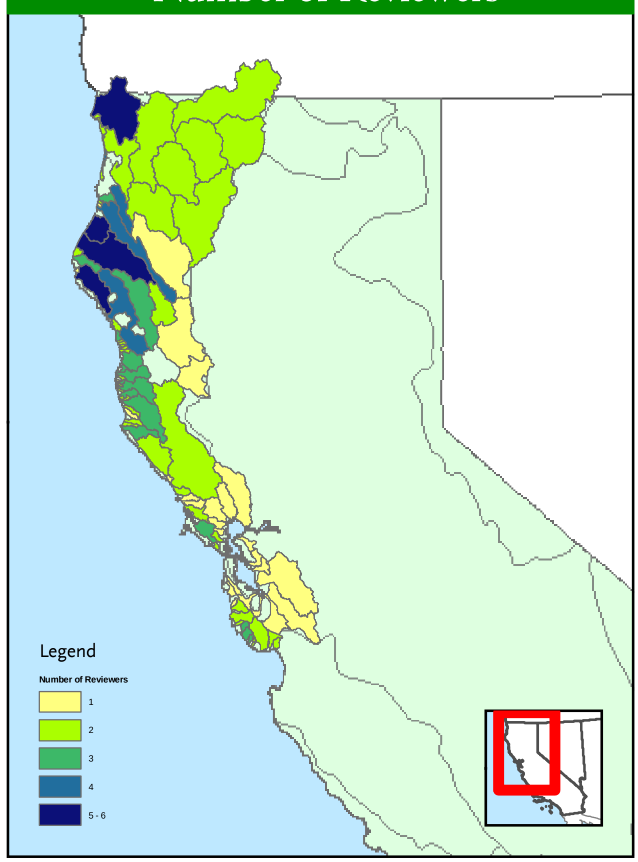
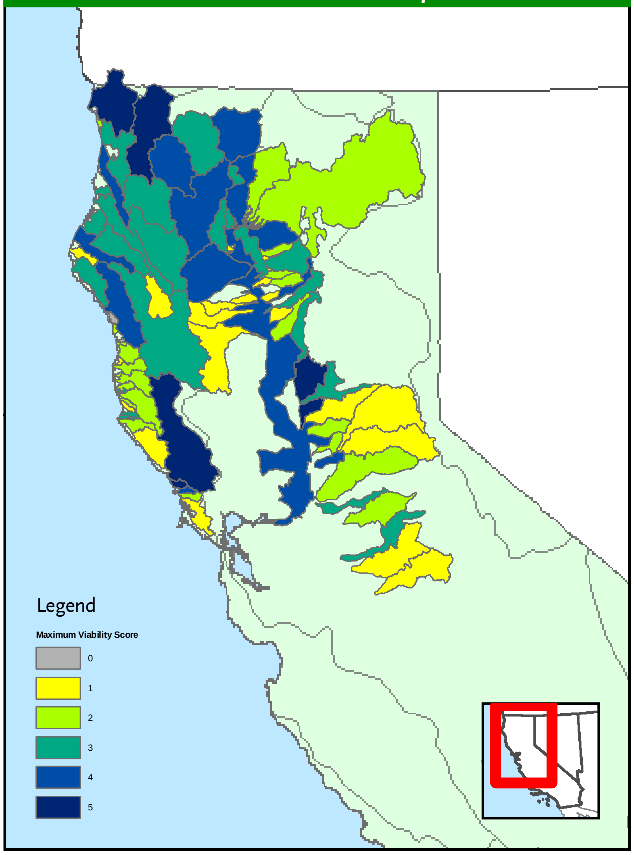


California Fall-Run Chinook Populations

Maximum Viability Score



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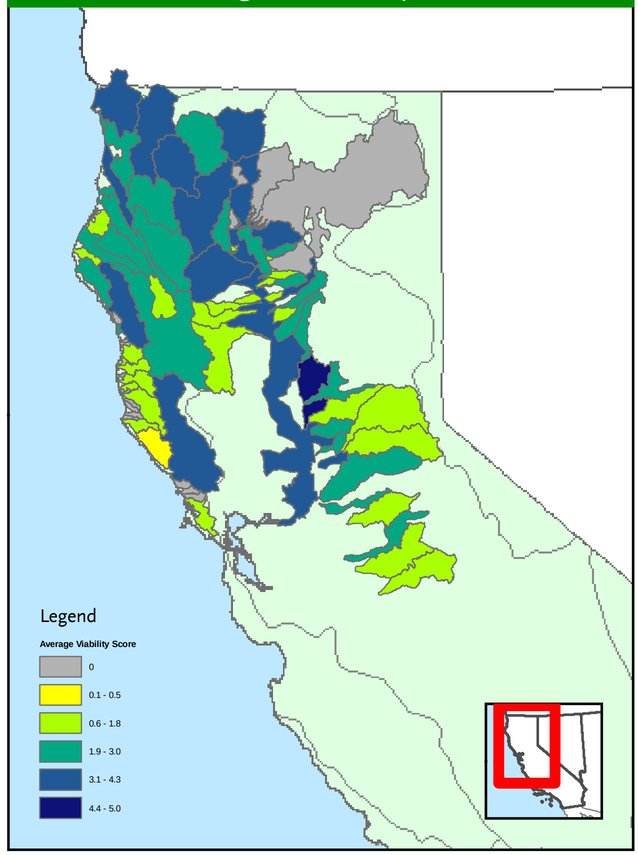

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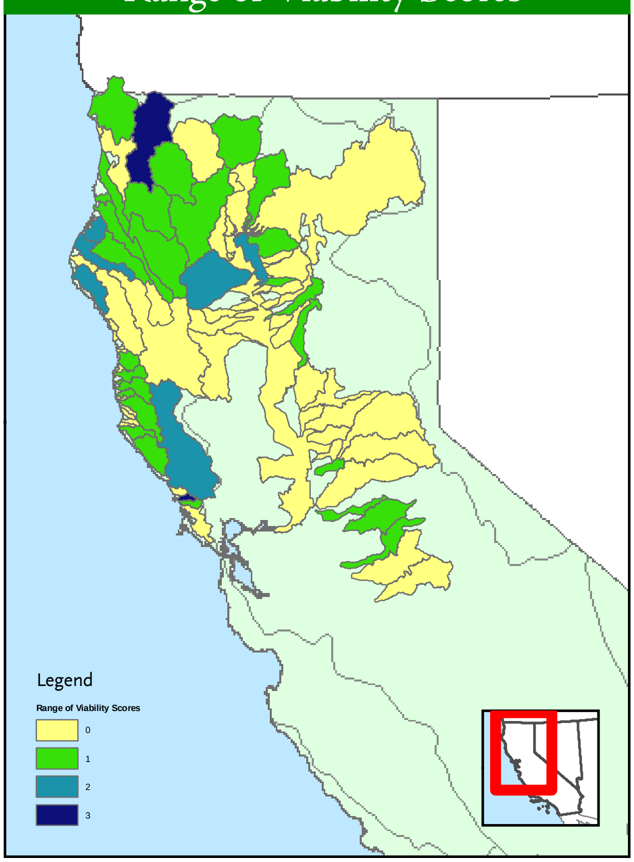

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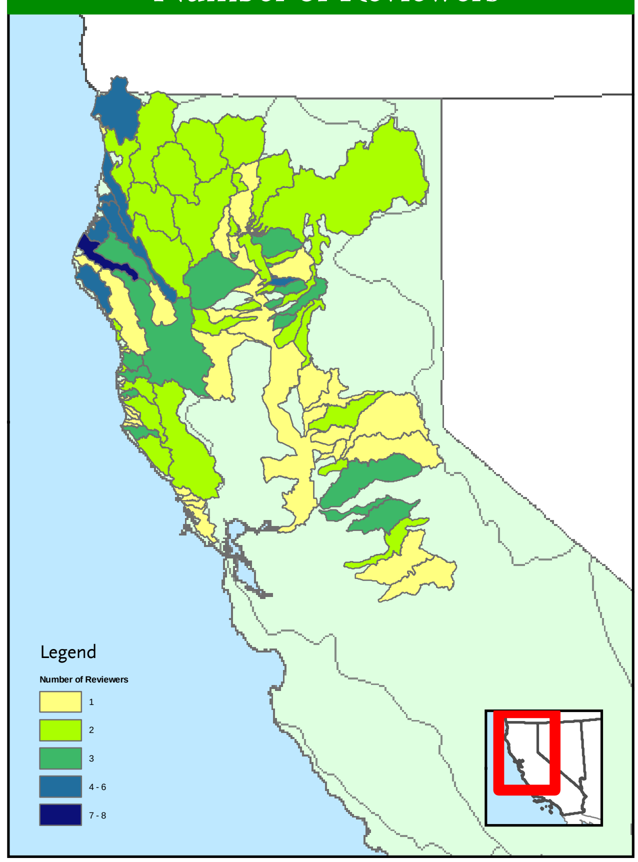

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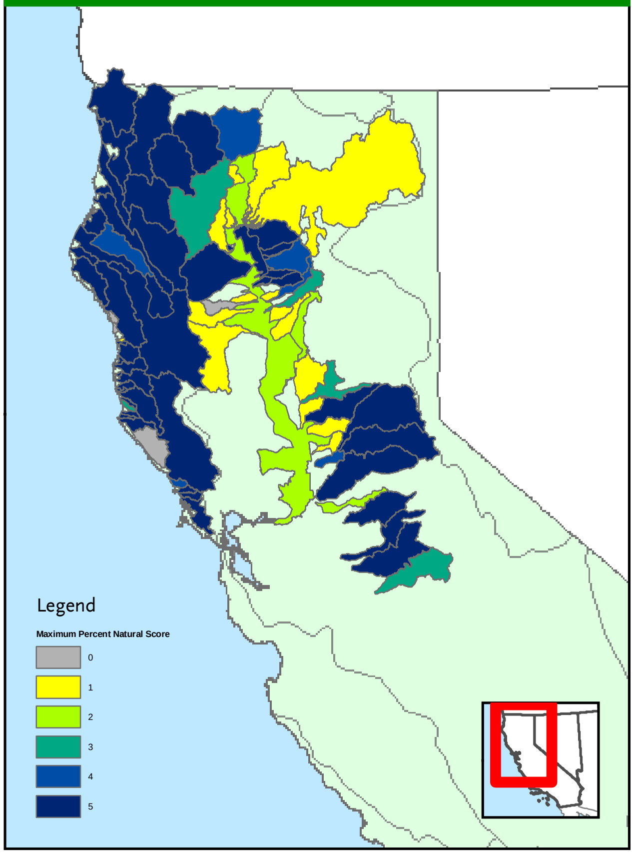

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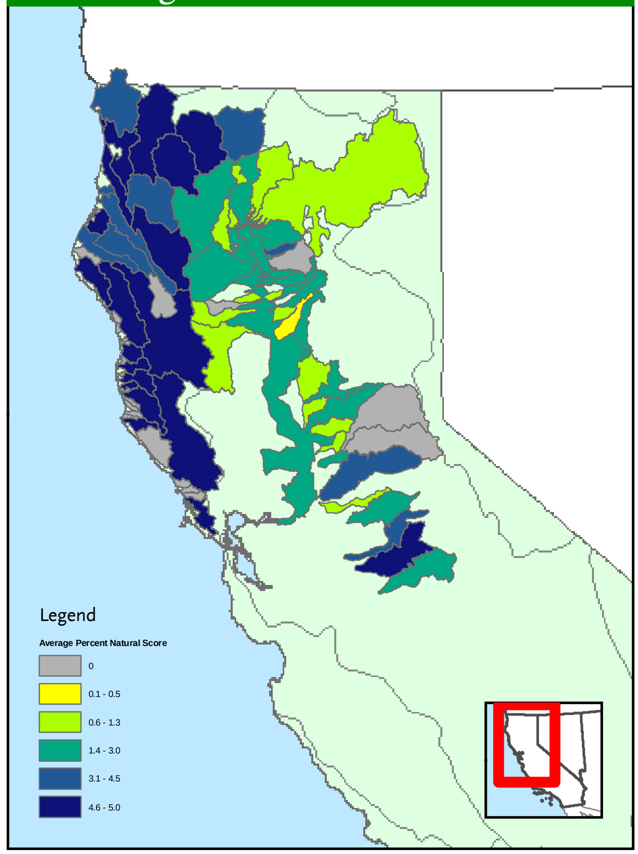

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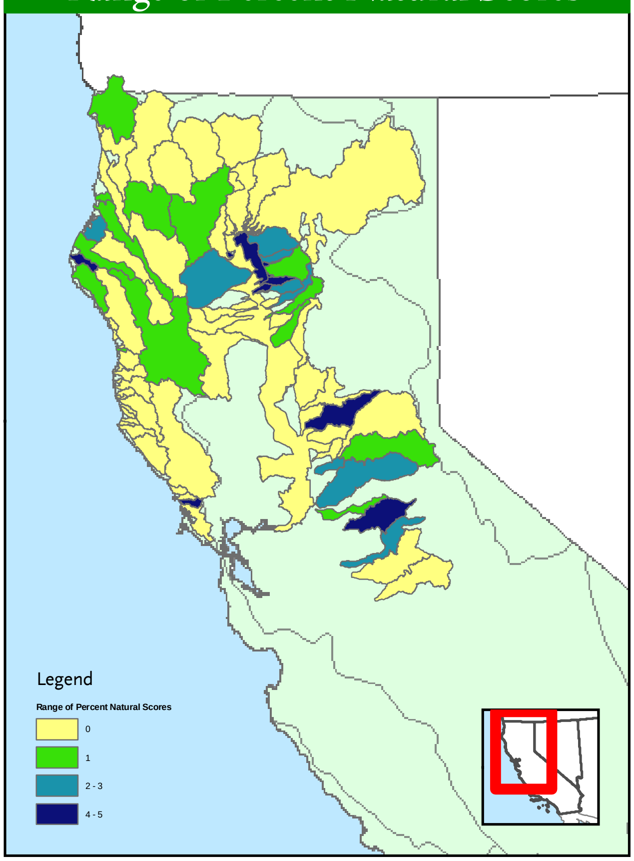

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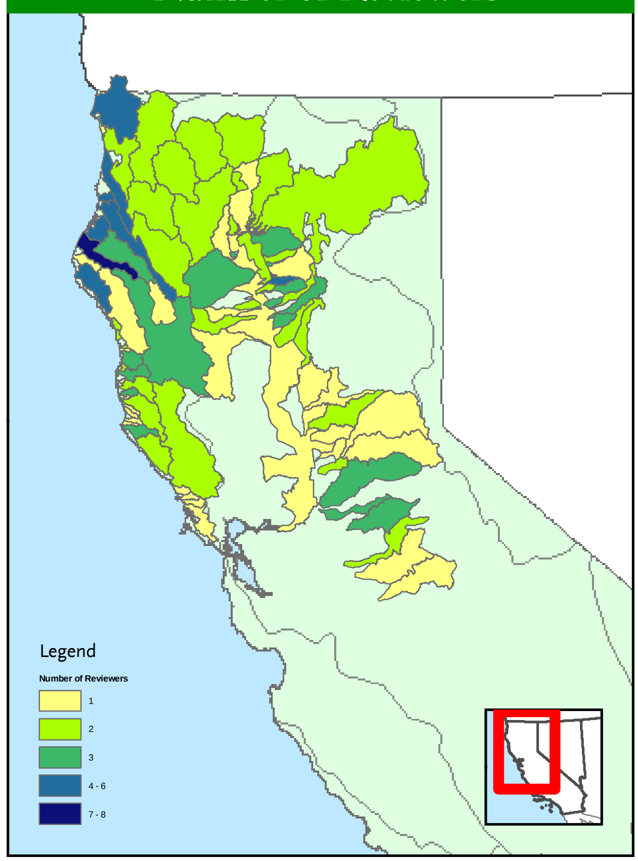
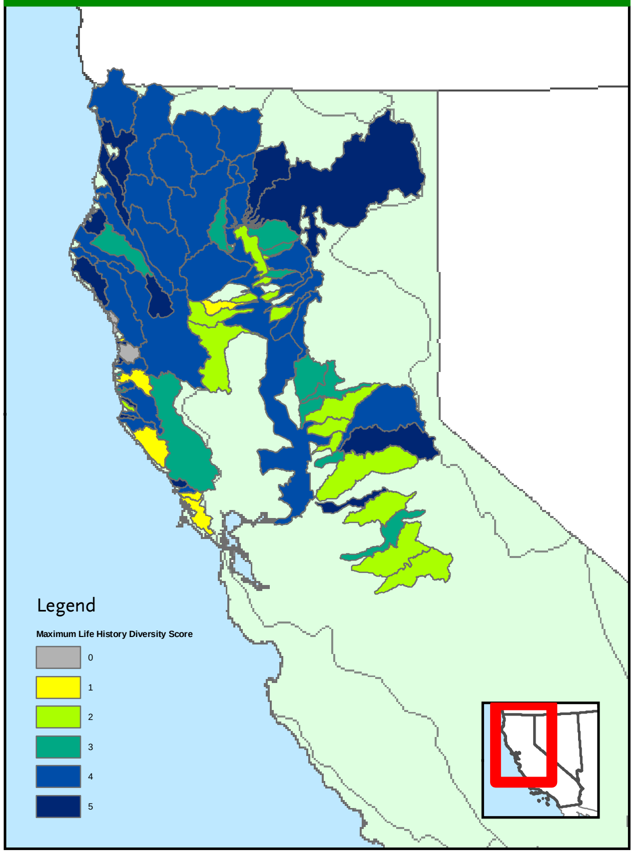


California Fall-Run Chinook Populations

Maximum Life History Diversity Score



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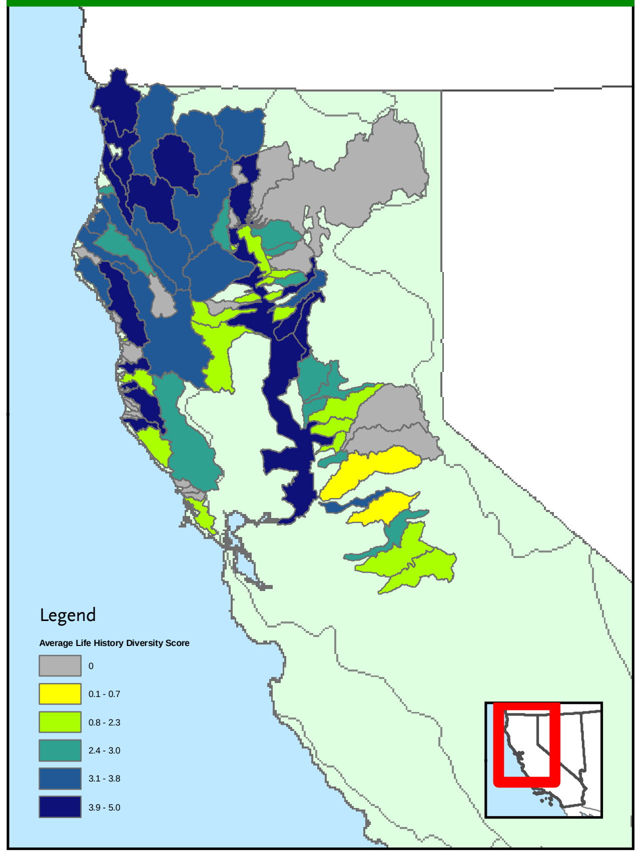
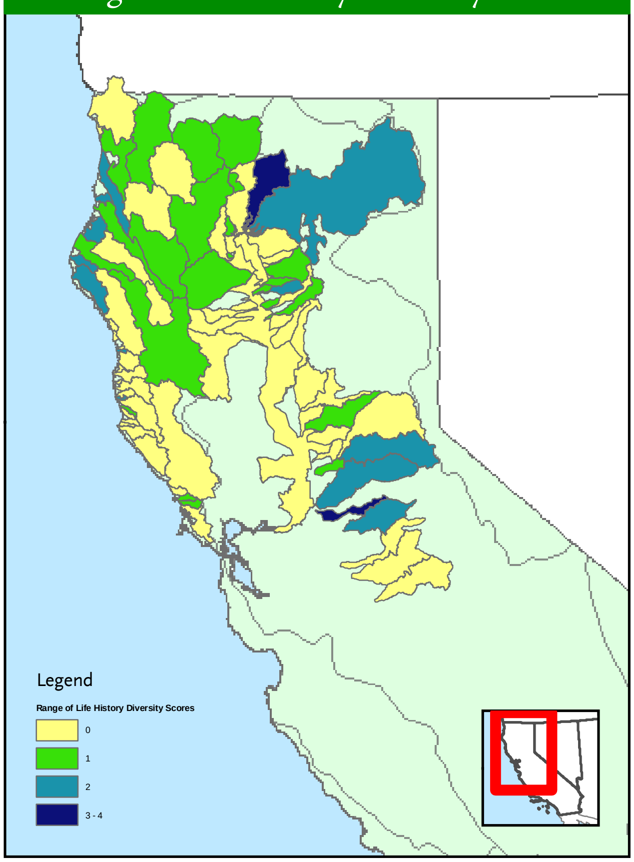


Range of Life History Diversity Scores



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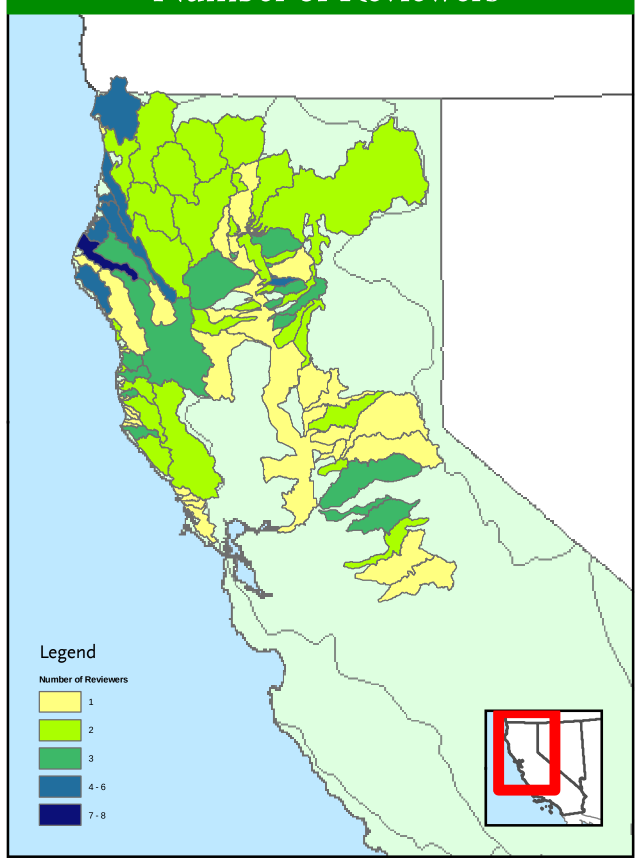

California Spring/Summer-Run Chinook Populations

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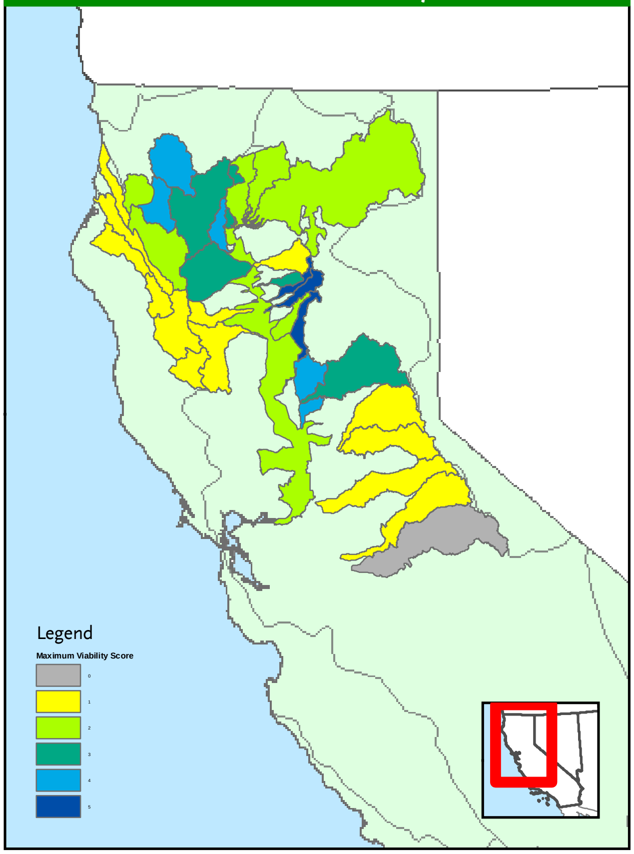

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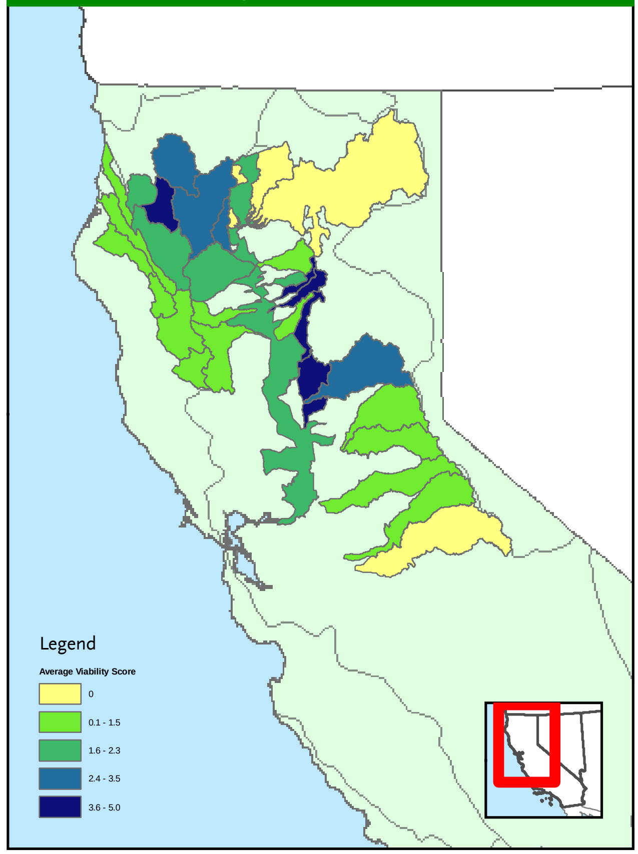

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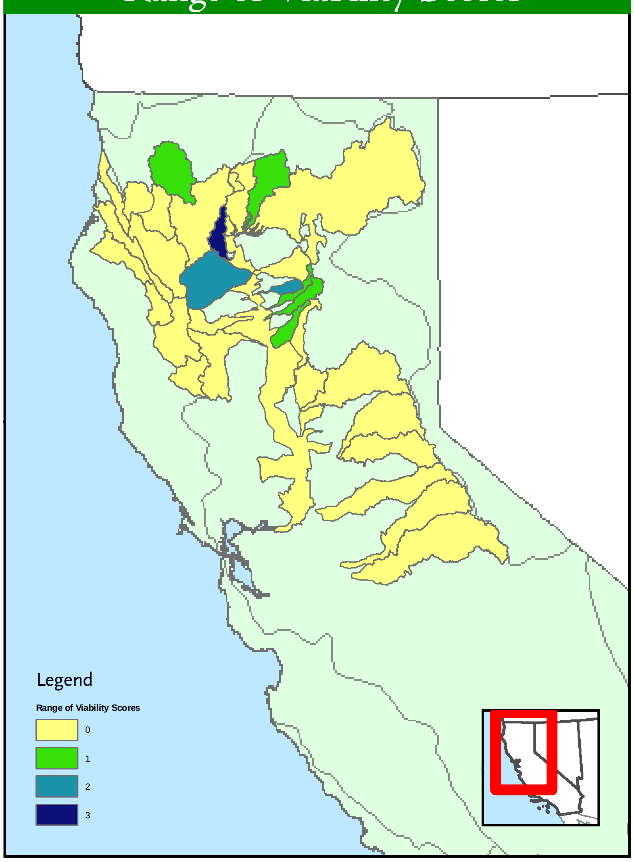

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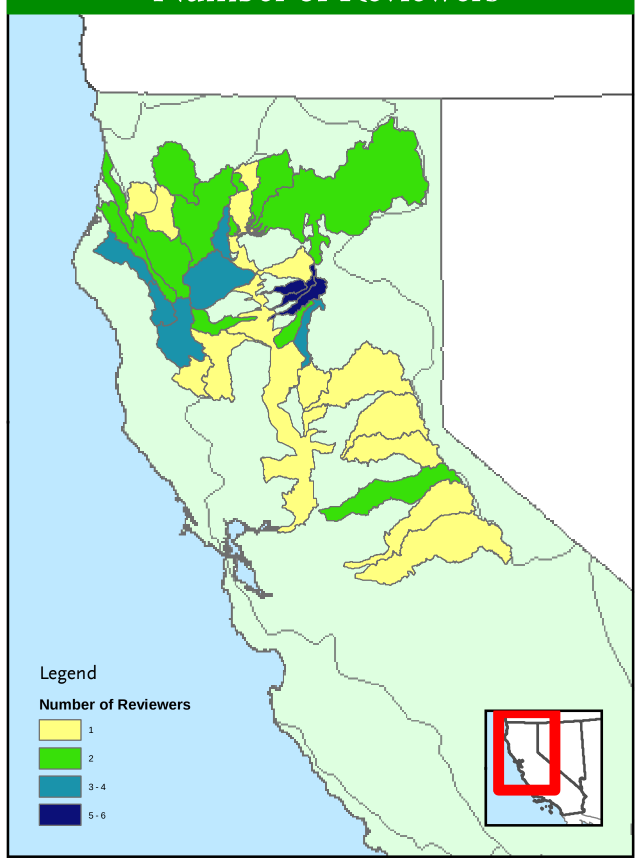

California Spring/Summer-Run Chinook Populations

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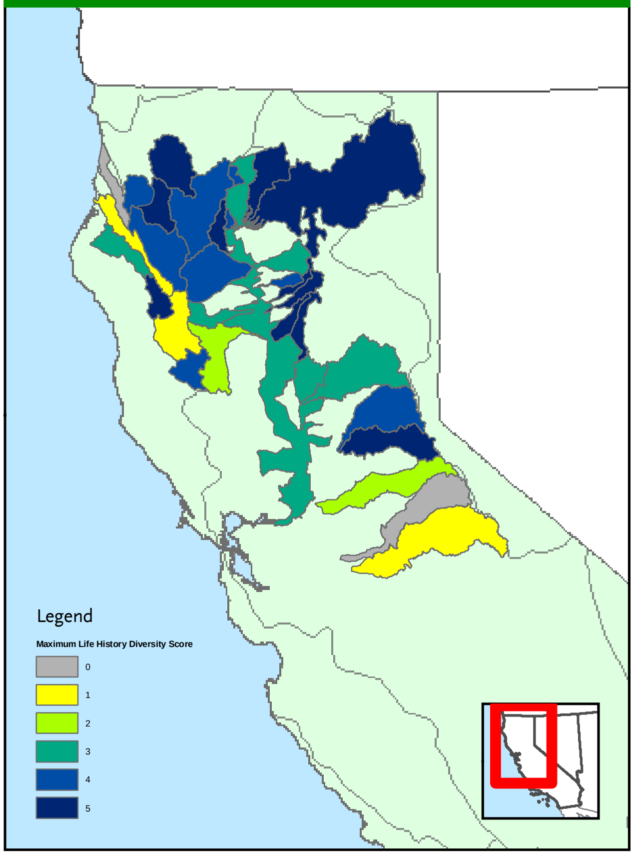

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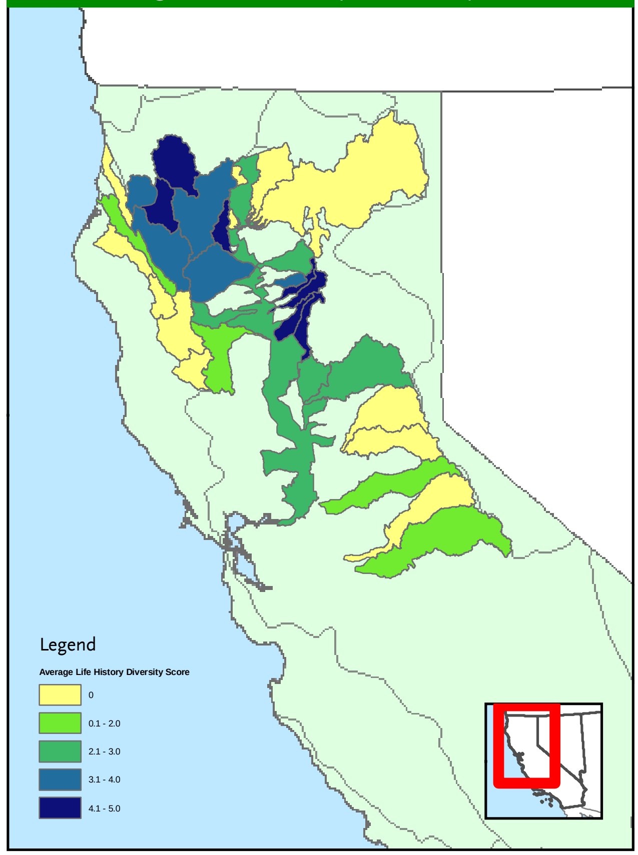

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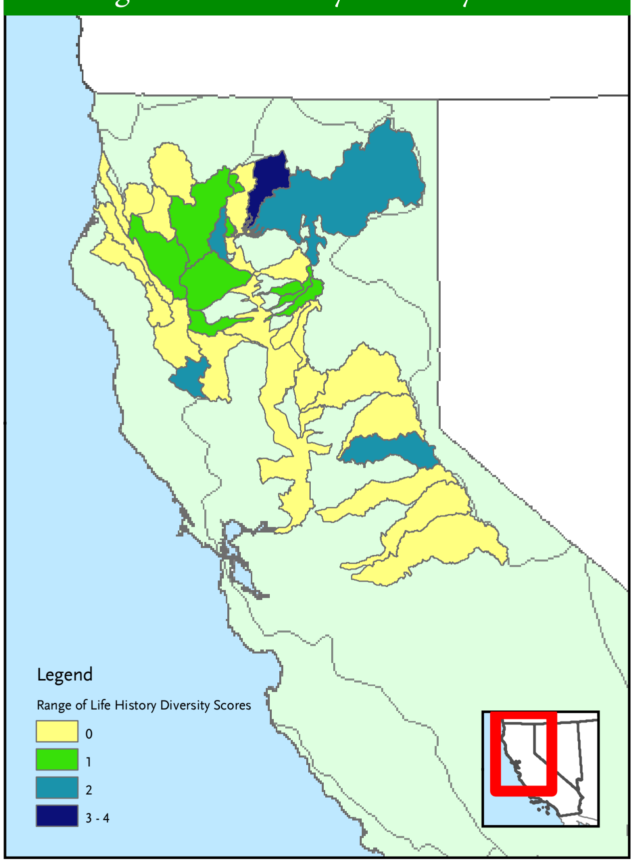

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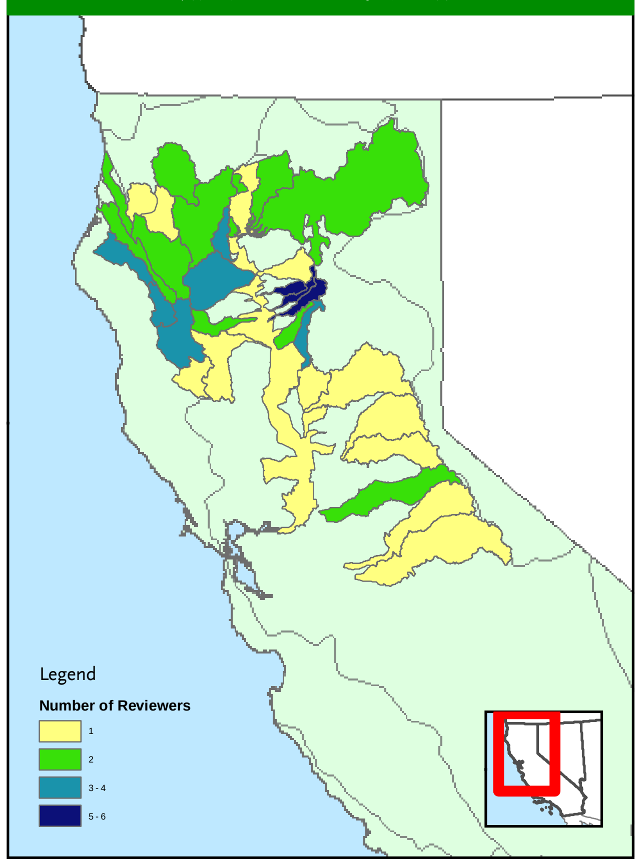
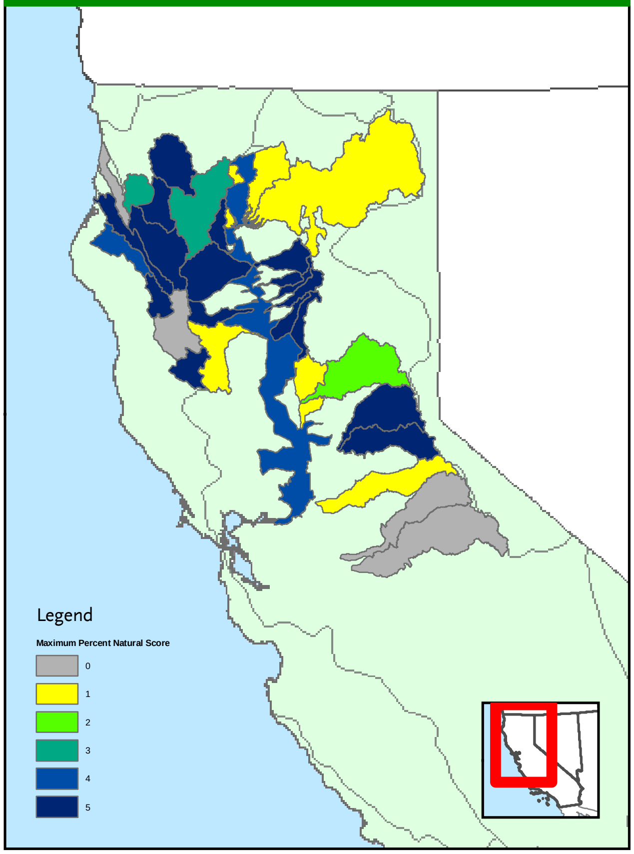


California Spring/Summer-Run Chinook Populations

Maximum Percent Natural Score



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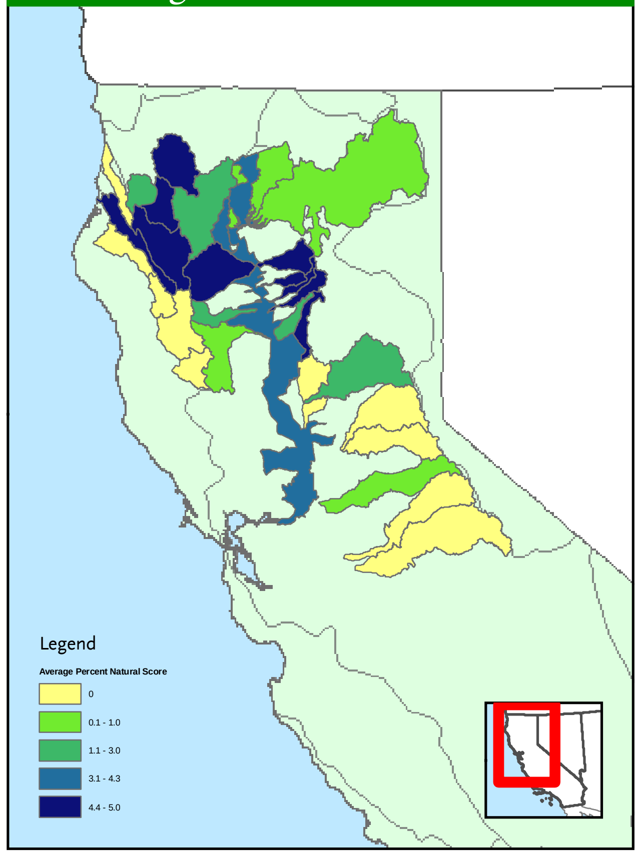

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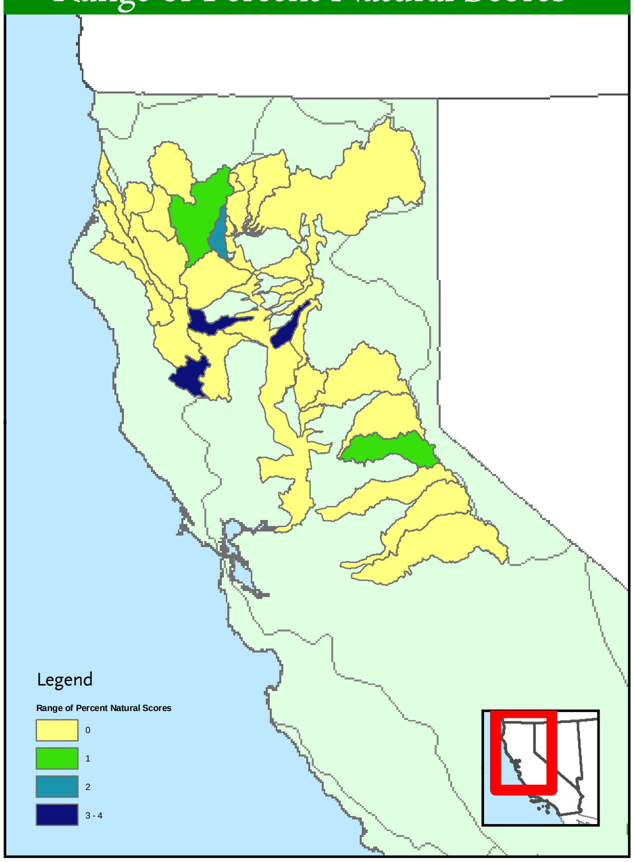

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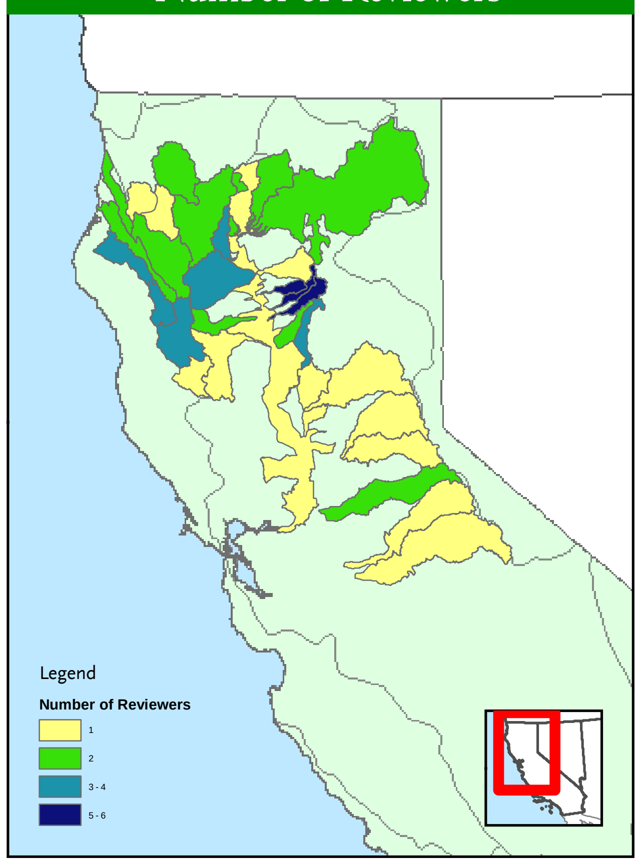

Appendix 4

California Strongholds: Threats and Vulnerabilities Assessment

California Strongholds: Threats and Vulnerabilities Assessment
North American Salmon Stronghold Partnership
Prepared by Trout Unlimited

Overview

A truly effective salmon conservation effort in California requires state, federal, and tribal resource managers along with leading non-governmental agencies to prioritize, coordinate, and fund landscape-scale strategies to conserve the healthiest wild salmon ecosystems – known as "salmon strongholds" – across jurisdictional boundaries, in partnership with local stakeholders. To reach that goal, the effort must first identify threats and needs in each of California's identified strongholds.

We have used California Trout's *Salmon, Steelhead, and Trout in California: Status of an Emblematic Fauna* report (the "SOS Report") and Trout Unlimited's Conservation Success Index (CSI) to identify the threats and vulnerabilities of each stronghold. The SOS Report is a comprehensive account of the status of California's native salmonids completed by Peter Moyle, Joshua Israel, and Sabra Purdy of University of California – Davis' Center for Watershed Sciences and commissioned by California Trout in 2008. The SOS Report provides detailed information on life history, habitat requirements, abundance, factors affecting status, conservation, and trends for each species. The full report is available at www.caltrout.org/SOS-Californias-Native-Fish-Crisis-Final-Report.pdf

The CSI is a watershed-scale assessment of information related to a species' distribution, habitat features, and future threats. The CSI assembles GIS data available from national or state resource management agencies in a database, summarizes the data by watershed, and assigns a categorical score (5 through 1, reflecting exceptional through poor condition) to the data based on the best scientific understanding of the influence of the particular data on salmon. These species-specific analyses – 17 "indicators" – are organized into four thematic groups and summed for the current distribution of each species/run: range-wide conditions, population integrity, habitat integrity, and future security. This threats and vulnerabilities analysis will focus on the habitat integrity and future security indictors. Habitat integrity metrics assess habitat condition based on stressors that can be readily captured by GIS data. Each indicator takes into account a variety of factors related to watershed condition (primarily roads), temperature, watershed connectivity (barriers), water quality (primarily land uses), and flow regime. Future security indicators anticipate the threats salmonids will face in the near future. Indicators account for a variety of factors related to land conversion (urban and vineyard), resource extraction (renewable and non-renewable), climate change, sedimentation, and land stewardship.

The effects of climate change will be of particular interest within the strongholds. The CSI assesses the vulnerability of salmonids to climate change based on three risk factors – increasing summer temperatures, changes in flow volume, and changes in precipitation and flow regime. Increasing air temperatures will increase water temperatures, displacing species from portions of their current distribution. Based on the observed relationship between the distribution of coho and winter steelhead in California and August air temperature (Agrawal et al 2005), the CSI calculates the average risk of exceeding these species-specific temperature thresholds under current climate conditions (PRISM, 2008) and using forecasts for 2050 (Maurer, 2007). The CSI also assesses changes in flow volume, which will be most pronounced in systems with surface runoff flow regimes. The CSI summarizes precipitation forecasts for 2050 (Maurer, 2007) and base flow index (Wolock, 2003), the ratio of base flow (groundwater flows) to total flow expressed as a percentage, by watershed. Finally, the CSI identifies areas vulnerable to changes in precipitation and flow regime. Transitions in California's winter precipitation regimes may be associated with changes in spring peak flow timing and magnitude, summer low flow magnitude, and increased likelihood of rain-on-snow events. For each watershed, we predict the transition in precipitation regime, where regimes include snow-dominated (Dec – Feb mean temperature < - 1°C), mixed (Dec – Feb mean temperature between – 1°C and 1°C), and rain-dominated (Dec – Feb mean temperature > 1°C), based on current climate (PRISM, 2008) and forecasts for 2050 (Maurer, 2007).

Additional information, including descriptions of the variables, a scoring framework, and references for all data used in the analysis, is available at www.tu.org/csi

Taken together, the SOS Report and the CSI provide an in-depth narrative account of species-specific factors affecting salmonid survival and persistence and a quantitative assessment of habitat and threat data of consistent source and scale to characterize their watersheds. These findings are summarized below by stronghold. The threats and needs identified are the factors that stand out as immediate threats or through comparison across strongholds; *local understanding and knowledge will provide important information on fine-scale threats and needs within strongholds.*

Smith River stronghold

The Smith River has characteristics that evoke a pristine stronghold – clear, cold rivers flowing from a largely protected watershed. Nonetheless, several stressors are present that could influence the stronghold.

CSI findings focused on existing habitat conditions identify several factors that currently influence the productivity of the system. Barriers are relatively abundant, both within watersheds (especially in watersheds surrounding the estuary) and downstream on mainstem streams and rivers. These barriers can inhibit salmon and steelhead passage and represent false movement corridors, entraining juveniles. Additionally, active mines are present in lower portions of the stronghold.

CSI future security results identify the expansive forest resources within the stronghold as a potential vulnerability. However, much of these resources are encumbered within formally protected federal lands, including the Smith River National Recreation Area and the Siskyou Wilderness Area. CSI climate change analyses identify the surface runoff regime within the stronghold as moderately susceptible to changes in precipitation and flow volume. Several watersheds have moderate risk for increased summer temperature for coho, the most temperature intolerant of California's salmon species. The inherent geomorphic structure of the basin is at moderate risk to shallow landslides. Some of this vulnerability is due to roads, many a legacy of historical logging activities, which traverse unstable slopes. The patterns of these stressors are depicted in Map 1. Average CSI metrics and scores for all watersheds within each stronghold are summarized in Table 1.

The SOS Report also suggests that the logging legacy within the basin continues to contribute sediment to streams. Two other vulnerabilities for the system described by the SOS Report are the estuary conditions, where dikes and levees have contributed to the conversion of much of the important estuary habitats, and hatchery influences, especially the small and unnecessary fall chinook program at the Rowdy Creek Hatchery. Nonetheless, the Smith River is the largest coastal river in California without a major dam. Conservation efforts, including the designation of the Smith River National Recreation Area and private conservation actions by groups like the Smith River Alliance, have made major strides in ensuring the continued productivity of the Smith River.

Salmon/Mid-Klamath stronghold

The Salmon/Mid-Klamath stronghold contains largely uninhabited watersheds in federal ownership held by the US Forest Service, but many of the threats and vulnerabilities to the stronghold relate to legacy land uses and conditions upstream and downstream that influence the access, survival, and persistence of salmon and steelhead locally.

The CSI identifies several factors that are current threats to the Salmon and Mid-Klamath system. Both strongholds have temperature issues, reflected in high mileages of streams listed by the State Water Resources Control Board (303(d)) for temperature and in miles of habitat currently exceeding the summer temperature threshold for coho. The mainstem Klamath is also listed for microcystin toxins, which can directly and indirectly influence the survival of adult and juvenile salmon and steelhead. Both strongholds also are identified as having relatively high numbers of downstream barriers. Additionally, the Salmon River stronghold is identified as having a high ratio of road mileage within the riparian zone to stream miles, a metric that can reflect floodplain alteration and the disruption of river connectivity.

For future security, the CSI reveals an inherent geomorphic risk related to shallow slope landslides that can be particularly exacerbated by roads and suppressed fire regimes. Building on current climate stresses, future climate scenarios suggest further increasing risk for coho and moderate risk for steelhead due to increased summer temperatures, especially along the mainstem Klamath and lower elevation portions of its tributaries. Map 2 provides an overview of the distribution of these threats in the stronghold.

These temperature findings are confirmed by the SOS Report, which details the importance of coldwater tributaries to the integrity of the basins. The SOS Report further describes a number of additional stressors, including the legacy effects of logging and fires in both strongholds and

19th century mining in the Salmon River stronghold. Although under a temporary moratorium until 2012, continued suction dredge mining remains a threat in the Salmon River.

Other vulnerabilities for the Salmon/Mid-Klamath stronghold are related to its position upstream of the lower Klamath and Trinity Rivers and downstream of hydroelectric and agricultural development in the Upper Klamath. Upstream dams influence the stronghold by altering flow and temperature regimes in the mainstem Klamath. Downstream threats include the condition of mainstem and estuary habitats, ich and columnaris disease (especially for chinook runs), behavioral and genetic interactions with hatchery fish, and harvest (including commercial and sport fisheries that take all species and the illegal harvest of summer steelhead while holding in mainstem pools during summer).

Mattole/South Fork Eel stronghold

The Mattole and South Fork Eel stronghold, which also encompasses the Bear River, is largely privately owned and populated at low densities. Active forestry and some agriculture – and their legacies - are associated with many of the vulnerabilities within this stronghold.

The habitat assessment indicators within the CSI reveal multiple existing stressors in the Mattole/South Fork Eel stronghold. The South Fork Eel and Mattole basins both have a relatively high mileage of streams on the 303(d) list for sedimentation and temperature. Much of the sedimentation in both systems is associated with historical logging, slope failures, and flooding. High road densities in the Mattole and South Fork Eel and high ratios of road miles in riparian zones to stream miles in the South Fork Eel are also reflective of the logging legacy. A relatively high number of instream sand and gravel mining operations are an additional stressor in the South Fork Eel.

Future threats identified by the CSI specific to the Mattole River are vineyard conversion and roads that exist on slopes susceptible to shallow landslides. The vineyard conversion analysis within the CSI looks at the climatic, topographic, and soil characteristics that are suitable for growing wine grapes, an increasing cause of land conversion in coastal California. Vineyards are associated with water uses for frost and heat protection during critical low instream flow periods. The South Fork Eel is also at risk to vineyard conversion, as well as at moderate risk for increased summer temperature for coho. The entire stronghold is vulnerable to the effects of continued forestry operations and the lack of formally protected lands. The pattern of threats within the Mattole/South Fork Eel stronghold are displayed in Map 3.

The SOS Report describes multiple additional threats to the Mattole/South Fork Eel stronghold. In the Mattole, elevated instream temperatures are an issue likely tied to low flows resulting from widespread rural landowner water use. Additionally, the Mattole estuary is impaired by temperature, habitat degradation, and sedimentation. Much of the sediment in the estuary is related to the logging legacy in the basin. The South Fork Eel is similarly influenced by the effects of historical logging, particularly on mainstem habitats. Like the Salmon/Mid-Klamath stronghold, the integrity of the South Fork Eel stronghold is susceptible to conditions in the downstream river, including estuary conditions and predation of juveniles by introduced Sacramento pikeminnow in the mainstem.

Sacramento stronghold
The Sacramento River stronghold encompasses much of the best remaining habitat in what was once the most productive salmon system in California. Antelope, Mill, Deer, and Butte Creeks and the mainstem Sacramento River are included in the stronghold.

Existing threats to the Sacramento stronghold, as identified within the CSI, fall into four main categories: passage and flow alterations associated with water infrastructure, urban and agricultural development, resource extraction, and inherent conditions. Mill and Deer Creeks are least affected by water infrastructure, but have relatively high numbers of downstream barriers, like all watersheds in the stronghold. Antelope and Butte Creek and the mainstem Sacramento have high risk of altered flows and juvenile entrainment due to high densities of canals (Butte and Sacramento), high densities of within watershed diversions (Antelope), high densities of diversions (Antelope and Sacramento), and the presence of multiple dams (Butte). Urban and agricultural development is relatively abundant in Butte Creek and along the Sacramento. Resource extraction activities in the stronghold are reflected in relatively high counts of active mines (Butte Creek), instream sand and gravel mining operations (Butte Creek), oil and gas wells (Butte Creek and the mainstem Sacramento), and miles of riparian area roads to stream miles (Antelope and Deer Creek, Sacramento). All watersheds except Deer Creek exceed the summer air temperature threshold related to steelhead persistence, though the spring-fed creeks in the stronghold may be buffered from air temperatures.

Future threats classified within the CSI for the Sacramento stronghold range from land use change to resource development to climate change. Urban development forecasts are most pronounced in Butte Creek. Developing the geothermal or wind resources in Deer and Mill Creek or forest resources in all watersheds except the Sacramento could bring new disturbance to those watersheds. Potential hydroelectric sites have been identified in Deer and Butte Creeks and the Sacramento, a threat that will have more immediacy with increasing water demands of agricultural and urban users in California. CSI climate change analyses find warming risk to be moderate for all watersheds in the stronghold, but high in the mainstem Sacramento. Headwater drainages in Butte, Deer, and Mill Creeks are at moderate risk of flow regime change, as they are forecast to transition from a snow/rain mixed winter precipitation regime to rain-dominated. Map 4 depicts CSI metrics and results.

The SOS Report describes an additional suite of threats and vulnerabilities for the Sacramento stronghold. Lost habitat, in the form of floodplain loss along the mainstem Sacramento and estuary conversion downstream to San Francisco Bay, is a major limiting factor for the stronghold. Harvest and competition with hatchery fish in the estuary represent additional vulnerabilities outside of the stronghold. Mill, Deer, and Butte Creeks are the watersheds in the stronghold with the least local influence of hatchery fish. The effects of historical mining in Mill and Deer Creeks and widespread logging in the upland portions of all the stronghold watersheds are a legacy influence on current productivity. The SOS Report identifies an extreme threat in the form of the destructive eruption of Mt Lassen, which could eliminate much the productivity of the northern Sacramento River. The stronghold is also vulnerable to wildfire and sustained drought as less severe natural disturbances.

Big Sur stronghold

The Big Sur stronghold includes the Big Sur and Little Sur Rivers and San Jose Creek. These systems drain out of the Los Padres National Forest and portions of the Ventana Wilderness Area directly into the Pacific Ocean.

Within the Big Sur watershed, the only stressor identified by the CSI for current conditions is the ratio of diversions to stream miles, representing surface water usage. San Jose Creek has a relatively high number of active mines, within watershed barriers, and miles of riparian area roads to stream miles. The Little Sur River has no current threats as reflected in the metrics included in the CSI.

The CSI identifies several future threats for the stronghold. The Big Sur and Little Sur River watersheds are both at moderate risk for flow volume changes (as surface runoff dominated systems), moderate inherent risk to shallow slope landslides due to geomorphology, and high risk to landslides due to road placement on unstable slopes. The San Jose Creek watershed has similar vulnerability to flow volume change, but faces additional threats from land conversion to urban development and forest resource development. CSI results and metrics are mapped in Map 5.

The SOS Report describes the degraded estuary and lagoon conditions of each watershed in the Big Sur stronghold as the primary limiting factor related to anthropogenic causes. Other vulnerabilities for these watersheds relate to wildfire, drought, and increasing temperatures inland. These last stressors have likely historically acted upon all the small watersheds in the south-central California coast, causing some populations to become temporarily extirpated, but later recolonized by stray steelhead from neighboring watersheds.

Santa Clara stronghold

The Santa Clara stronghold represents the southernmost-identified stronghold for California's salmon and steelhead and the winter steelhead runs it is intended to protect are the southernmost-occurring anadromous species in North America. Given the significant declines of these runs and the urbanization of Southern California, this stronghold is faced with the largest suite of threats and vulnerabilities.

The CSI identifies multiple existing stressors in the Santa Clara. Large portions of the lower basin are converted to agricultural and urban land uses, a disturbance associated with many detrimental instream impacts. High road densities, high mileages of road miles in the riparian zone relative to stream miles, and high mileage of canals reflect these land uses. To meet the water needs of agricultural and urban water users, the basin has highly developed water storage infrastructure; these dams, barriers, and diversions block fish passage and alter flow and temperature regimes. Instream sand and gravel mining operations, other mines, active oil and gas wells, 303(d) listing of the mainstem Santa Clara for toxins, and warm summer temperatures in the lowest elevation reaches also all pose additional existing threats to the stronghold. Future threats revealed by the CSI are increased urbanization, renewable energy development (solar and wind) in the eastern portion of the basin, and increasing summer temperatures. Map 6 shows the general distribution of threats in the Santa Clara basin.

The SOS Report confirms these findings, listing channel connectivity and barriers as major threats. Nonetheless, most of these threats are concentrated in the mainstem, migratory habitats. Large portions of rearing habitat on a major tributary are formally protected in the Sespe Creek Wilderness Area. If these habitats became readily accessible, they could again become highly productive. Additional work to restore habitat and mitigate pollution in the estuary and reduce the abundance of introduced, predatory smallmouth bass could further secure the Santa Clara stronghold.

Prepared by Kurt Fesenmyer, Trout Unlimited Science Staff

References

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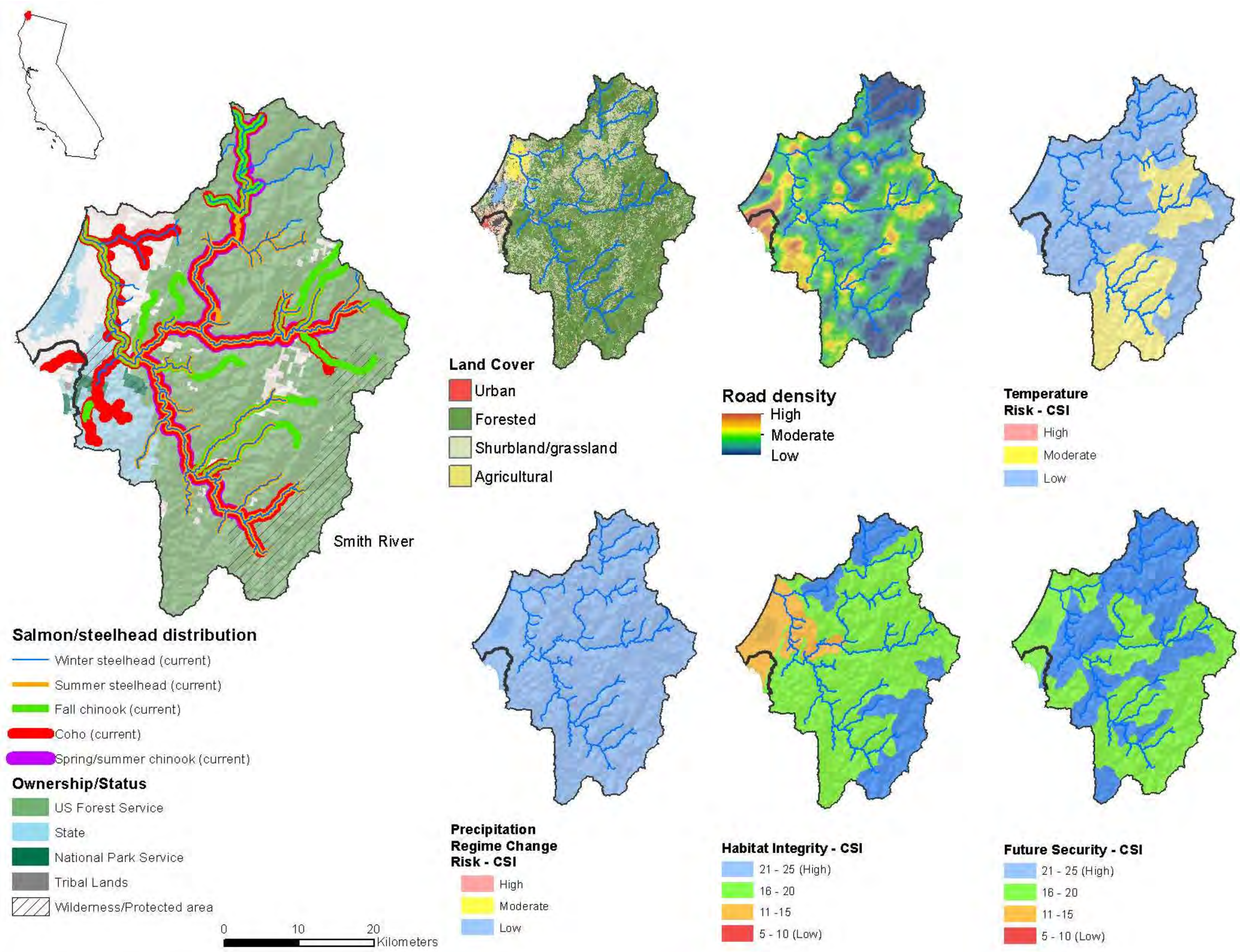
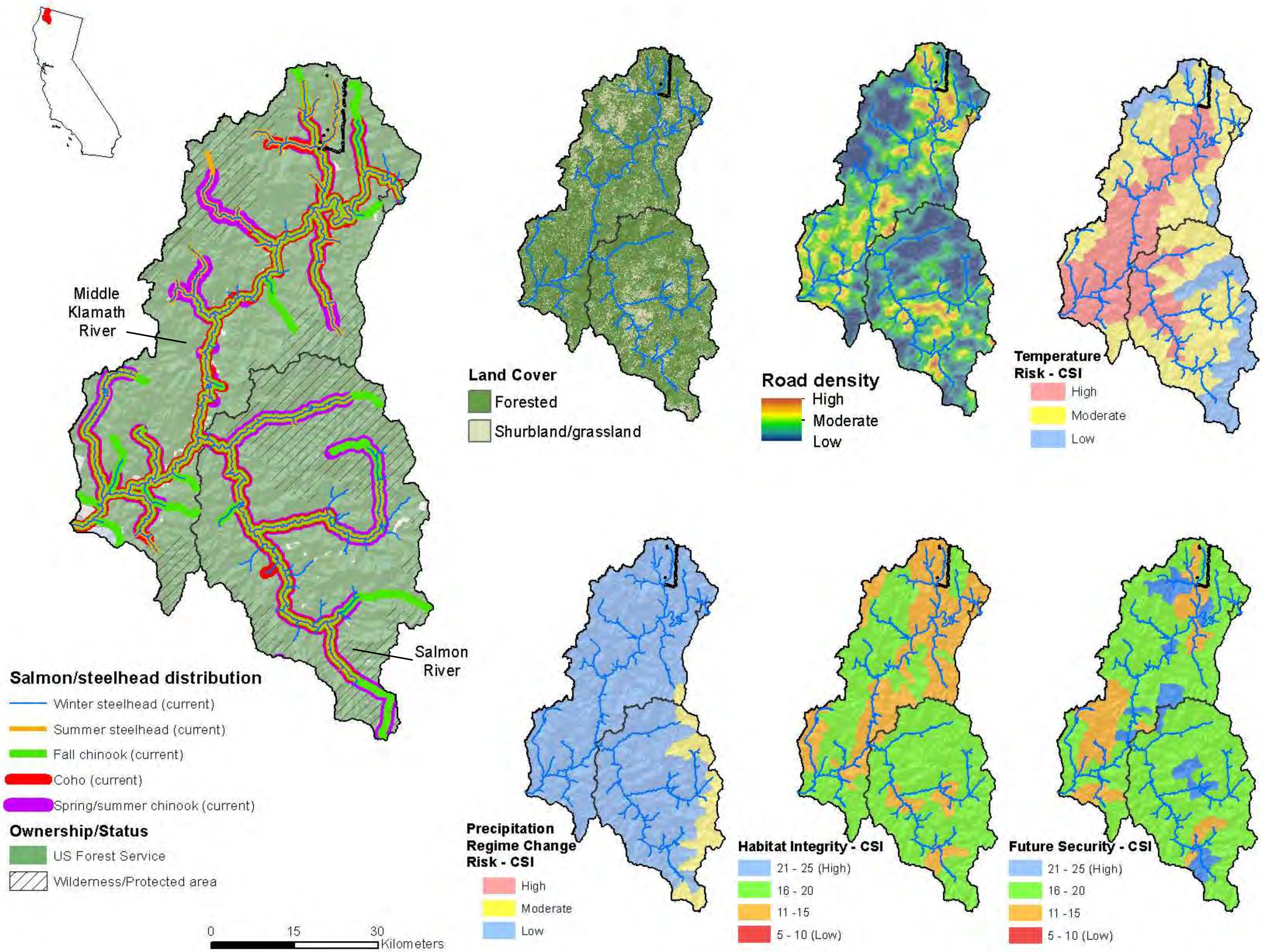
Table 1: Average CSI results by stronghold. Metrics that are potential threats are highlighted in red, while lowest threats are highlighted in green.

		Smith	Salmon	Mid-Klamath	Mattole	South Fork Eel	Bear	Antelope Cr	Mill Cr	Deer Cr	Butte Cr	Sacramento	Big Sur	Little Sur	San Jose Creek	Santa Clara
Habitat Integrity	Miles 303d sediment	0.0	0.0	0.0	17.1	15.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Road mi/stream mi	0.2	0.3	0.2	0.3	0.5	0.2	0.3	0.1	0.3	0.2	0.3	0.2	0.1	0.3	0.4
	Road density	2.2	1.9	2.4	2.2	3.4	1.4	2.1	1.5	2.1	2.3	2.5	1.1	1.0	1.8	2.7
	Sand and gravel mine count	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.4
	Watershed Conditions CSI score	**2.8**	**2.4**	**2.6**	**2.3**	**1.7**	**3.2**	**2.3**	**3.5**	**2.5**	**2.6**	**2.4**	**3.4**	**4.0**	**2.0**	**2.0**
	Miles 303d temperature	0.0	12.0	13.3	17.1	15.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	% stream miles > 21.5 C (Coho threshold)	0.0%	35.4%	49.5%	0.0%	6.9%	0.0%									
	% stream miles > 24 C (Winter steelhead threshold)	0.0%	0.7%	0.5%	0.0%	0.0%	0.0%	28.7%	22.3%	16.6%	68.6%	81.9%	0.0%	0.0%	0.0%	39.7%
	Temperature Limitations CSI score - Coho	**4.4**	**2.5**	**2.2**	**3.0**	**2.9**	**4.5**									
	Temperature Limitations CSI score - Steelhead/Chinook	**4.4**	**3.0**	**3.0**	**3.0**	**3.0**	**4.5**	**4.0**	**4.0**	**4.2**	**2.3**	**1.1**	**5.0**	**5.0**	**5.0**	**2.3**
	Barriers in watershed	5.4	0.6	1.3	2.6	2.4	0.0	3.3	1.8	2.0	2.6	1.5	2.4	0.3	15.0	7.5
	Barriers downstream	19.2	5.2	6.7	1.3	3.6	0.0	18.7	13.5	21.3	6.6	5.9	1.4	0.3	0.0	0.3
	Watershed Connectivity CSI score	**2.2**	**2.4**	**2.8**	**3.5**	**2.7**	**5.0**	**2.0**	**2.5**	**2.0**	**2.7**	**3.7**	**3.2**	**4.3**	**2.0**	**2.9**
	Miles 303d toxins/nutrients	0.0	0.1	13.3	0.0	0.0	0.0	0.0	0.0	0.1	0.6	6.8	0.0	0.0	0.0	17.4
	% agricultural or urban	4.6%	1.6%	3.1%	2.0%	4.4%	1.2%	1.1%	2.6%	4.2%	40.7%	69.0%	2.2%	0.3%	2.9%	15.1%
	Active mines	1.11	0.49	0.47	0.12	0.15	0.17	0.00	0.25	0.17	1.13	0.66	0.20	0.67	2.00	1.93
	Active oil and gas wells	0.0	0.0	0.0	2.12	0.1	0.2	0.3	0.0	0.0	32.3	118.9	0.0	0.0	0.0	794.0
	Water Quality CSI score	**4.4**	**4.7**	**3.0**	**4.9**	**4.7**	**4.8**	**5.0**	**4.8**	**4.5**	**2.8**	**1.7**	**4.6**	**4.3**	**4.0**	**2.3**
	Dam count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.5
	Miles canal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	47.1	89.9	0.0	0.0	0.1	4.3
	Storage/stream mile	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	18.8	16.4	0.0	0.0	0.0	77.6
	Diversions/stream mile	0.2	0.2	0.2	0.1	0.2	0.0	0.4	0.2	0.2	0.3	0.8	0.5	0.3	0.3	0.3
	Flow Regime CSI score	**4.9**	**4.9**	**4.8**	**4.9**	**4.8**	**5.0**	**4.3**	**5.0**	**4.8**	**2.3**	**2.4**	**4.8**	**4.7**	**5.0**	**4.0**
Future Security	% vulnerable to conversion (urban)	0.7%	0.1%	0.2%	0.3%	1.1%	0.1%	0.0%	1.1%	0.1%	10.0%	3.2%	1.4%	0.7%	13.9%	11.3%
	% vulnerable to conversion (vineyard)	0.1%	0.0%	0.0%	2.4%	10.4%	0.5%	0.0%	0.0%	0.0%	0.6%	0.4%	0.0%	0.7%	0.1%	3.9%
	% easements	0.0%	0.0%	0.0%	0.0%	3.0%	0.0%	1.3%	3.0%	5.8%	2.4%	3.7%	0.6%	0.0%	11.3%	0.1%
	% productive forest	58.5%	11.6%	45.2%	72.4%	57.4%	60.9%	0.0%	8.1%	0.1%	0.2%	0.0%	29.3%	31.9%	5.9%	0.0%
	% vuln. to conv. (urb. + vin., no redwood or easement)	0.7%	0.1%	0.2%	2.5%	10.7%	0.6%	0.0%	1.1%	0.1%	10.1%	3.5%	1.4%	1.3%	14.0%	13.5%
	Land Conversion CSI score	**5.0**	**5.0**	**5.0**	**5.0**	**4.7**	**5.0**	**5.0**	**5.0**	5.0	**4.8**	**5.0**	**5.0**	**5.0**	**5.0**	**4.7**
	% vulnerable to resource extraction (all energy)	1.9%	0.1%	0.2%	0.5%	1.1%	2.8%	2.2%	7.0%	10.2%	0.2%	1.4%	0.3%	0.7%	0.2%	13.0%
	% vulnerable to resource extraction (forestry)	10.3%	25.4%	48.6%	58.6%	47.1%	60.0%	40.1%	26.4%	42.2%	26.2%	0.0%	8.1%	19.2%	56.2%	3.3%
	New dams	0.00	0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.50	0.19	0.05	0.00	0.00	0.00	0.00
	% vuln. to res. ext. (en. + for., adjusted for own.)	7.5%	6.7%	13.0%	50.4%	35.7%	46.3%	18.3%	13.1%	30.0%	13.0%	1.4%	4.9%	14.9%	50.9%	9.5%
	Resource Extraction CSI score	**4.3**	**3.7**	**1.9**	**1.7**	**2.3**	**1.8**	**2.0**	**2.3**	**1.7**	**2.5**	**3.3**	**4.2**	**3.3**	**2.0**	**3.7**
	Warming risk - Coho	Low	Moderate	Moderate	Low	Moderate	Low									
	Warming risk - Steelhead/Chinook	Low	Low	Moderate	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	High	Low	Low	Low	Moderate
	Flow risk	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
	Precipitation regime risk	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
	Climate Change CSI score - Coho	3.6	3.4	2.5	3.6	2.9	3.7									
	Climate Change CSI score - Steelhead/Chinook	**4.0**	**4.6**	**4.1**	**4.0**	**4.0**	**4.0**	**3.7**	**3.5**	**3.8**	**2.2**	**1.4**	**4.0**	**4.0**	**4.0**	**2.6**
	Inherent geomorphic risk	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Low
	Geomorphic risk (fire regime on unstable slopes)	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Low
	Geomorphic risk (road network on unstable slopes)	Moderate	High	Moderate	Moderate	Low	Low	Low	Moderate	Low	Low	Low	High	High	Low	Low
	Sedimentation and Scour CSI score	2.8	1.6	2.3	3.2	4.5	4.3	5.0	4.0	5.0	5.0	5.0	1.0	1.0	5.0	4.2
	% stream habitat protected	85.8%	66.7%	45.6%	13.3%	20.4%	0.0%	18.0%	32.7%	24.0%	0.8%	13.6%	88.6%	65.2%	0.8%	29.3%
	% watershed area protected	85.5%	65.0%	39.7%	14.0%	13.0%	0.2%	19.6%	36.0%	24.4%	1.3%	8.6%	84.4%	63.0%	0.1%	30.7%
	Land Stewardship CSI score	**4.7**	**4.5**	**3.7**	**1.8**	**2.5**	**1.0**	**2.0**	**3.3**	**3.0**	**1.0**	**1.9**	**5.0**	**4.7**	**1.0**	**3.1**

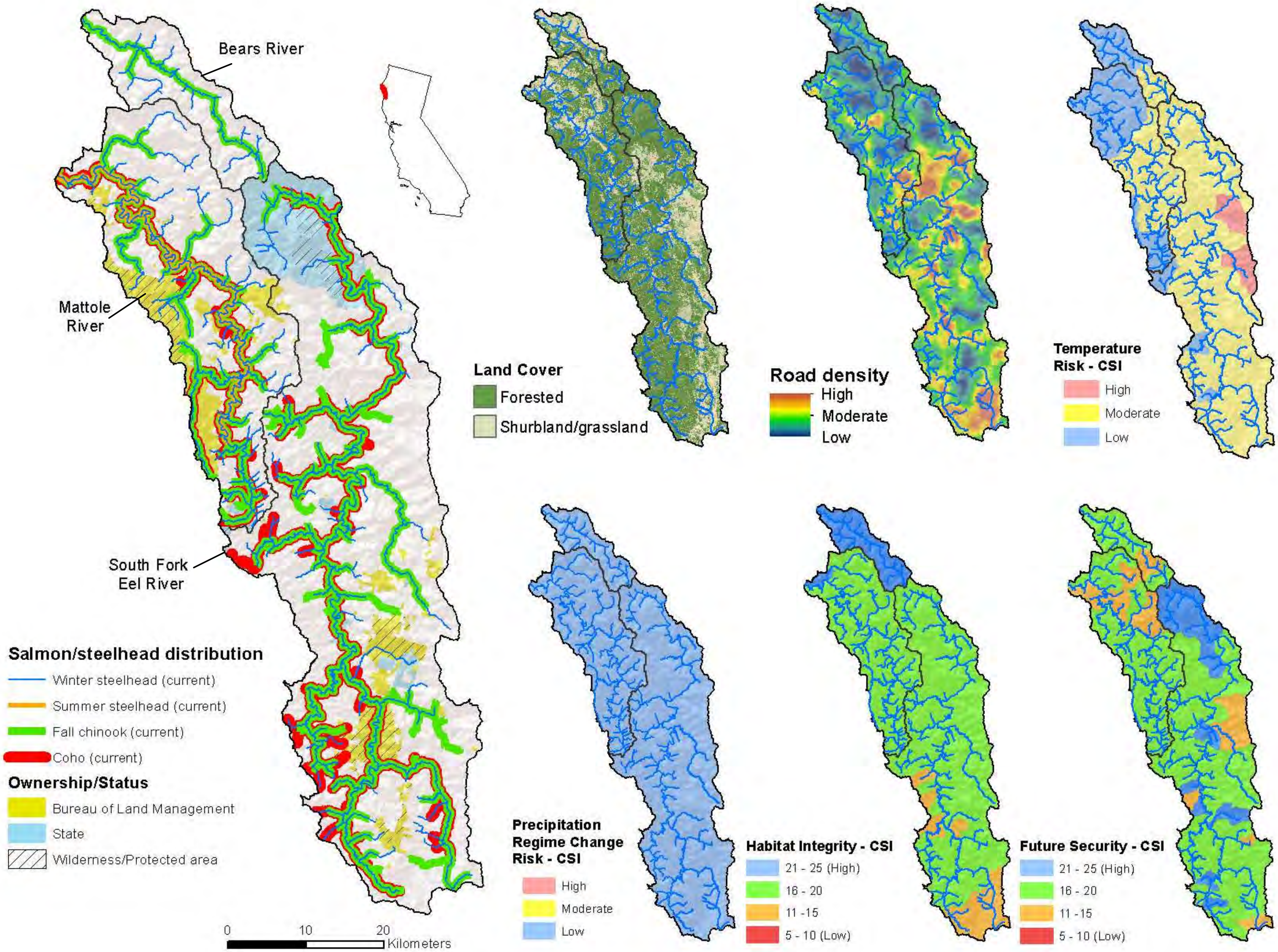
Map 1: Smith River Stronghold



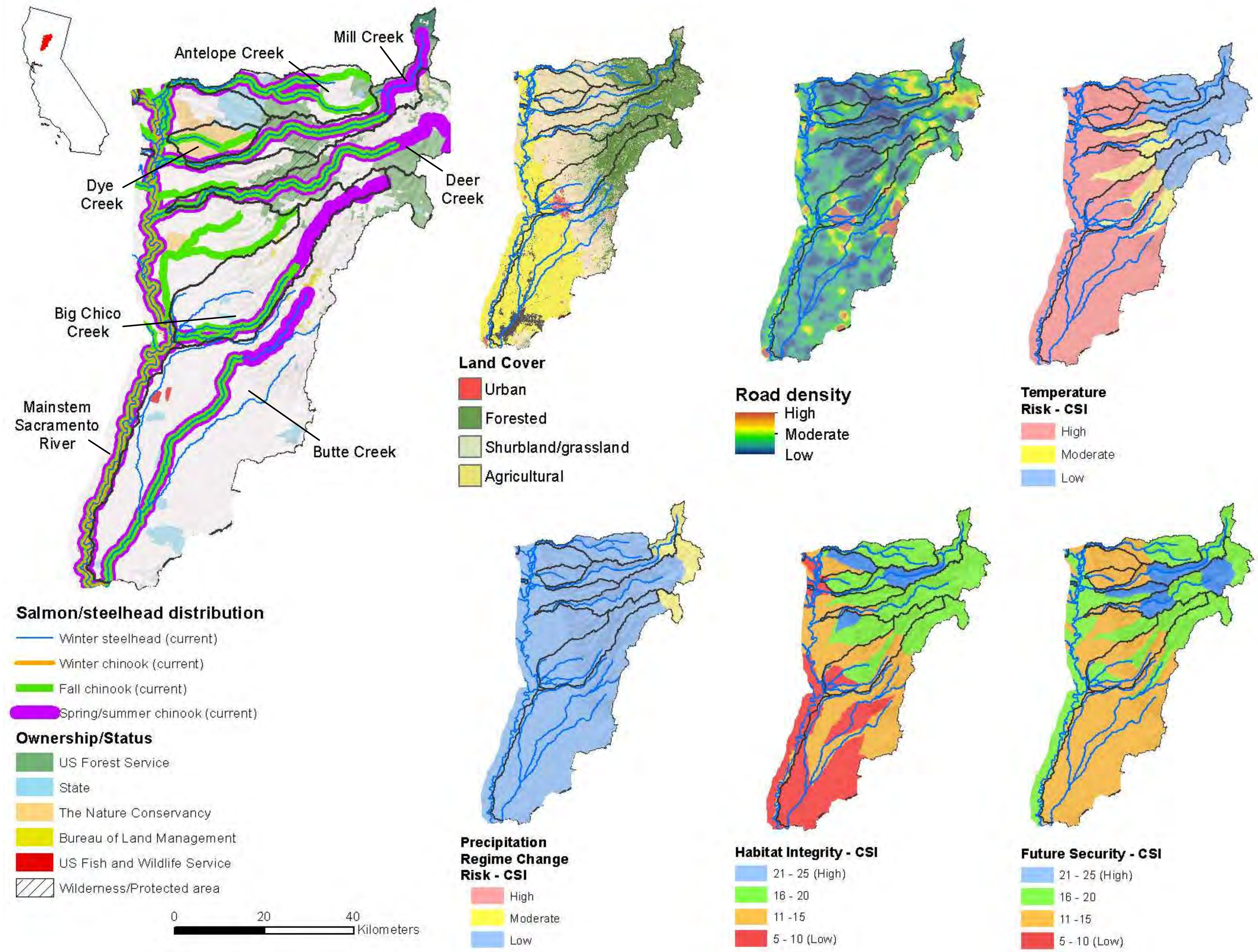
Map 2: Salmon/Mid-Klamath River Stronghold



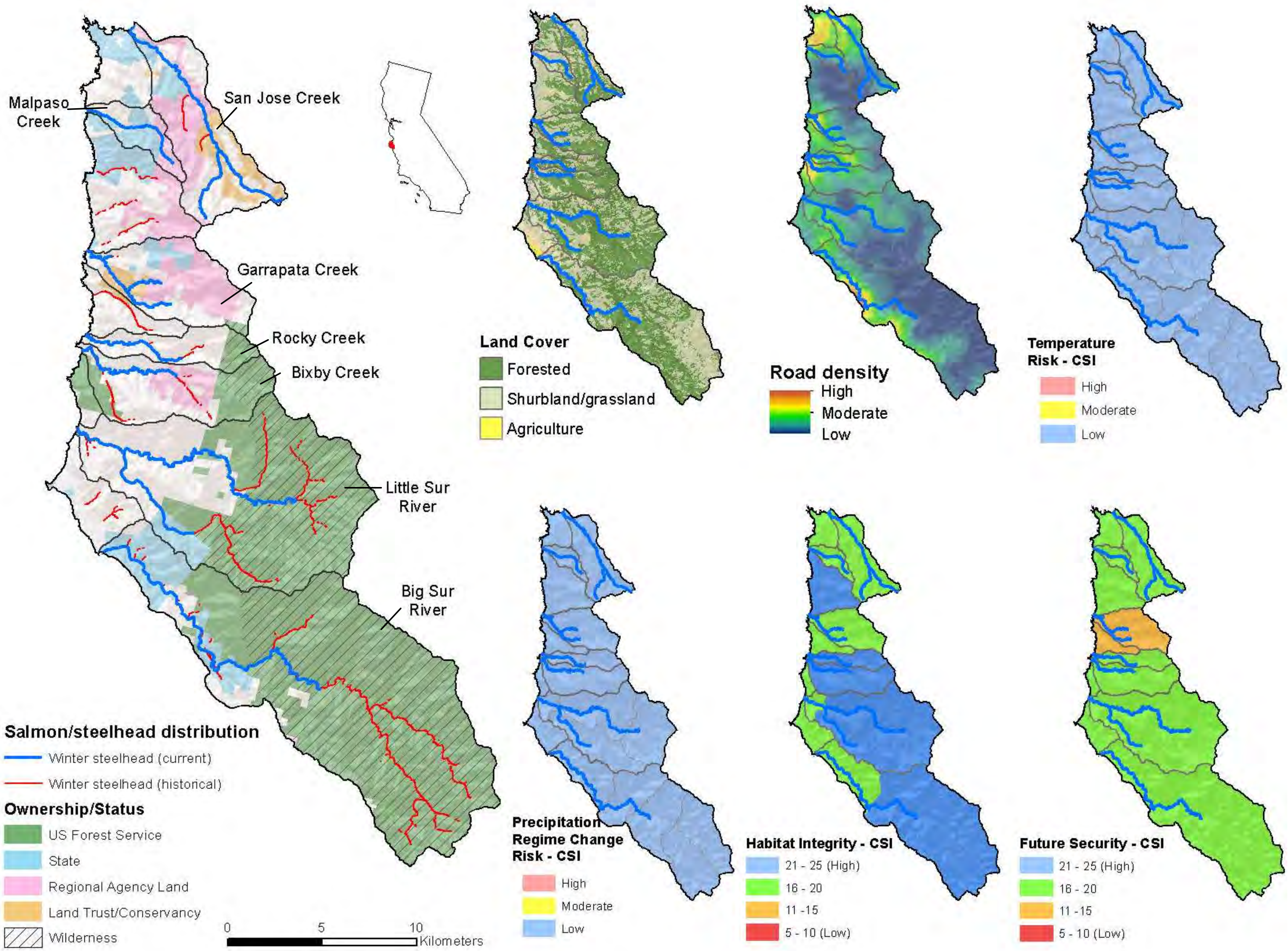
Map 3: Mattole/South Fork Eel Stronghold



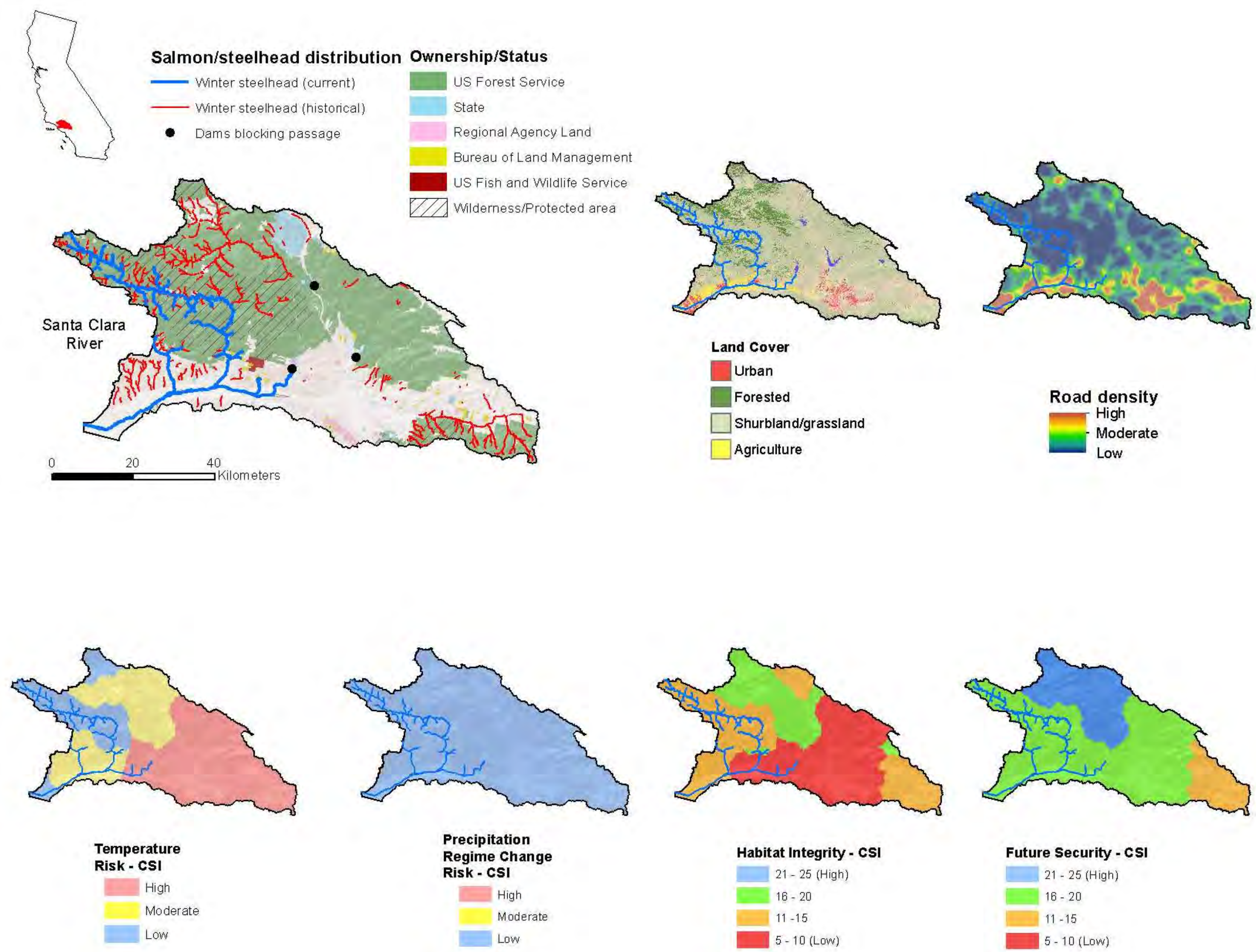
Map 4: Sacramento River Stronghold



Map 5: Big Sur Stronghold



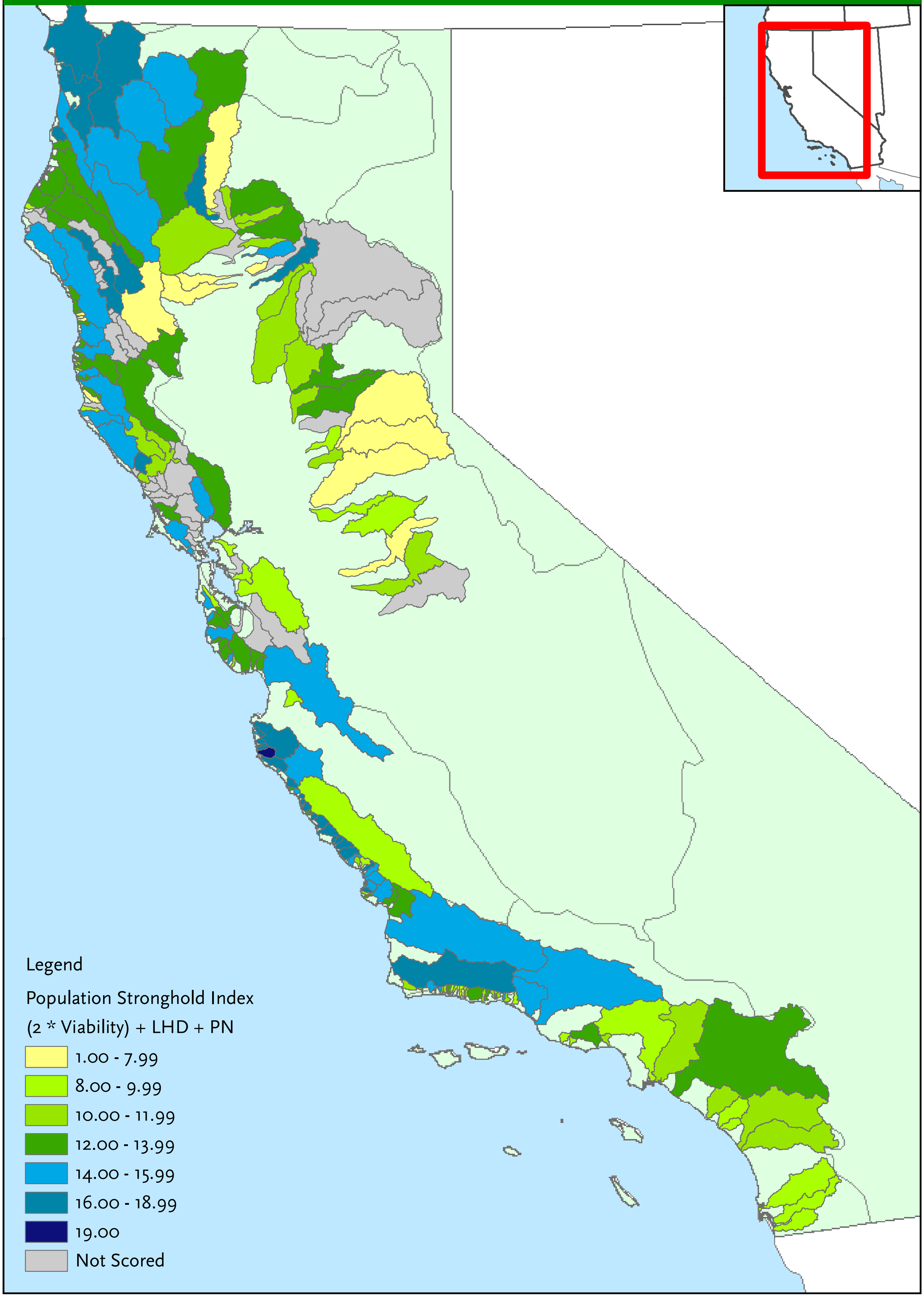
Map 6: Santa Clara River Stronghold



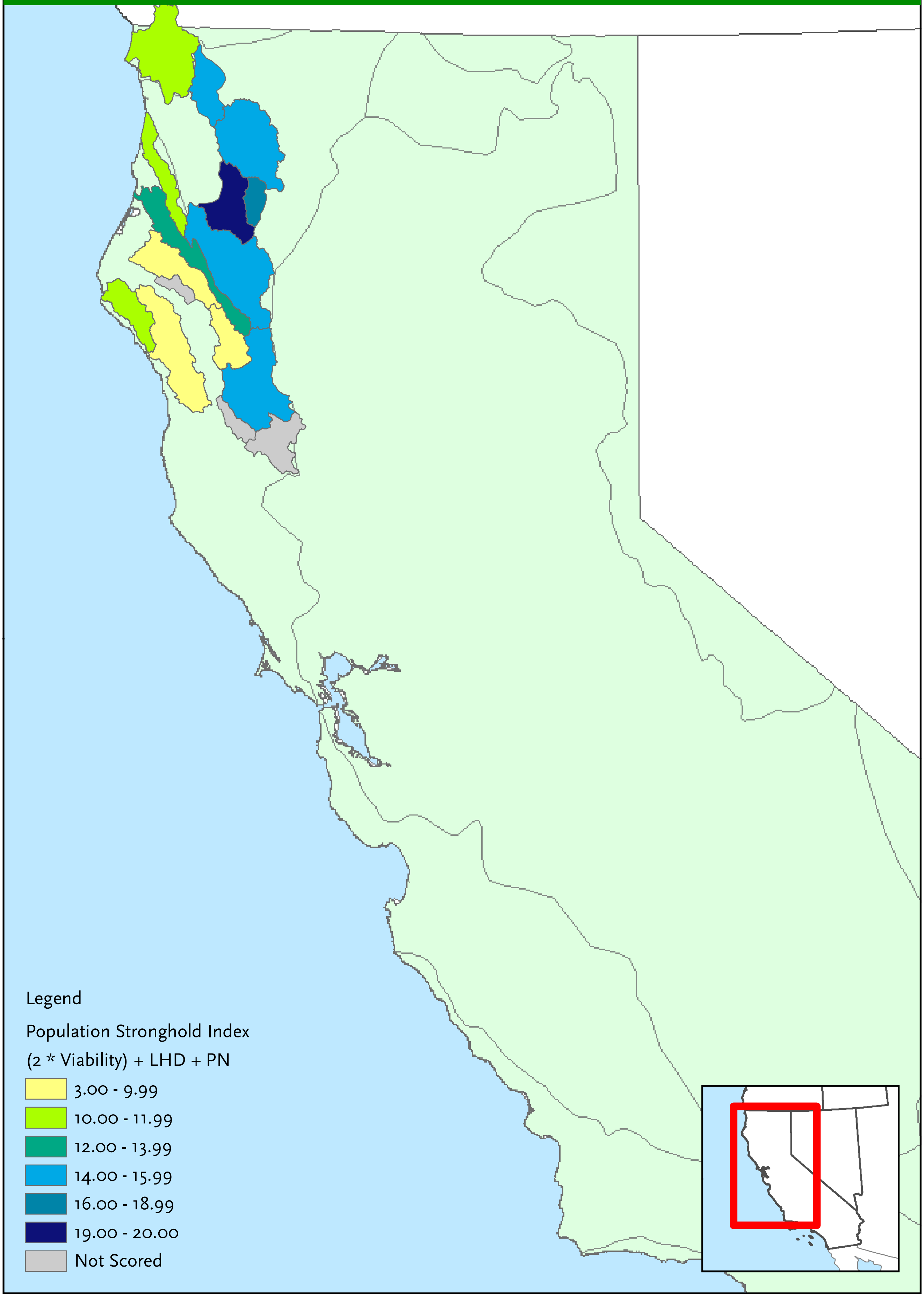
Appendix 5

Maps of Population Scoring Index by Species

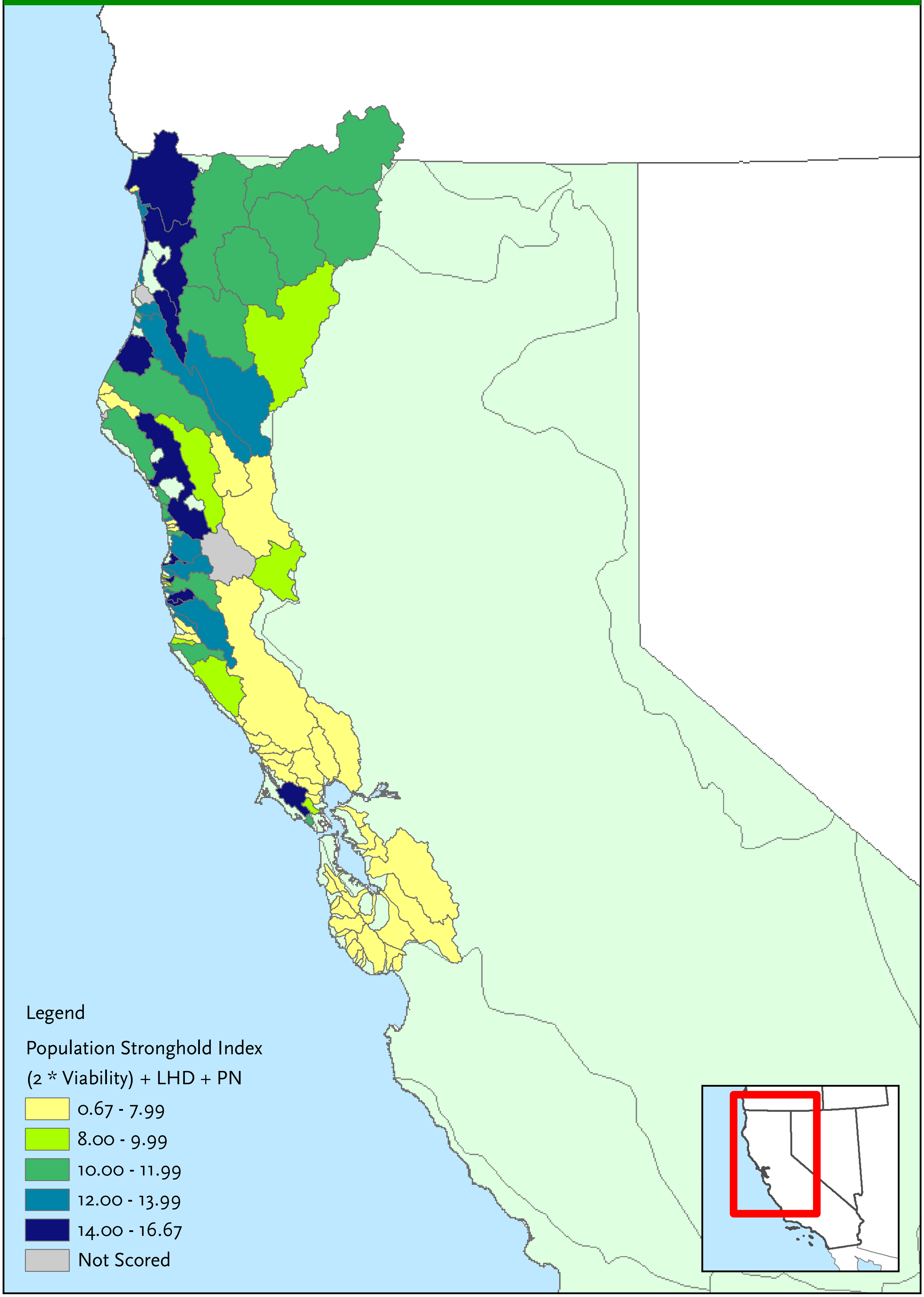
California Winter Steelhead Populations



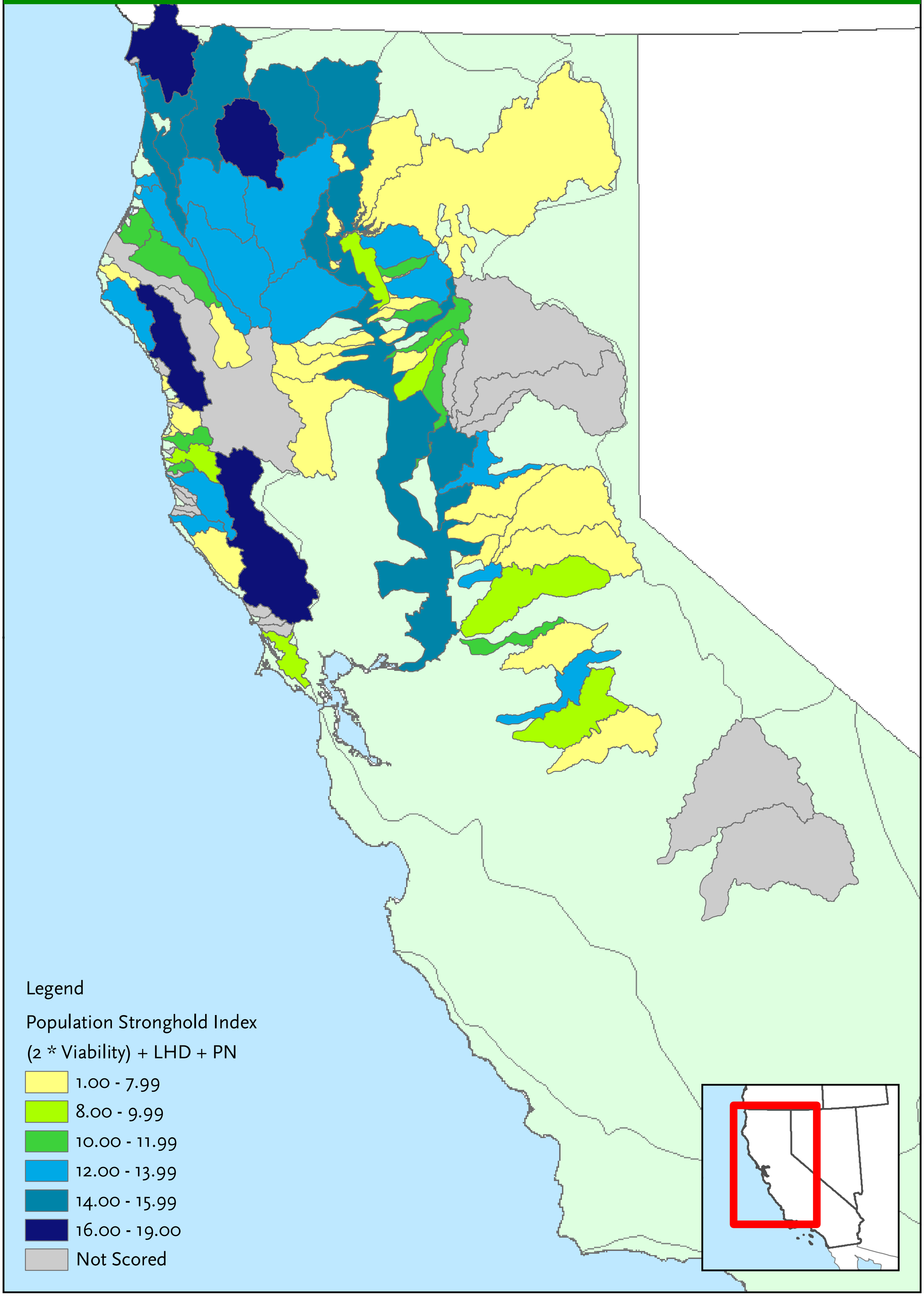
California Summer Steelhead Populations



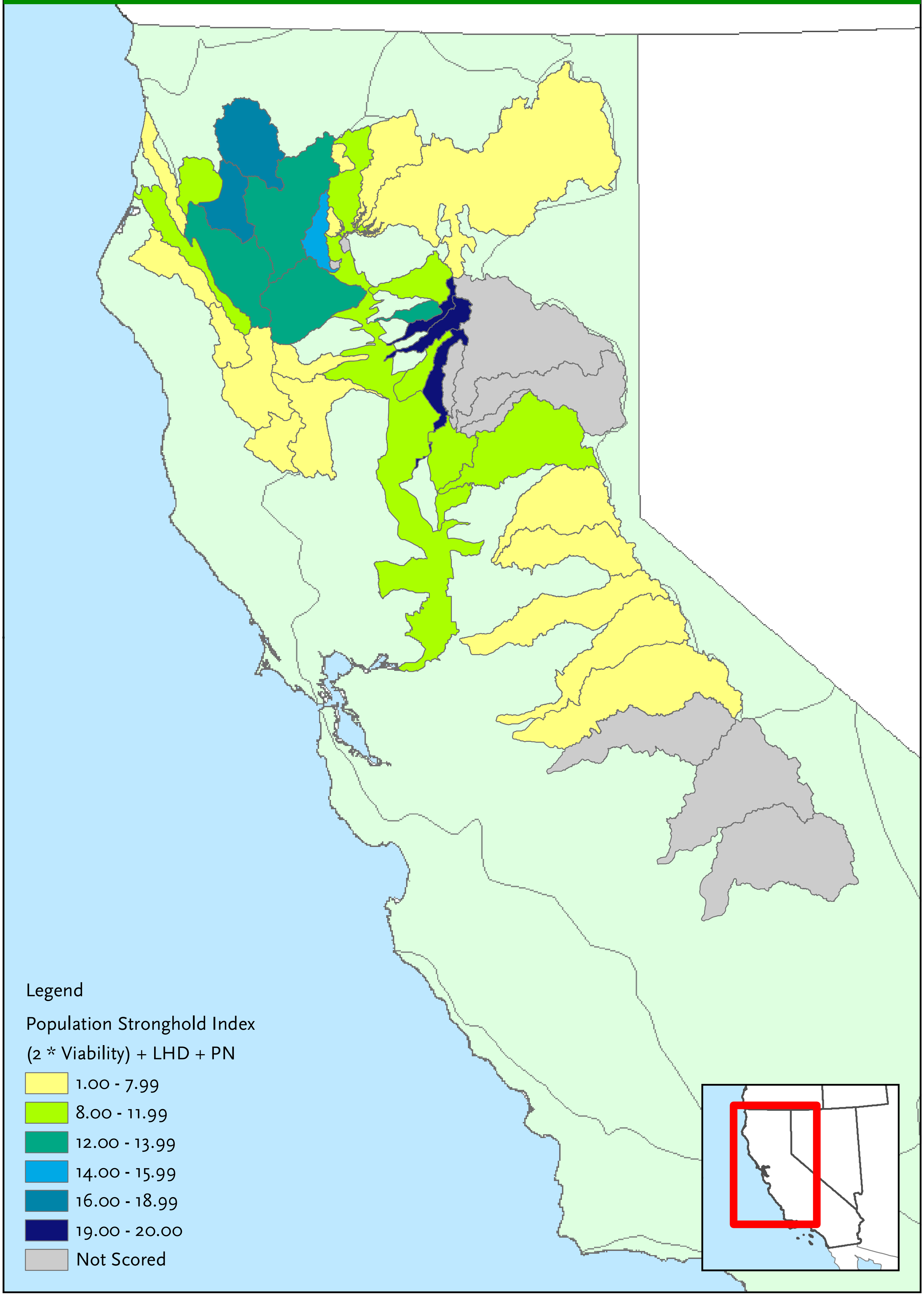
California Coho Populations



California Fall Run Chinook Populations

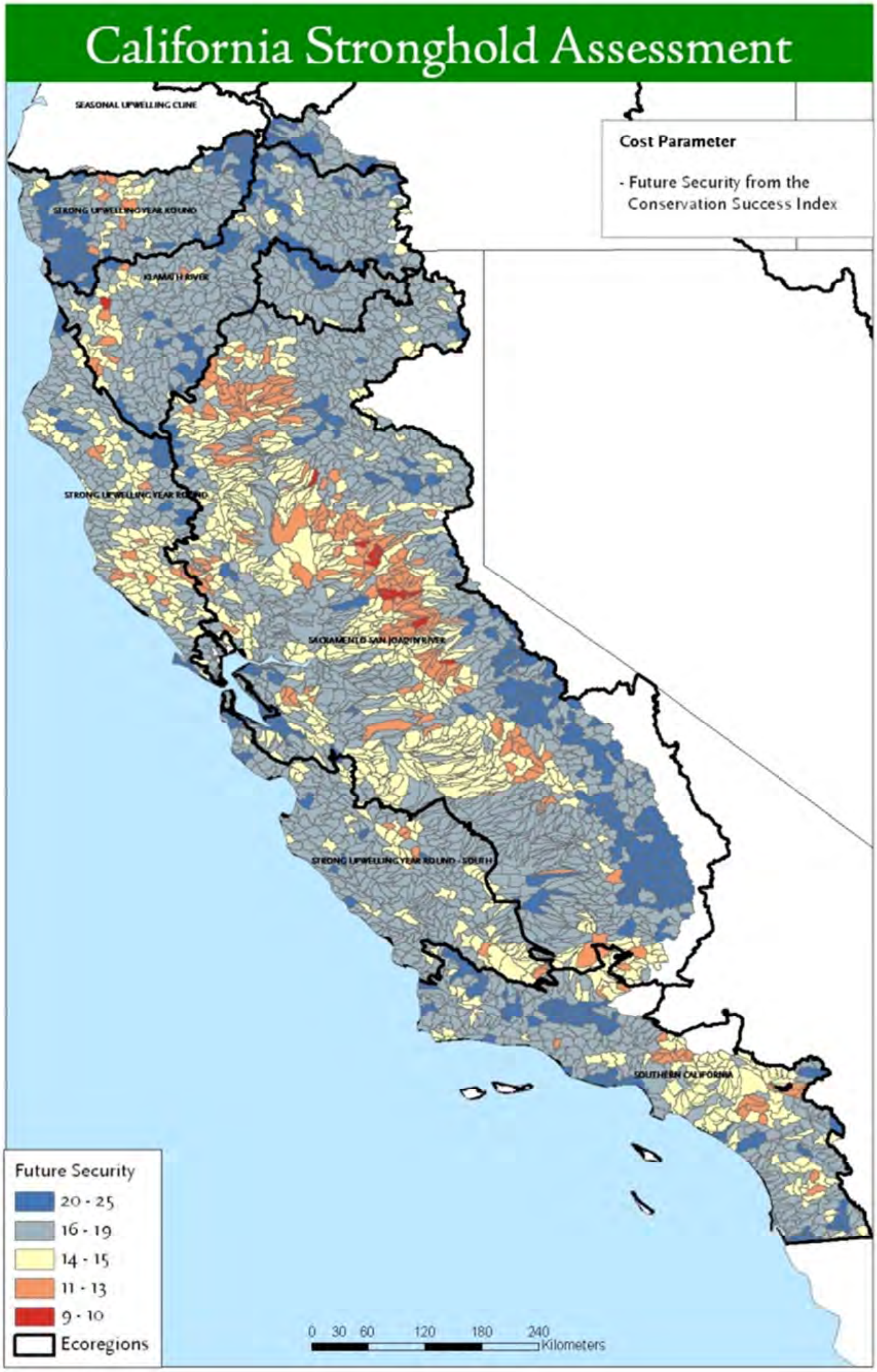


California Spring/Summer-Run Chinook Populations

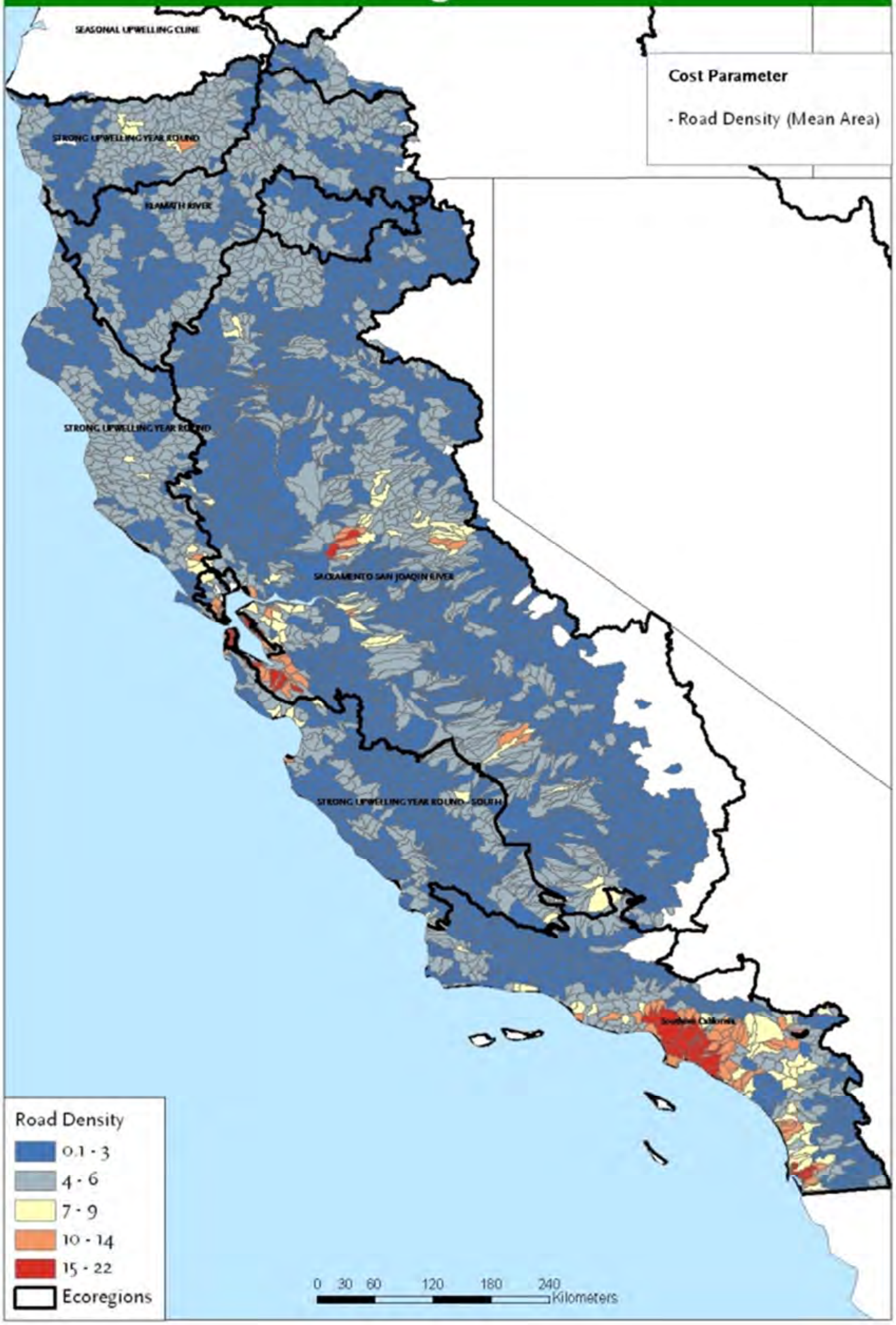


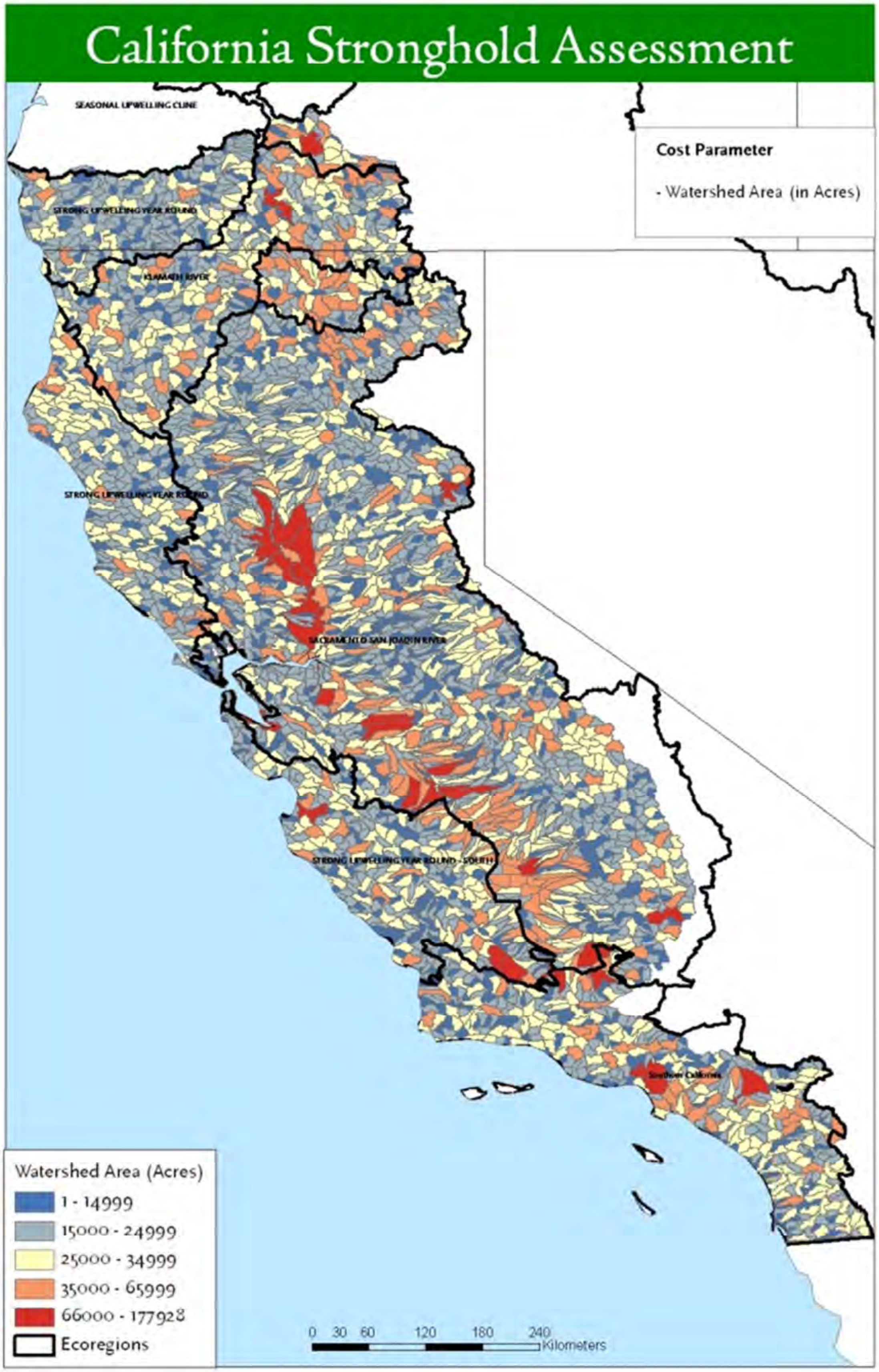
Appendix 6

Selected Sensitivity Analysis Maps

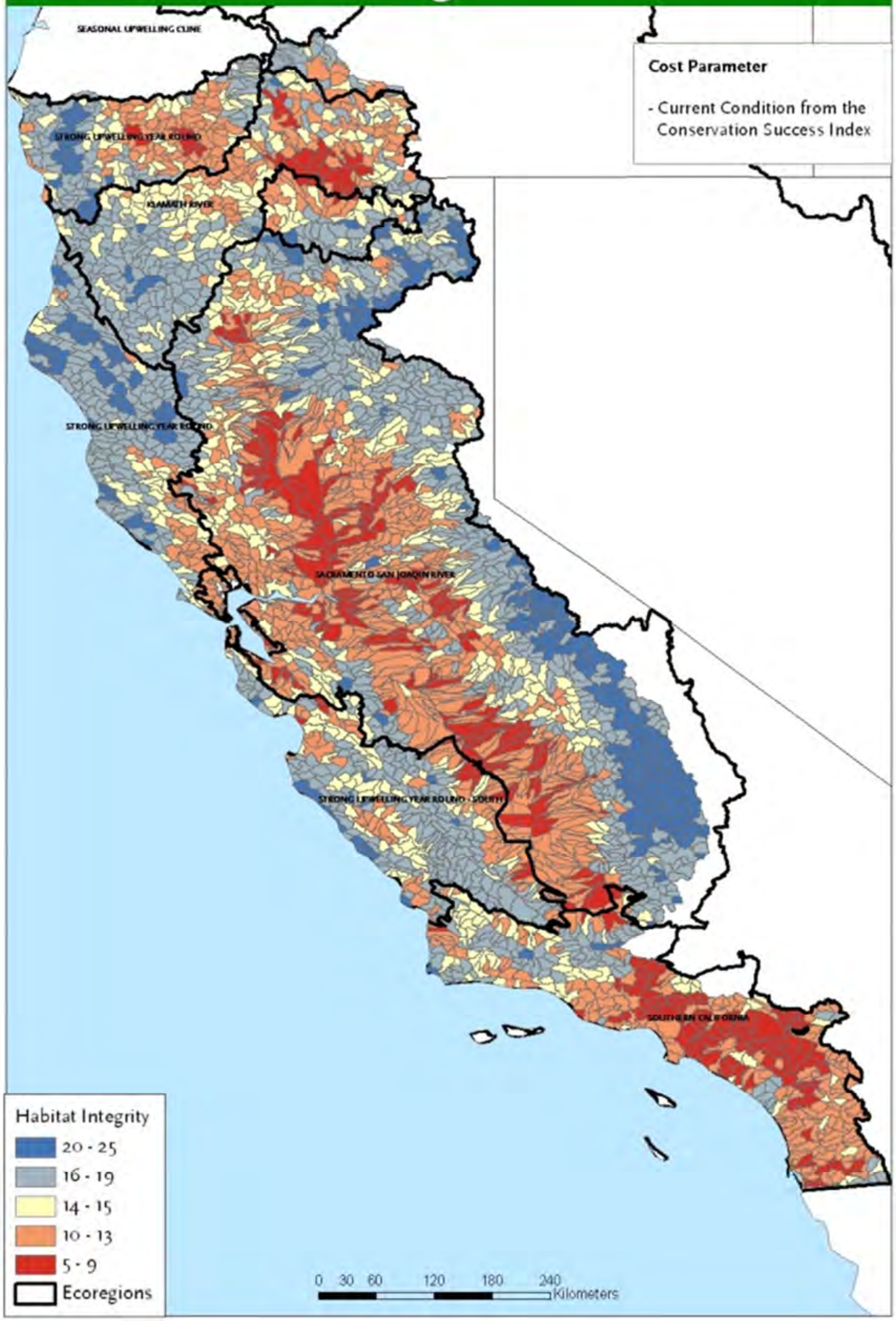

California Stronghold Assessment
Cost Parameter
- Future Security from the Conservation Success Index
SEASONAL UPWELLING CLINE
STRONG UPWELLING YEAR ROUND
KLAMATH RIVER
STRONG UPWELLING YEAR ROUND
SACRAMENTO SAN JOAQUIN RIVER
STRONG UPWELLING YEAR ROUND - SOUTH
SOUTHERN CALIFORNIA
Future Security
20 - 25
16 - 19
14 - 15
11 - 13
9 - 10
Ecoregions
0 30 60 120 180 240
Kilometers

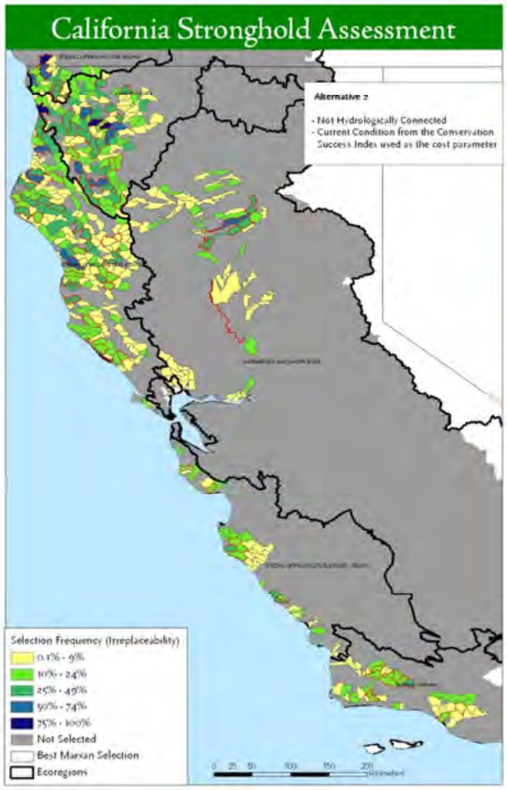
California Stronghold Assessment

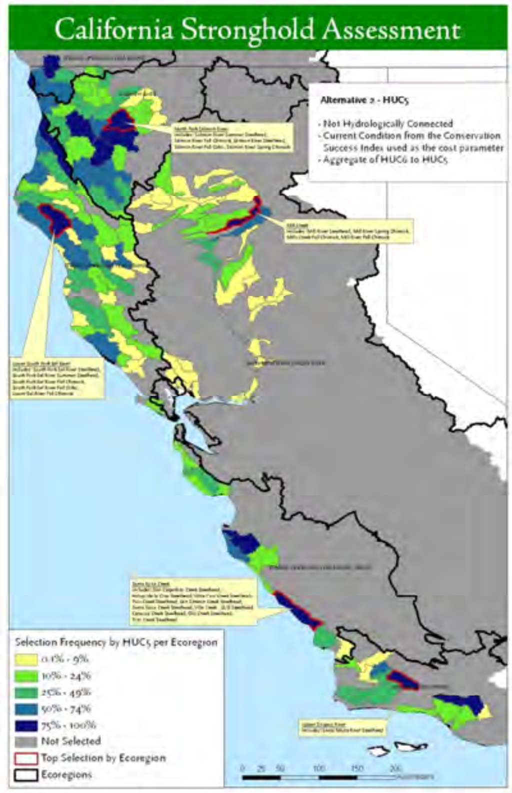


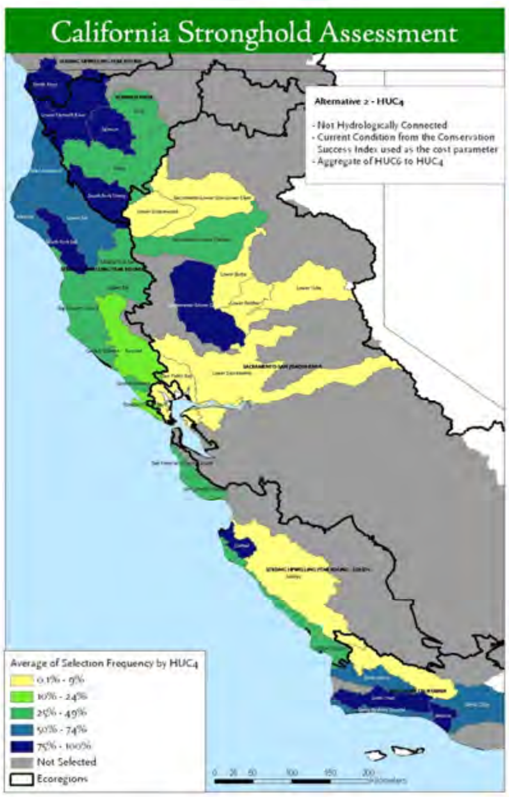

California Stronghold Assessment
Cost Parameter
- Watershed Area (in Acres)
Watershed Area (Acres)
1 - 14999
15000 - 24999
25000 - 34999
35000 - 65999
66000 - 177928
Ecoregions
0 30 60 120 180 240
Kilometers

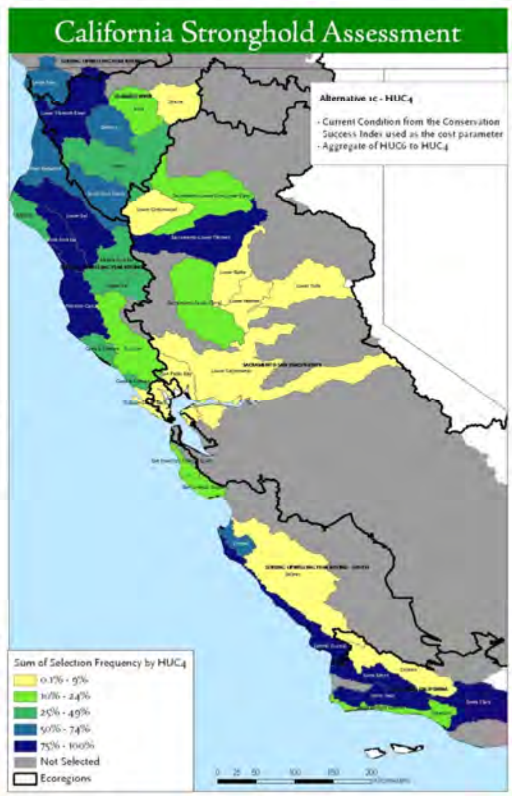
California Stronghold Assessment



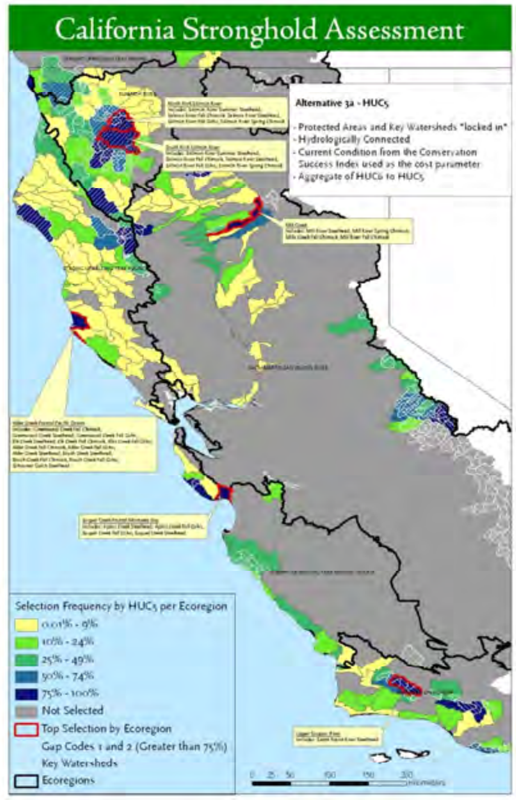

California Stronghold Assessment
Alternative 2
- Not Hydrologically Connected
- Current Condition from the Conservation Success Index used as the cost parameter
Selection Frequency (Irreplaceability)
0.1% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Best Marxan Selection
Ecoregions

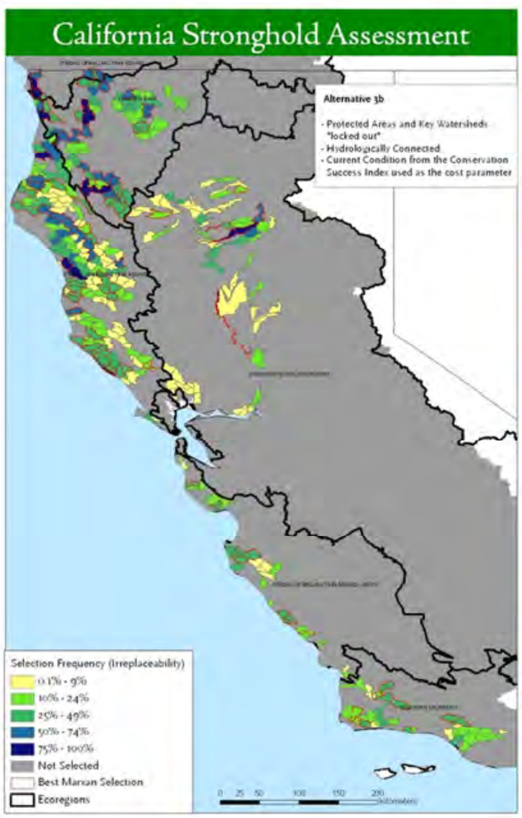

California Stronghold Assessment
Alternative 2 - HUC5
- Not Hydrologically Connected
- Current Condition from the Conservation Success Index used as the cost parameter
- Aggregate of HUC6 to HUC5
Selection Frequency by HUC5 per Ecoregion
0.1% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Top Selection by Ecoregion
Ecoregions

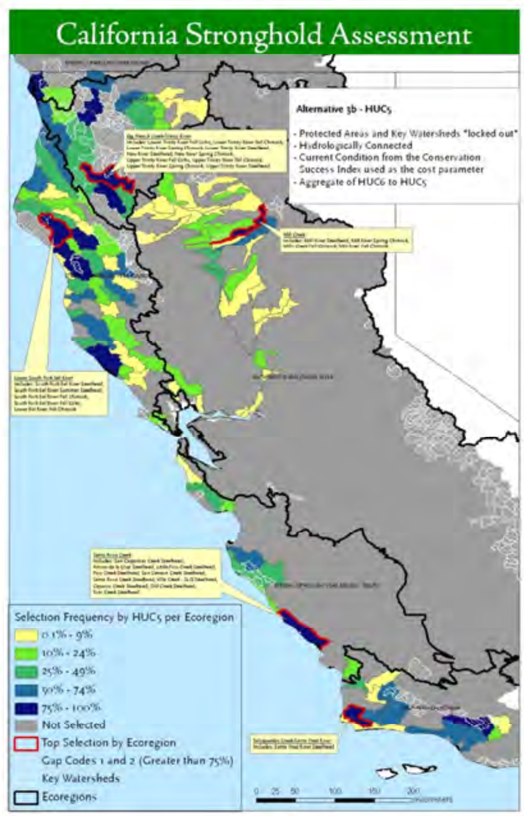

California Stronghold Assessment
Alternative 2 - HUC4
- Not Hydrologically Connected
- Current Condition from the Conservation Success Index used as the cost parameter
- Aggregate of HUC6 to HUC4
Average of Selection Frequency by HUC4
0.1% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Ecoregions


California Stronghold Assessment
Alternative 1c - HUC4
- Current Condition from the Conservation Success Index used as the cost parameter
- Aggregate of HUC6 to HUC4
Sum of Selection Frequency by HUC4
0.1% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Ecoregions


California Stronghold Assessment
Alternative 3a
- Protected Areas and Key Watersheds "locked in"
- Hydrologically Connected
- Current Condition from the Conservation Success Index used as the cost parameter
Selection Frequency (Irreplaceability)
0.01% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Best Marxan Selection
Ecoregions
0 37.5 75 150 225 300 Kilometers


California Stronghold Assessment
Alternative 3a - HUC5
- Protected Areas and Key Watersheds "locked in"
- Hydrologically Connected
- Current Condition from the Conservation Success Index used as the cost parameter
- Aggregate of HUC6 to HUC5
Selection Frequency by HUC5 per Ecoregion
0.01% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Top Selection by Ecoregion
Gap Codes 1 and 2 (Greater than 75%)
Key Watersheds
Ecoregions
0 25 50 100 150 200 Kilometers


California Stronghold Assessment
Alternative 3b
- Protected Areas and Key Watersheds "locked out"
- Hydrologically Connected
- Current Condition from the Conservation Success Index used as the cost parameter
Selection Frequency (Irreplaceability)
0.1% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Best Marxan Selection
Ecoregions
0 25 50 100 150 200 Kilometers


California Stronghold Assessment
Alternative 3b - HUC5
- Protected Areas and Key Watersheds "locked out"
- Hydrologically Connected
- Current Condition from the Conservation Success Index used as the cost parameter
- Aggregate of HUC6 to HUC5
Selection Frequency by HUC5 per Ecoregion
0.1% - 9%
10% - 24%
25% - 49%
50% - 74%
75% - 100%
Not Selected
Top Selection by Ecoregion
Gap Codes 1 and 2 (Greater than 75%)
Key Watersheds
Ecoregions
0 25 50 100 150 200 Kilometers

Appendix 7

Correspondence with Expert Reviewers

August 18, 2009

Re: Invitation to participate in "Expert Rating" of California salmon and steelhead populations

Dear Expert Reviewer:

I am writing to invite your participation in one of three round table discussions of California (CA) salmon populations taking place the week of August 31 - September 4, 2009. The purpose of each meeting is to review the abundance, productivity, and diversity of CA salmon populations to identify salmon strongholds in the state. California Trout, Trout Unlimited and Wild Salmon Center have initiated this project in CA as part of a larger initiative, the North America Salmon Stronghold Partnership (NASSP), which is being led by a consortium of state and federal agencies, conservation organizations, and tribes.

As an expert with unique knowledge of the biological characteristics of several CA salmon and steelhead populations, we hope you will join this process by providing your expertise to help us enhance the Stronghold Partnership's population database. This database will be used to identify "Core Salmon Strongholds" distributed throughout four CA ecoregions. Your name was identified as a potential participant by the project's steering committee, which includes:

- Dan Free, NOAA
- Nick Hetrick, USFWS
- Wendy Millet, TNC
- Jay Nicholas, WSC
- Kevin Shaffer, CDFG
- Tom Weseloh, CalTrout
- Jack Williams, TU

Meetings are scheduled for: Arcata (August 31); Davis (Sept 2); and San Luis Obispo (Sept 3). Please find enclosed a one page summary of the watersheds and populations that will be discussed at each meeting (See "Which meeting should I attend?").

INTERNATIONAL HEADQUARTERS
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Additional Background

The North American Salmon Stronghold Partnership is a voluntary initiative intended to supplement existing ecosystem protection and restoration efforts by providing leadership, enhanced coordination, and public and private resources to support science-based, locally supported conservation actions in salmon strongholds. Currently NASSP is engaged in the process of identifying "core" salmon Strongholds from California through Alaska. (See attached "Stronghold Classification Framework" for additional information on "core" and "contributing" strongholds.) The expert rating scores provided for CA, OR, ID, and WA will provide the foundation for Stronghold identification in these four states. (The methodologies for stronghold identification are currently under development for populations in British Columbia and Alaska.)

The process now underway in CA follows a similar process undertaken by the Wild Salmon Center during 2007 and 2008 in CA, OR, WA, and ID. This early work tested the expert interview methodology and scoring criteria, and yielded a preliminary screening of the strongest remaining salmon and steelhead populations in the lower 48. The intent of the current series of "expert" interviews is to validate and supplement data collected during the initial polling. This series of interviews with CA salmon and steelhead experts is expected to considerably strengthen the accuracy of stronghold identification by substantially increasing the number of experts interviewed and adding to the number of populations that are rated.

Process and Outcomes

1. On the enclosed "Population Rating Worksheet", experts will score the salmon and steelhead populations for which they have sufficient expertise (see "Scoring Instructions"). Scores will be provided for three criteria: a) viability, b) wildness, and c) diversity. (See "Database Scoring and Criteria Summary" for explanations of these criteria). Experts will submit their scores to Tom Miewald (contact information provide below) week prior to meetings on **August 25, 2009**.

2. Experts will meet during the week of August 31 – September 4 to discuss, review, and finalize scores. In addition to collaborating on reviews of specific populations, experts will discuss appropriate ecoregional and/or ESU delineations that may be applicable to Core Stronghold analyses in CA. This analysis will follow the scoring process.

3. Wild Salmon Center and CalTrout staff will analyze scores provided by experts and produce new maps displaying scores of salmon and steelhead populations.

4. New scores will provide the basis for identifying core Salmon Strongholds by ecoregions, ESU, and/or similar unit as is most meaningful to long term conservation of anadromous salmonids.

On behalf of all the partners engaged in this effort, I would like to thank you for your participation in this process. The result, identification of the strongest remaining salmon and steelhead populations distributed across CA, will be a key element of long-term efforts to both protect and recover these magnificent fish from California through Alaska.

Please RSVP the meeting(s) that you will attend to Trozell Weaver at tweaver@wildsalmoncenter.org or 971-255-5560.

If you have questions about this process and/or scoring populations, please contact WSC's Conservation Planner, Tom Miewald, tmiewald@wildsalmoncenter.org (971-255-5556) or myself (503-222-1804).

Sincerely,

Jay Nicholas
WSC, NASSP Coordinator

Enclosures:

- Population Rating Worksheet
- Scoring Instructions & Deadline
- Database Scoring and Criteria Summary
- Ecoregional Approach Summary
- Stronghold Classification Summary
- "Which Meeting Should I Attend?"
- Population and Basin Maps