2. Chapter 2: Selection of Focus Areas

The SHaRP approach is based on the concept that focusing restoration in areas where steelhead and salmon still persist offers the best potential for making measurable progress toward recovery overall, and toward specific recovery needs for particular areas. The concept of larger populations maintaining a source of colonists for occupying vacant habitats, and those populations demographically connecting and supporting each other as metapopulations is well established in ecology and shown graphically in Figure 2-1. (Levins 1969, Hanski and Gilpin 1996).

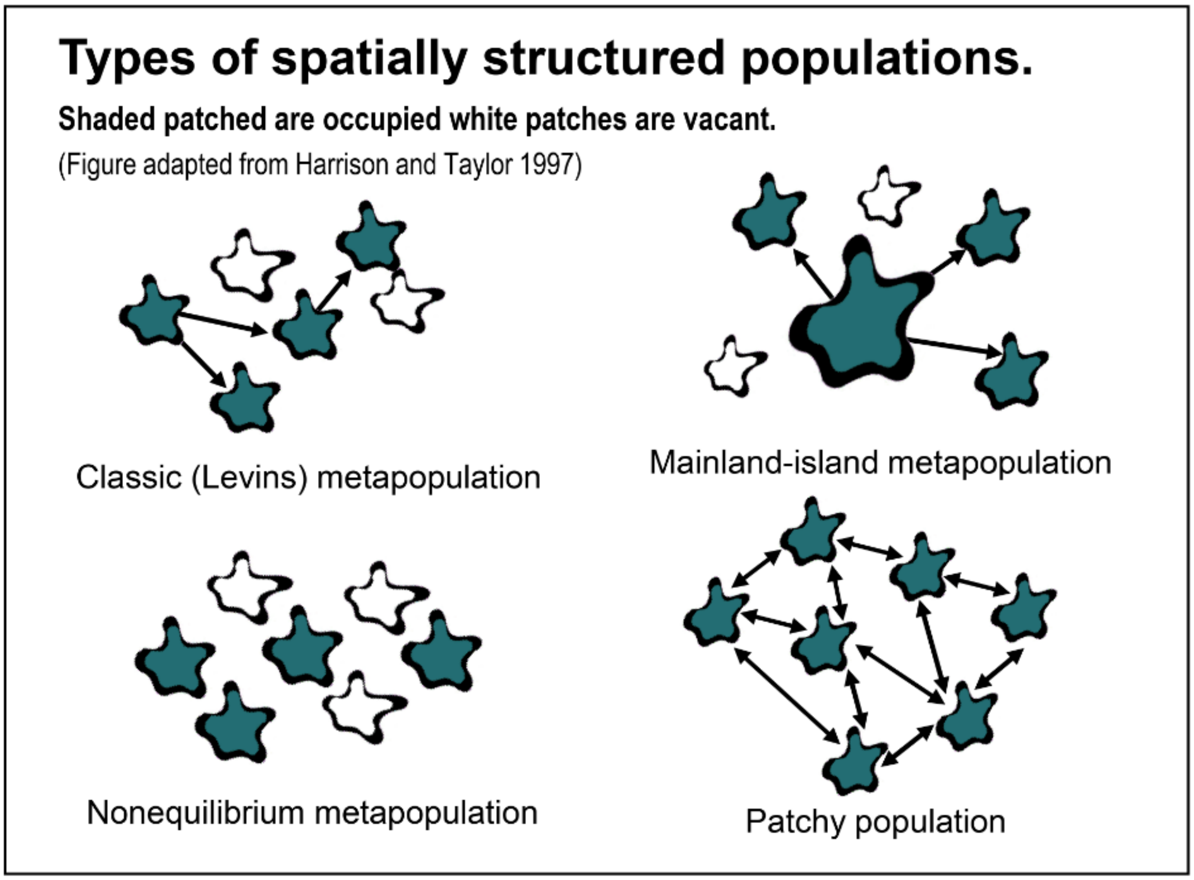

Figure 2-1. Diagram of types of metapopulations and emigration from occupied to unoccupied areas (Levins 1969, Hanski and Gilpin 1996).

Whether a species can persist in a patch or not depends on the quantity and spatial configuration of habitat within a network of connected patches. Under metapopulation models, patch occupancy is dynamic and governed by local colonization and extinction processes (Hanski et al. 1998). As habitat loss, degradation, and fragmentation are among the most serious threats to Pacific salmon, the metapopulation concept has been embraced in salmon conservation and management (Schtickzelle and Quinn 2007, McElhany et al. 2000). Salmon recovery efforts should focus not just on restoring habitat but also on the proximity of habitat to sources of potential colonists. As a first principle, the strongest local populations are then the most critical watersheds to secure and recover in the short term to ensure proximal habitats have the potential to be colonized over the longer term when suitable habitat becomes available. These strategies are rooted in the idea of ‘protecting the best first’ and expanding restoration outward (Beechie et al. 2008). The SHaRP process is guided by this principle to focus limited salmonid recovery dollars in patches with the highest potential for recovery of salmonids and build out restoration from these core areas.

Therefore, the first step of the SFER SHaRP pilot effort was to identify the patches with the highest potential for recovery of salmonids. This chapter describes the process the steering team followed to compare the 19 United States Geological Survey (USGS)-delineated Hydrologic Unit Code (HUC) HUC-12 sub-watersheds that make up the SFER sub-basin and determine which to select for further detailed planning. Figure 2-2 depicts the SHaRP process steps, including where and when the collaborative leveraged best available science, with the first box, outlined in red to demonstrate where we are in describing the process. We also use this figure in the following chapters to highlight where subsequent aspects of process are described.

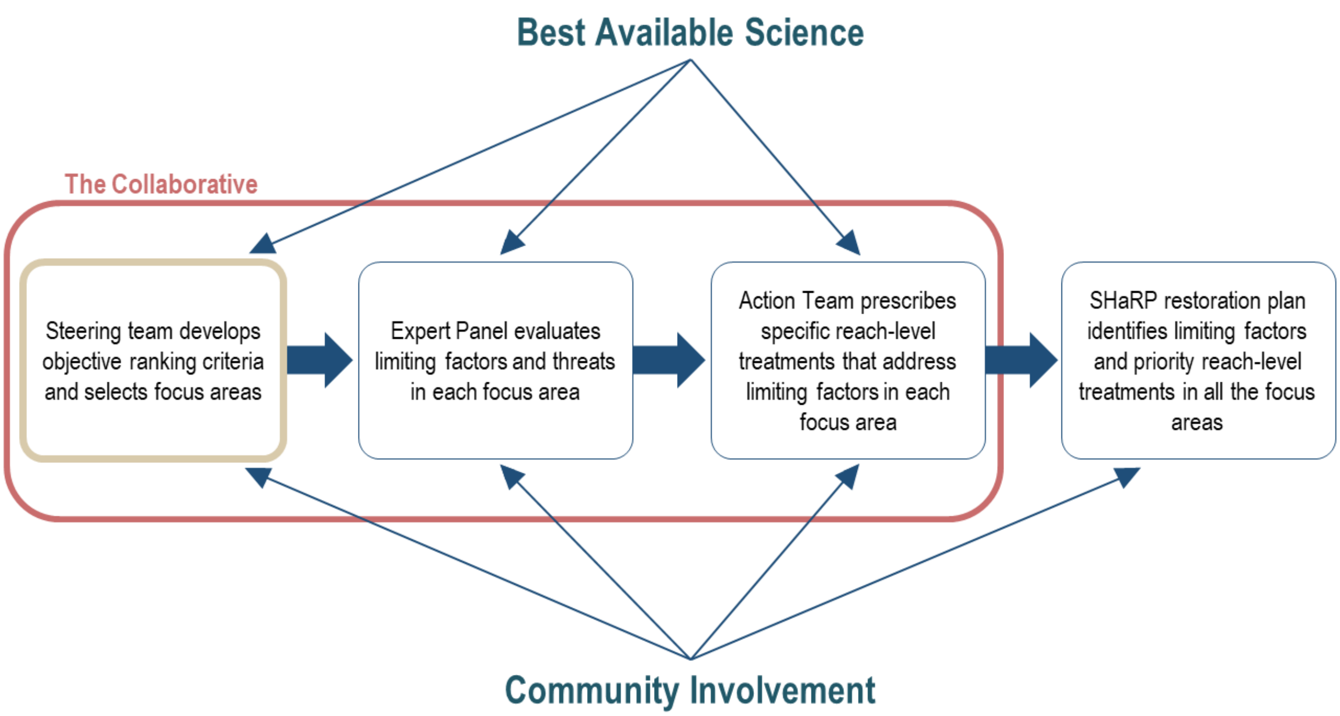

Figure 2-2. The South Fork Eel River SHaRP process, with emphasis on selection of the focus areas.

Selecting Focus Areas

The steering team compiled and evaluated data from across the South Fork Eel River (SFER) sub-basin that described the condition of salmonids and their habitat, as well as human impacts. Only data sources available for all or most of the 19 HUC-12s were included. Metrics were developed for each data source, and each metric was assigned to one of four categories inspired by Bradbury et al. (1995): Biological Importance, Habitat Condition, Optimism and Potential, and Integrity and Risk. The team used an iterative process to assign weights to each metric and added qualitative scoring criteria to account for important aspects for which data were not available.

For each category, each contributing metric was ranked relative to the distribution of values for all sub-watersheds such that the highest metric is given a percent rank of 100 and the lowest metric is given a percent rank of 0. Rank-weighted scores were then assigned by quartiles; metrics with a percent rank of 75-100 were given the highest score of 4, metrics with a percent rank of 50-74 received a score of 3, etc. These rank-weighted scores were then adjusted to account for confidence in the data. Where data was of questionable quality or representation, a confidence multiplier (1.25-0.25) could be applied to either increase or decrease the effect of that metric on the overall ranking process. An adjustment for confidence occurred only seven times in this process. All metric scores were then totaled and a final adjustment was applied to weigh the final score for each category. The scores for each category were then summed to provide a final score for each HUC-12 sub-watershed.

Data used for each category outlined in Bradbury et al. (1995), associated processing, and description of any final adjustments are described by category below. Appendix A details the data used in the SHaRP process.

Biological Importance

The steering team summarized publicly available data on the current distribution and spawning density of salmonids as a ranking metric for the biological importance of each HUC-12 watershed. Current estimated Chinook and Coho Salmon and steelhead distribution was based on data collected from a variety of sources: CDFW, NMFS, private timber companies, university research, local watershed stewardship programs, and various stakeholders. This data has largely been compiled and available in CDFW's Biogeographic Information and Observation System (BIOS). The total length of stream (km) within the current distribution of Coho Salmon (Christy 2016), Chinook Salmon (Gavette 2005), and steelhead (Christy 2012) were summed for each HUC-12 sub-watershed. The total length of stream within Coho Salmon and steelhead distribution was adjusted based on CDFW staff assessment of the most up-to-date salmonid distribution. Some values were also adjusted to reflect removal of mainstem Eel River distribution because in most instances this habitat was used for migration rather than spawning or rearing. Chinook Salmon values were not adjusted in this way because this species uses the mainstem Eel River for spawning and rearing.

Adult salmonid spawner density was primarily determined using the CDFW CMP Adult Salmonid Spawning Ground Surveys completed annually since 2010. The CMP is designed to describe the regional status of Coho Salmon in coastal watersheds including the SFER (Adams et al. 2011). Coho Salmon, Chinook Salmon, and steelhead redd density (redds/km) from 2010-2016 (Starks and Renger 2016) were standardized by year (z-scored) and the mean redd density across all years for each HUC-12 sub-watershed was used as the final contributing metric. Standardizing by year ensured that the random samples drawn for surveying each year were fairly represented by the relative strength of each year's salmonid return. Redd surveys followed CMP protocols and targeted Coho Salmon, so results for Chinook Salmon and steelhead are incomplete. As suggested by Bradbury et al. (1995), Biological Importance was weighted twice as high as the other categories of data to reflect the focus on salmonids in this process.

Habitat Condition

The steering team assembled habitat data available from SFER Watershed Assessment (SFER WA) (CDFW 2014) and CDFW habitat inventories. The SFER WA included watershed-wide ranking of stream habitat suitability for Coho Salmon using a combination of available data and professional judgment (CDFW 2014). The length of streams (km) which were ranked as either "High Quality" (i.e. relatively undisturbed habitat with the range and variability of conditions necessary to support species diversity and natural salmonid production) or "High Potential" (i.e. diminished but good quality habitat with salmonids present, currently managed to protect natural resources with the possibility to become high quality refugia) were summed for each HUC-12 and used as a contributing metric. Additionally, the SFER WA also included habitat suitability index (HSI) scores from an Ecosystem Management Decision Support (EMDS)–based analysis of CDFW habitat typing surveys completed in the 1990s and 2000s. Outputs of the EMDS-based analysis that were used as metrics in the SHaRP ranking process included overall HSI scores, canopy cover scores, pool depth scores, pool shelter scores, and pool tail-out gravel embeddedness scores. Standardized score values ranged from -1 (fully unsuitable) to 1 (full suitable) and HUC-12 scores are based on a length-weighted mean of the reach scores within each sub-watershed (i.e. longer reaches have more influence on the average than shorter reaches). Number of pieces of large woody debris (LWD) per stream kilometer from CDFW surveys, compiled by CDFW Fortuna for 2009-2010 and UC Hopland for 2002-2008 were also used as a contributing metric. The number of pieces of LWD in both size classes (6-20 ft. long and > 20 ft. long) were summed for each surveyed reach and the final HUC-12 sub-watershed scores were based on a length-weighted mean of the reach scores within each sub-watershed.

The steering team also utilized modeled data including the Intrinsic Potential model (IP model; Agrawal et al. 2005) and the NorWeST stream temperature model (Chandler et al. 2016) to rank the current physical habitat available to salmonids based on methods utilized in the Nehalem Strategic Action Plan process (2020). Both models were used to subset stream reaches which were ranked as “anchor-sites,” meaning that they are expected to support all life stages of Coho Salmon. Anchor sites have mean August temperatures <17.8° degrees (NorWeST model) and either: A) 1-3% gradient with valley width of 40-100m or 100-500m; or B) 0-1% gradient with valley width of 500-1000m or 1000-4000m (IP model). The length of stream (km) which met these criteria were totaled for each HUC-12 sub-watershed and used as a contributing metric. An important adaptation from the methods used in the Nehalem SAP process was that calculations for “high-value terraces” were not included due to the lack of LiDAR data across the SFER watershed.

Optimism and Potential

The steering team summarized data to characterize the inherent potential of a watershed to support salmonids and the history of support for restoration. The likelihood values (0 – 1) available from the IP models for Coho Salmon, Chinook Salmon, and steelhead (Agrawal et al. 2005) were first categorized into three rankings: “High” (1 – 0.66), “Medium” (0.65 – 0.33), and “Low” (0.32 – 0.00). Stream lengths (km) with “High” and “Medium” IP likelihood values were then summed for each species in each HUC-12 sub-watershed and the total linear length of stream for each species and rank was used as a contributing metric. Several HUC-12 sub-watersheds included in the analysis included portions of the mainstem Eel River. IP values from the mainstem portions of the Eel River were removed from this analysis.

Data on the presence of mélange geology was also used to characterize the inherent hydrology of a watershed. Mélange layers are relatively impermeable, have a shallow depth of weathered bedrock, and store very little ground water leading to streams with naturally low summer base flows (Hahm et al. 2016). Watersheds with high percentages of mélange geology are typically vulnerable to desiccation during drought and more prone to impacts from water diversions which in turn makes salmonid populations in these streams more vulnerable to perturbations and environmental stochasticity. Based on geologic mapping data available from Langenheim et al. (2013), the percentage of mélange geology in each HUC-12 watershed was used as a contributing metric.

Land ownership was summarized to represent the conservation potential of each watershed. The area (km^2) of land within each sub-watershed that is public, owned by a timber company, or designated as tribal land were all summed within each HUC-12 sub-watershed and represented as a percentage of the total watershed area. We used data compiled in the SFER WA which had a broad definition for the "Timber Company" category to capture the numerous small landowners that participate in timber operations (CDFW 2014). These lands are assumed to have a higher conservation potential than other land ownerships due to environmental regulations and conservation objectives typically associated with the ownership types listed above. Additionally, we used parcel size as an index of habitat fragmentation and potential for water diversions. The mean parcel size for each sub-watershed was calculated from GIS data compiled for the SFER WA (CDFW 2014) and used as a contributing metric.

The steering team also added an “Other Considerations” scoring criteria to Optimism and Potential to account for community support and past financial commitments made within each watershed. The steering team assessed each sub-watershed in three categories: 1) the history of community support for watershed health; 2) the financial resources devoted to past restoration actions; and 3) the presence of landowners with significant holdings in a sub-watershed and receptivity to restoration and conservation. By default, each HUC-12 sub-watershed received 1 point towards “Other Considerations” with additional points awarded based on expert opinions and professional judgement. If expert opinion of a sub-watershed indicated high, moderate, or low value in a category, an additional 0.15, 0.08, or 0.0 points were awarded for that category, respectively. This increased the overall score for Optimism and Potential by up to 1.45 points.

Integrity and Risk

The steering team summarized data to characterize the apparent anthropogenic threats and disturbances across the landscape of each sub-watershed including water temperature, road density, population density, and land ownership. Both measured and modeled temperature data were used to assess the amount of suitable cold-water habitat available for salmonids. The percentage of stream miles of small to medium-sized streams (drainage area <300 sq. km) with measured Mean Weekly Maximum Temperature (MWMT) less than 20 degrees Celsius was used as a contributing metric for each sub-watershed. This metric was calculated from the Eel River Recovery Project (ERRP) database of 1980-2015 stream temperatures in the Eel River basin which was compiled from multiple sources (Asarian et al. 2016). The NorWeST stream temperature model data (Chandler et al. 2016) were used to calculate the length of stream with mean August temperatures less than 17.8 degrees Celsius in each HUC-12 sub-watershed and used as a contributing metric. Temperature thresholds were developed based on a literature review of temperature requirements for rearing juvenile Coho Salmon (reviewed in Asarian et al. 2016).

Road networks often contribute large amounts of sediment to the SFER or cause large land disturbances that lead to sedimentation of waterways (Stillwater Sciences 1999). The steering team summarized available road data to characterize this threat. Source data was compiled by CalFire from various sources, including topographic maps and timber harvest plans (CDF 2015). Road density was calculated as the miles of road per square mile of land for each HUC-12 sub-watershed and used as a contributing metric. It should be noted that many unmapped roads exist for areas that have not had timber harvest plans filed in several decades and the steering team was not able to account for this.

Population census and parcel data were used to characterize the threats associated with increasing human population size including land development, increased water demands, and habitat fragmentation. We used census data from the 2010 U.S. Census which was first modified to better characterize the wildland-urban interface and effects of human development on natural areas (Radeloff et al. 2005). The census blocks were first intersected with each HUC-12 watershed boundary using the ArcGIS intersect tool (ESRI 2017). The population density (persons per km^2) reported for each census block was then converted into the count of persons for each census block using the new partial-block area. The population density for each HUC-12 sub-watershed was then calculated as the sum of persons within each sub-watershed divided by the respective sub-watershed area. This population density was then used as a contributing metric. Land ownership, which was categorized as private, non-timber company land per the SFER WA was used to characterize the potential for land development and water extraction. The percentage of land within each sub-watershed that fell into this category was summarized and used as a contributing metric.

The steering team incorporated an Integrity and Risk scoring adjustment to account for undocumented water diversion pressure which has been estimated to substantially impact dry season flow (Bauer et al. 2015). The steering team reviewed the Integrated Resource Water Management Plan's data set of registered diversions and found it to be deficient of most water diversions. In lieu of a quantitative evaluation, the steering team used information on human population, land sub-division, and expert opinion of marijuana cultivation impacts. This adjustment was based on professional judgement and expert opinion of the perceived diversion pressure within each sub-watershed. Each sub-watershed received a default adjustment of 1 and a reduced score of either 0.5 or 0.75 depending on the perceived severity of water diversion pressure. This adjustment score was then multiplied by the sum of the previously described contributing metrics (after accounting for rank and confidence), effectively reducing the final Integrity and Risk score by 25 or 50% for each sub-watershed with moderate to severe diversion pressure, respectively.

The results of the steering team ranking process are depicted in Figure 2-3. Scores ranged from 136.5 for Hollow Tree Creek to 49.5 for the Upper East Branch. The top seven ranked sub-watersheds were as follows: Hollow Tree Creek, SFER Headwaters (Elder Creek), Indian Creek, Sproul Creek, Bull Creek, Redwood Creek, and Standley Creek.

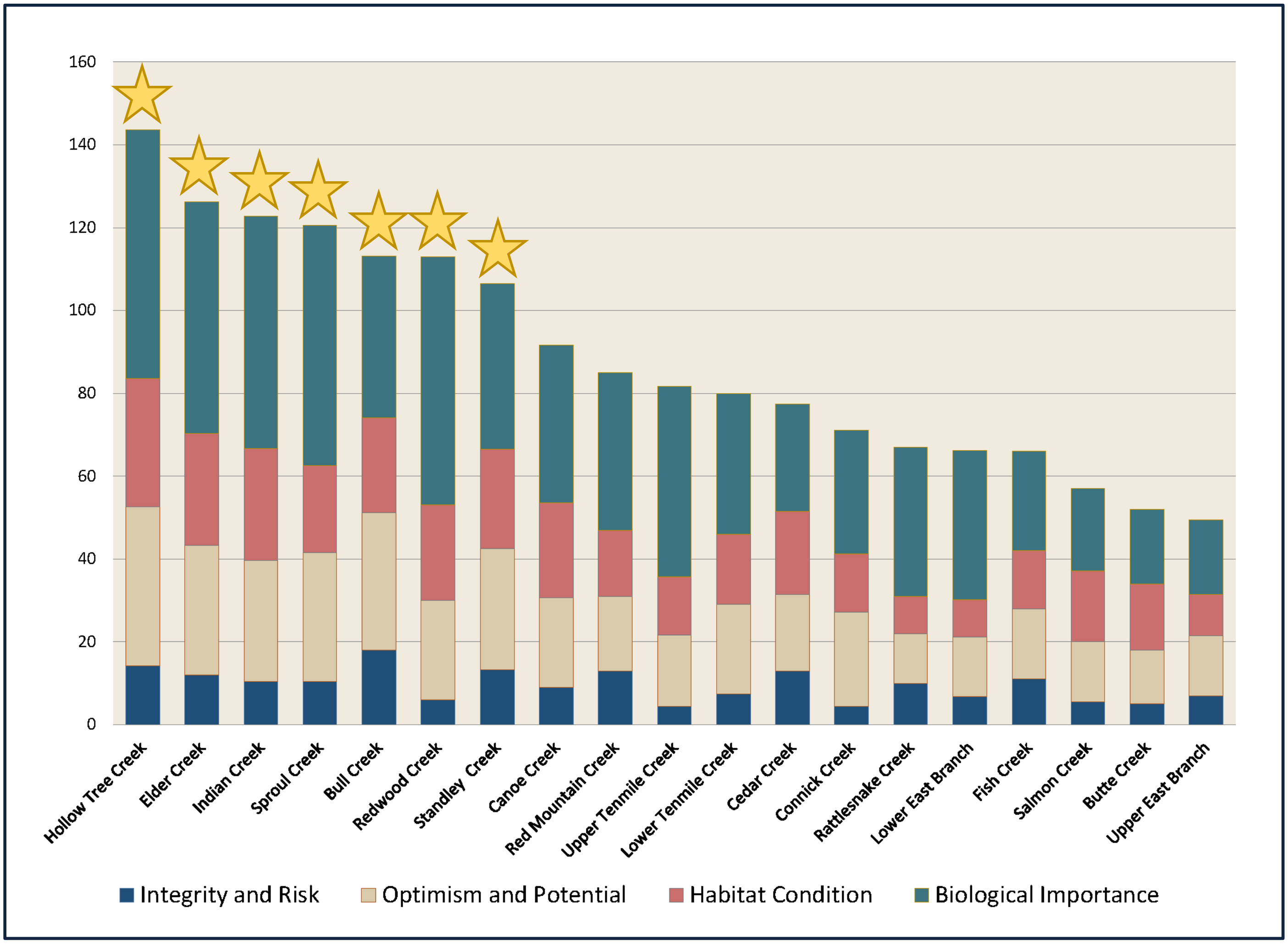

Figure 2-3. Stacked bar chart of the sub-watershed scores, by category, for each of the nineteen HUC-12 sub-watersheds of the SFER. The seven highest-scoring sub-watersheds, marked with yellow stars, were selected as focus areas for further SHaRP planning.

The steering team presented the initial results of the sub-watershed ranking process at public meetings in Bayside, Laytonville, and Briceland, California in late 2017. We held two meetings in Briceland to maximize the opportunity for public input. At these meetings, the steering team described the SHaRP process and sought input on the preliminary sub-watershed ranking results. Meeting participants were neutral to supportive of the SHaRP concept and generally agreed with the team's preliminary selection of focus areas. A few participants suggested other data to include in the ranking, and the team explained that these data didn't fit the criteria for inclusion because they did not apply to all 19 sub-watersheds. Participants didn't suggest any other changes to the preliminary ranking methodology or results.

Results of Focus Areas Selection

After the public meetings, the steering team finalized the SFER SHaRP focus areas which are, from north to south: Bull Creek, Redwood Creek, Sproul Creek, Indian Creek, Standley Creek, Hollow Tree Creek, and the SFER Headwaters. This last area was originally called Elder Creek after the name of the HUC-12, but ultimately renamed because the HUC contains many other important tributaries in the headwaters area. The location of these focus areas within the SFER sub-basin is shown in Figure 2-4.

All seven focus areas are on the west side of the SFER (Figure 2-4). This outcome reflects the spatial distribution of areas with high underlying potential for salmonid habitat in the SFER. In addition, it is influenced by the geologic and hydrologic drivers of salmonid habitat potential (detailed in Chapter 4): the underlying geology on the west side can hold water through the dry summer months that result from the region's Mediterranean rainfall patterns, while differing geology on the east side has less water-holding capacity; and dry season coastal fog moderates temperatures and helps support west side redwood/Douglas fir forests. The distribution and relative abundance of Coho Salmon and steelhead, which was explicitly accounted for in scoring, may reflect generational success in those west-side areas where summer rearing is more successful.

After the focus areas were selected, the steering team began planning for each of the focus areas. This planning started with identifying the known "experts" with experience in a particular focus area, inquiring of these experts who else should be included, and holding an Expert Panel and Action Team meeting for that focus area. These important steps in the process are described in Chapter 3. The steering team came to refer to all the people that participated in at least one of the Expert Panel and/or Action Team meetings (which included the steering team members) as the Collaborative.

Figure 2-4. The 19 HUC-12 sub-watersheds of the SFER. The seven sub-watersheds shown in red were selected for further restoration planning using SHaRP and subsequently described as focus areas.