NOAA Technical Memorandum NMFS

OCTOBER 2005

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NOAA-TM-NMFS-SWFSC-383

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

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HISTORICAL OCCURRENCE OF COHO SALMON IN STREAMS OF THE CENTRAL CALIFORNIA COAST COHO SALMON EVOLUTIONARILY SIGNIFICANT UNIT

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Abstract

Analyses of recent occupancy of coho salmon in streams within the geographic range of the Central California Coast (CCC) Evolutionarily Significant Unit (ESU) have figured prominently in decisions to list this ESU under both the federal and state endangered species acts. In this paper, we present an updated and comprehensive list of streams within the geographic range of the CCC ESU for which there is historical or recent evidence of coho salmon occurrence, providing documentation supporting each stream's inclusion on the list, categorizing each stream according to the strength of these historical records, and characterizing the streams according to their intrinsic habitat potential. Overall, we found strong evidence of coho salmon occurrence for 336 streams, and more equivocal evidence of occurrence for an additional 44 streams within the range of the CCC ESU. The 336 streams for which we found strong evidence of coho salmon occurrence represent nearly a two-fold increase compared to a previously published list (Brown and Moyle 1991), which has served as the baseline in previous analyses of occupancy. The vast majority of these newly identified streams were added to the list based on recent (post-1995) observations of occurrence, reflecting increased research and monitoring activities that have occurred since this ESU was first proposed for listing. Compared with previously identified streams, newly identified streams tend to be smaller headwater streams with relatively low predicted habitat capacity. Thus, while the number of known coho salmon streams has increased markedly in the last decade, these new streams represent a relatively small percentage of the total habitat available to coho salmon. Our results have practical implications both for the design of future coho salmon monitoring efforts and for interpreting existing compilations of presence-absence information.

Introduction

Coho salmon populations in watersheds along the coast of California have experienced marked declines in abundance in recent decades. These declines have triggered a series of endangered species determinations at both the state and federal levels. In 1995, the State of California listed coho salmon populations south of San Francisco Bay as "endangered" under the California Endangered Species Act (CESA; CDFG 2002). Subsequently, the National Marine Fisheries Service (NMFS) conducted a coastwide analysis of coho salmon populations from California to Washington, in which they delineated six distinct population segments or "Evolutionarily Significant Units" (ESUs) on the West Coast and then assessed the status of these ESUs (Weitkamp et al. 1995). Two ESUs were found to include coho salmon populations in California: The Central California Coast (CCC) ESU, which includes populations from Monterey Bay in the south to Punta Gorda in the north, inclusive of San Francisco Bay tributaries; and the Southern Oregon-Northern California Coasts (SONCC) ESU, which extends from Punta Gorda in the south to Cape Blanco in southern Oregon. Based on this status review, NMFS listed coho salmon in the CCC ESU as "threatened" in 1996 (61 Federal Register 56138, October 31, 1996) and those in the SONCC ESU as "threatened" in 1997 (62 Federal Register 24588, May 6, 1997) under the federal Endangered Species Act (ESA). In 2003, NMFS revisited the status of coho salmon in the CCC and SONCC ESUs (Good et al. 2005), and based on these reviews, the agency changed the status of the CCC ESU from "threatened" to "endangered," while retaining the "threatened" determination for the SONCC ESU (70 Federal Register 37192-37193, June 28, 2005). Lastly, the California State Fish and Game Commission recently considered a CESA petition to list coho salmon populations north of San Francisco Bay. During this process, they adopted the federal ESU definitions and separately considered the status of populations within the CCC and SONCC ESUs. In March 2005, the State of California formally listed coho salmon in the CCC ESU as "endangered" and those in the California portion of the SONCC ESU as "threatened" under CESA (California Regulatory Notice Register, Register 2005 Volume 10-Z: March 11, 2005, p. 327).

Each of the federal and state status reviews of coho salmon has acknowledged the lack of reliable estimates of adult coho salmon population size in streams of California (Weitkamp et al. 1995; CDFG 2002; Good et al. 2005). With the exception of fish counts at a few hatcheries and egg collecting stations, there are virtually no reliable current time series of adult abundance spanning more than a few years, and consequently, little is known about the current abundance of coho salmon in the wild. Because of this dearth of population information, conclusions regarding the status of coho salmon in the SONCC and CCC ESUs were based largely on estimates of recent occupancy of streams that once supported coho salmon populations. Particularly influential in both the original listing determinations and in subsequent status reviews were analyses by Brown and Moyle (1991) and Brown et al. (1994), in which the authors, through review of published literature, file reports, and personal communications with agency biologists, compiled a list of streams in California thought to have historically supported coho salmon and then estimated the number of streams where coho salmon remain, where they apparently have been extirpated, and where data

documenting recent occurrence or absence was lacking. The former publication, a report submitted to NMFS (Brown and Moyle 1991), provides a detailed list, henceforth referred to as the "Brown and Moyle list," of 582 streams in California (396 in the SONCC ESU, 182 in the CCC ESU, and 4 lying outside of these ESUs[1]) suspected of supporting coho salmon at one time. The latter journal article (Brown et al. 1994) contains summary statistics on apparent occupancy rates of historical coho salmon streams both coastwide and in major basins, without the detailed stream list found in Brown and Moyle (1991). In these documents, the authors estimated that, of the streams (248 of the 582 total) for which there was recent (1987-1991) information on coho salmon occurrence, approximately 46% no longer supported coho salmon (Brown et al. 1994).

Since its publication, the Brown and Moyle list has provided the primary baseline from which the federal and state agencies have examined historical and recent occupancy of streams by coho salmon in California. However, new information has come to light about both the historical distribution of coho salmon and their recent occupancy of streams within the state. The listing of coho salmon (and other salmonids) under ESA prompted substantial new effort on the part of federal, state, and local agencies, as well as private landowners and local watershed groups, to monitor coho salmon populations or to determine their current distribution on both federal and nonfederal lands. As a result, there has been a considerable increase in information regarding the spatial distribution of coho salmon in California, with coho salmon being documented in numerous streams where information on past occurrence was lacking. The NMFS Southwest Fisheries Science Center, in cooperation with CDFG, has been compiling information on the occurrence of coho salmon in streams within the CCC ESU, while CDFG has been engaged in a similar effort for both the CCC and SONCC ESUs. CDFG's effort has included field sampling of most of the streams on the Brown and Moyle list in both ESUs, and a publication is in preparation. As a result of these efforts over the last decade, and additional review of the historical record, the list of streams in California for which there is documented evidence of coho salmon occurrence has grown substantially.

In this paper, we provide an updated and comprehensive list of streams within the Central California Coast ESU for which there is historical or recent evidence of coho salmon occurrence[2]. Streams on the list are categorized according to the relative strength of observations indicating occurrence, as well as according to characteristics of these streams and watersheds that may be

[1] Brown and Moyle (1991) actually listed 183 streams within the CCC ESU as historical coho streams; however, one stream listed as a coastal stream (Indian Creek) is a tributary to the Eel River and thus lies outside of the ESU boundary. The four streams south of Punta Gorda falling outside of the ESU include the Sacramento and Feather rivers in the Sacramento River basin, and the Carmel and Big Sur rivers south of Monterey Bay. For the latter two rivers, we found no credible evidence supporting their inclusion on the historical stream list. Note that in this manuscript, we refer to streams within the geographic range of the CCC ESU as being "in" the ESU for convenience, recognizing that ESU membership does not apply to a stream but rather to the fish within that stream.

[2] A similar analysis of streams in the SONCC is being prepared by the California Department of Fish and Game, with an expected completion date later in 2005.

indicative of their relative importance to overall historical production of coho salmon. Although NMFS and CDFG are currently collaborating to develop a comprehensive plan for monitoring coho salmon and other salmonids in coastal areas of California, meaningful time series of abundance are unlikely to be available for a decade or more. Consequently, analysis of presence-absence information may continue to play a significant role in future assessments of coho salmon status within the State of California. Our primary goals in publishing this updated stream list are four-fold: 1) to provide a more accurate account of the historical distribution of coho salmon to assist in salmon recovery planning; 2) to provide a robust baseline from which researchers can assess changes in the distribution of coho salmon; 3) to provide information on the characteristics of identified coho salmon streams so that statistics on trends in occupancy rates can be viewed in an appropriate context; and 4) to offer recommendations regarding future monitoring of coho salmon within the CCC ESU.

Methods

Compilation of Historical Information

We gathered published and unpublished data documenting or asserting the occurrence of coho salmon in streams within the CCC ESU, the portion of the coho salmon's freshwater range extending from Punta Gorda to northern Monterey Bay (Figure 1). The list of 182 streams published in Brown and Moyle (1991) provided an initial set of streams to examine; however, this list was rapidly expanded using information from a broad spectrum of federal, state, and local agencies, as well as private land owners and watershed groups. Primary sources of information used to compile the stream list included published papers; stream surveys, field notes, and file memos from the California Department of Fish and Game's Yountville and Monterey offices; reports and electronic databases provided by California Department of Fish and Game biologists and private timber companies; reports and data records from the National Park Service and NOAA Fisheries Service Southwest Fisheries Science Center; museum collection records from the California Academy of Science and the Harvard Museum of Comparative Zoology; and reports prepared by consulting firms or watershed groups. Records documenting occurrence dated as far back as the 1860s and included records up through 2003.

For each stream on the list, we categorized the observations or assertions of occurrence according to their reliability. Four general categories were defined. Category 1 streams included those for which documentation included first-hand observations of coho salmon. This category included streams where on-the-ground field surveys, field notes, museum collection records, or other direct documentation reported coho salmon to be present. We treat these observations as unequivocal evidence of occurrence, though acknowledge the possibility of species misidentification in the field. Category 2 streams included those for which we found documents prepared by professional biologists directly asserting coho salmon presence in a stream, but where first-hand field documentation of occurrence was not uncovered. For example, stream surveys or other documents occasionally contained statements indicating that, although no coho salmon were observed during a

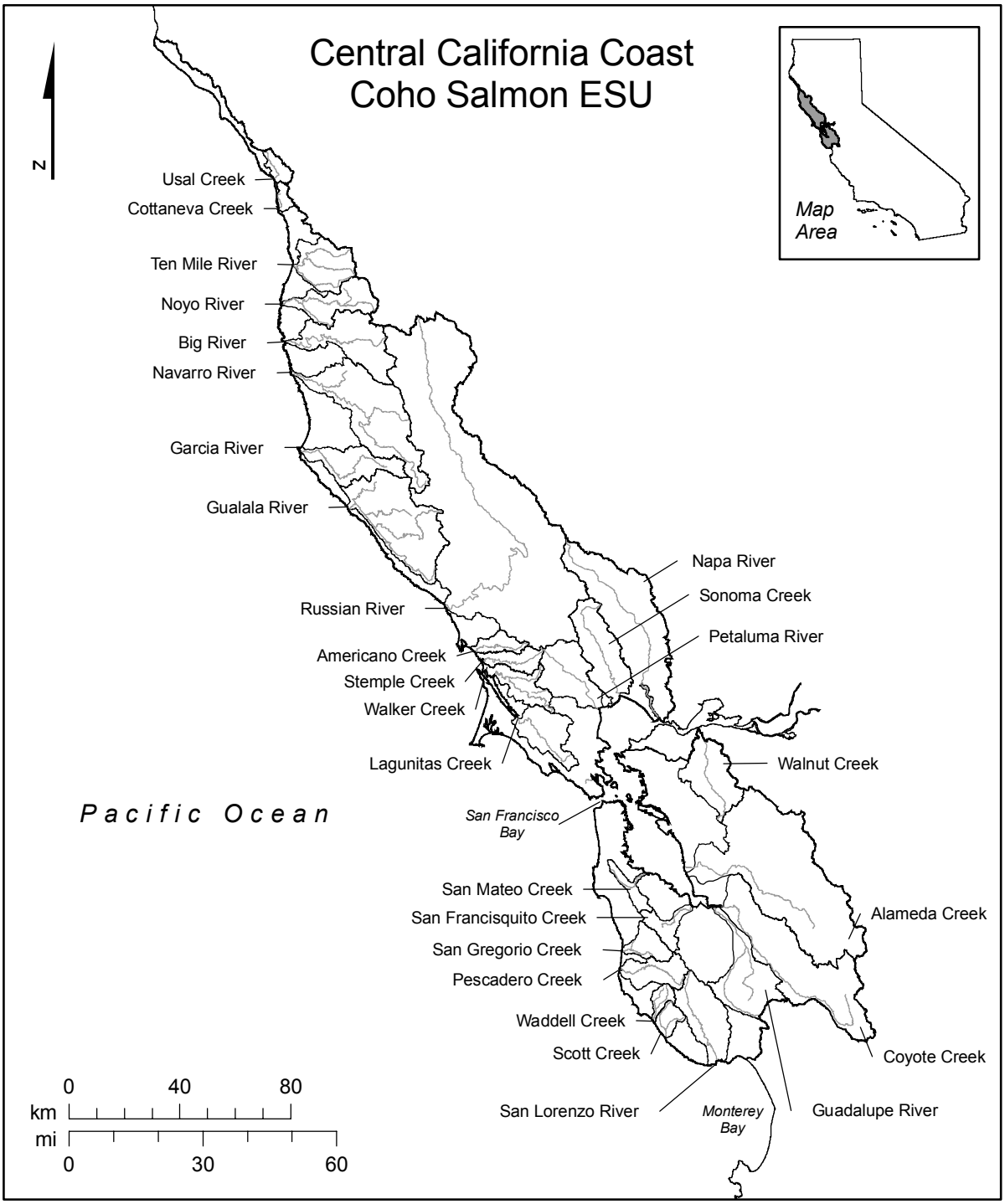

FIGURE 1. Map of Central California Coast Coho Salmon Evolutionarily Significant Unit, showing major rivers and watershed boundaries.

particular survey, they were known (at the time of the survey) to spawn or rear in the stream. Similarly, planning documents prepared by CDFG personnel sometimes included statements indicating that a stream or portions of a stream were used by coho salmon for spawning and rearing. A third type of evidence we accepted as sufficient for Category 2 designation was first-hand knowledge of professional biologists passed directly to one of the authors. Such evidence was allowed only when we believed that the assertion of presence came from direct, first-hand field experience, rather than a retelling of anecdotal information. Category 3 streams included those for which we deemed the evidence of presence to be equivocal. This category included several different data situations including reports of anecdotal observations by local residents (usually recorded on stream surveys) whose reliability in correctly identifying coho salmon could not be ascertained, statements in CDFG documents asserting historical presence where attribution of the observation could not be made, and generalized lists of habitat availability without an accompanying assertion of actual use by coho salmon[3]. Category 4 streams included those streams that had appeared on previous coho salmon stream lists, including the Brown and Moyle list, but for which we found no evidence supporting coho salmon occurrence in the cited references. Categories were further subdivided based on the type of evidence uncovered; these subcategories are defined in Appendix A.

Although we made every effort to apply the above criteria in a consistent manner, variability in the quality of the historical evidence makes such endeavors, by nature, somewhat subjective. In this regard, discriminating between Category 2 and Category 3 streams was the most difficult task for two reasons. First, language in various documents was often sufficiently ambiguous to prevent straightforward classification. Second, sometimes multiple pieces of evidence of varying strength were available for a particular stream. Particularly problematic were streams where coho salmon were believed to have once been present (based on anecdotal information and knowledge of local habitat conditions), but where populations appear to have been extirpated before the 1950s and 1960s when the California Department of Fish and Game first began performing formal stream surveys. In these cases, a 'weight-of-evidence' approach was employed, where all three authors reviewed the collective body of available information and came to consensus on the appropriate categorization.

Two additional points related to the categorization of streams warrant discussion. First, for Category 1 streams, the occurrence of coho salmon in a particular stream does not necessarily imply that persistent populations were or are present. Certain streams may be used only in years of

[3] A series of reports published by the California Department of Fish and Game in 1979 (known informally as the "Cherr and Griffin" reports), which contain county-wide streams lists and salmonids purported to use each stream, account for many of the Category 3 observations. These reports appear to identify streams not only where coho salmon had been directly observed, but also where surveys identified habitats as potentially suitable. In some cases, these have been found to be above long-standing natural barriers to anadromy; thus, we did not consider assertions of coho salmon occurrence on these lists to be, by themselves, definitive evidence of occurrence.

favorable environmental conditions. For example, access by spawning adults to smaller headwater streams may be contingent on stream flows during the migration period being sufficiently high. Similarly, drought conditions may cause some streams to become marginal or dry up altogether in some years. Thus, occupancy of such streams may be sporadic (Spence and Bjorkstedt, in prep.). Second, it is possible that some reported occurrences of coho salmon were the result of fish stocking activities. Comprehensive records of fish stocking are unavailable for the ESU, though movement of coho salmon among basins and even ESUs was fairly commonplace, particularly after about 1930 (Bjorkstedt et al. 2005). Where stocking records do exist, they typically fail to provide details about specific tributaries within a basin or region that received fish. Thus, there is no way to formally evaluate potential influence of stocking. Nevertheless, we believe that the overwhelming majority of the observations that prompted inclusion of streams on our list were the result of natural occurrences of coho salmon. Most of the identified streams are tributaries of larger rivers where historical occurrence of persistent populations is not in question, and in these instances we believe it far more likely that natural processes, rather than successful introduction of nonendemic hatchery fish, underlie the historical presence of coho salmon in these streams. Moreover, much of the early stocking was done to augment depleted stocks and, as such, these efforts would have most likely targeted habitats where historical occurrence was known or where habitat conditions were clearly favorable to coho salmon, rather than marginal streams where the probability of establishing persistent populations was low. Additionally, in the first half of the 20th century, common practice was to plant coho fry (rather than smolts), which typically have very low survival rates. Finally, attempts to establish Pacific salmonid populations outside their historical range have, with few exceptions, been unsuccessful (Wood 1995). An argument could be made that populations might be established through stocking near the periphery of the range, such as the San Francisco Bay area or San Mateo and Santa Cruz counties, where populations might be expected to be more ephemeral. However, in both regions, evidence of coho salmon occurrence predates the first known stocking of coho salmon in 1906[4]. It is possible that some more recent observations of coho salmon in a few streams may be the result of hatchery strays venturing into smaller systems. But if that is the case, then it seems equally if not more probable that such occurrences resulted from natural straying as well.

Physical Descriptions of Historical Streams

In generating the historical stream list, we adopted several conventions to facilitate correct identification of streams. For all streams identified as historical coho salmon streams, we use names taken from the 1:24,000 USGS topographic maps as the primary stream name, but we also noted other "local" names used by biologists, local residents or reported in publications, as well as alternative spellings we encountered on various maps, stream surveys, or other published documents. Unnamed tributaries were identified as such, though we also reported local names in the appendix. In Appendix A, watersheds are ordered north-to-south based on the point of ocean

[4] Museum specimens from the late 1800s place coho salmon in one San Francisco Bay area tributary and four streams on the San Mateo and Santa Cruz county coasts. See Appendix A for details.

entry. Within watersheds, streams were arranged hierarchically, with tributaries listed sequentially from the mouth of the stream to the headwaters. Geographic (UTM zone 10) coordinates at stream mouths were derived using ArcGIS 8.3 Geographic Information System (GIS) software (ESRI 2002) from a 1:100,000 hydrography produced by the Pacific State Marine Fisheries Commission and the California Department of Fish and Game (Christy and Haney 2003).

For each stream on the historical stream list, we used ArcGIS to estimate three watershed and stream characteristics: catchment area, mean annual discharge, and stream length weighted by an index of habitat potential (Intrinsic Potential or IP; see below for description) expressed in units of IP-km. Catchment area was derived using the WATERSHED function in ArcGIS in conjunction with a 10 m Digital Elevation Model (DEM)[5]. The WATERSHED function defines a grid with cells representing the upstream contributing area, the perimeter of which can then be converted into a polygon using the GRIDPOLY function. In a few instances, the resolution of the 10 m DEM was inadequate to capture subtleties in topography. Where this occurred, watershed boundaries were corrected by overlaying the watershed polygons onto the DEM and 1:100,000 hydrography and then manually adjusting the polygon boundaries. Watershed area estimates are nested: the area computed for a particular coho stream encompasses all upstream tributaries, including any identified as coho salmon streams.

Mean annual discharge at the mouth of each stream was estimated based on a modeled regression relationship between discharge and both watershed area and mean annual precipitation. Input data for developing this relationship included discharge data from unregulated USGS stream gages in coastal regions of central and northern California (Monterey Bay to the Oregon Border) and precipitation estimates from the PRISM model (Daly et al. 1994). The PRISM model estimates mean monthly precipitation at a 2 km grid resolution based on a 30-year (1961-1990) climatological record, adjusting for geographic and topographic variables such as elevation, aspect, and proximity to the ocean (Daly et al. 1994). Greater detail of the methodology for estimating mean annual discharge can be found in Agrawal et al. (2005).

Intrinsic Potential (IP) is an index of the historical (i.e., pre-anthropogenic disturbance) potential for a particular reach to develop habitat characteristics suitable for salmonids, in this case coho salmon, based on geomorphic and hydrologic characteristics. The IP model was developed by the Coastal Landscape Analysis and Modeling Study (CLAMS) to predict the distribution and relative habitat potential for juvenile coho salmon in streams of coastal Oregon (Burnett et al. 2003). The IP model uses a fuzzy logic approach to convert values for stream gradient, valley width index, and mean annual discharge into separate suitability ratings scaled between 0 and 1. The geometric mean of these three suitability values is taken to be the IP value for a particular reach. Scientists at NMFS Southwest Fisheries Science Center have adapted this model for application in coastal

[5] The 10 m DEM was generated by applying a spline to interpolate a seemless 30 m resolution DEM (USGS 2002) to 10 m resolution DEM (see Agrawal et al. 2005 for greater detail).

regions of northern and central California, incorporating an additional variable, mean August air temperature, to mask out regions where water temperatures are excessively warm for juvenile coho salmon. Modifications to the CLAMS IP model and methods used in developing the temperature mask are described in Agrawal et al. (2005). For each watershed, we calculated the sum of all stream segment distances weighted by their IP values, a value we termed IP-km. For example, a watershed with an IP-km value of 5 could arise in a stream with 5 km of accessible habitat having an average IP value of 1, a stream with 10 km of accessible habitat with an average IP value of 0.5, or a stream with 20 km stream with an average IP value of 0.25, etc.

Results

Historical Stream List

Our review of both historical (pre-1988) and recent (1988-2003) literature and unpublished data sources uncovered documentation confirming or asserting coho salmon presence in 380 streams within the Central California Coast ESU (Appendix A, Table A2). Of these streams, we classified 310 as Category 1 streams, indicating that we found published field reports documenting occurrence, and 26 as Category 2 streams, where we believe evidence suggests a strong likelihood of historical coho salmon occurrence, but where first-hand field documentation was lacking. The remaining 44 streams were classified as Category 3 streams, indicating that although we found some assertion of historical occurrence, evidence was anecdotal or otherwise sufficiently equivocal to warrant a lower reliability ranking. It is quite possible that many of these Category 3 streams did, in fact, at one time support coho salmon; however, available data were simply inadequate to draw solid conclusions about historical presence.

Of the 182 streams that were listed by Brown and Moyle (1991) as historical coho salmon streams within the CCC ESU, we classified 149 as Category 1 streams and an additional 17 as Category 2 streams. Thus, we believe there is strong evidence of historical occurrence for more than 91% of the streams on the Brown and Moyle list. We found evidence of occurrence to be equivocal for 13 streams on the Brown and Moyle list, which we classified as Category 3 streams. Additionally, in three cases, we found no evidence suggesting occurrence when we traced cited sources back to the original documents. Details of how each stream was classified can be found in Appendix A.

Characteristics of Historical Coho Salmon Streams

Overall, the 336 watersheds with conclusive or strong evidence of coho salmon occurrence ranged in size from more than 384,000 ha (Russian River) to less than 25 ha (an unnamed tributary to Big Creek in southern Humboldt County). The median watershed area for the all Category 1 and 2 streams was approximately 935 ha, and about 26% of the streams identified drained watersheds with areas less than 400 ha (Figure 2). Median estimated IP for Category 1 and 2 streams was 2.8 IP-km. Thirty-one of the Category 1 and 2 streams had estimated IP values of less than 0.1 IP-km, suggesting that use of these streams by coho salmon is probably restricted to the lowermost reaches of the stream (Figure 2).

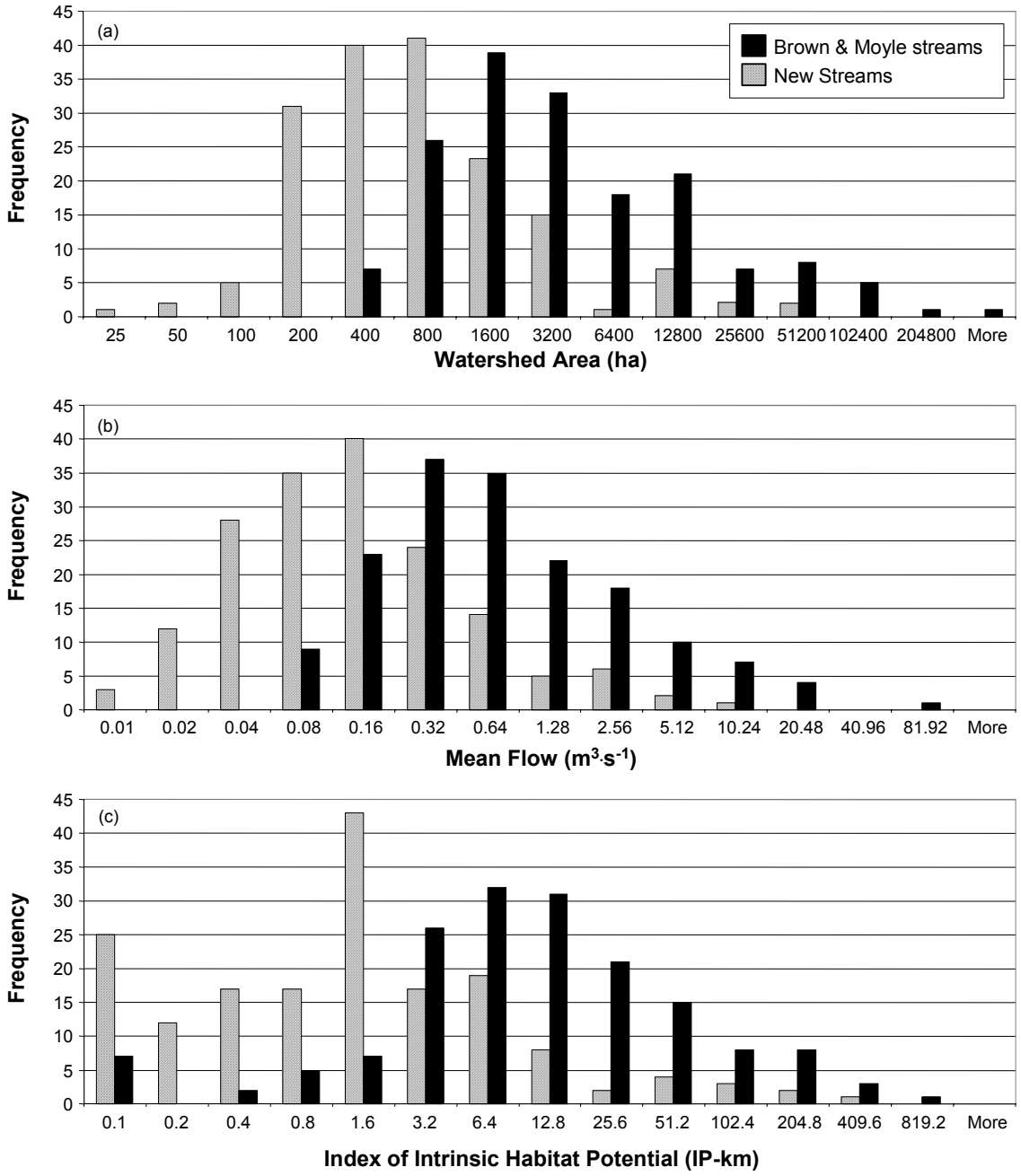

FIGURE 2. Frequency distributions of (a) watershed area, (b) estimated mean annual discharge, and (c) estimated intrinsic potential for 336 watersheds with conclusive or strong evidence of coho salmon occurrence in the Central California Coast ESU.

When taken as a group, the physical characteristics of the 170 "new" Category 1 and 2 coho salmon streams (i.e., those not on the Brown and Moyle list) and their associated watersheds differed markedly from those identified by Brown and Moyle (1991). Overall, the majority of newly identified coho salmon streams tended to be relatively small in size, with 77% draining watersheds less than 1,000 ha in size and 69% having estimated mean annual discharges of less than 0.16 $m^3 \cdot s^{-1}$ (Figure 2). In contrast, the vast majority (74%) of Brown and Moyle streams had watershed areas exceeding 1,000 ha and estimated mean annual discharges of more than 0.16 $m^3 \cdot s^{-1}$ (81%). The contrast was even more dramatic when estimates of IP-km were compared. More than half of the new streams had estimated IP values of 1 IP-km or less (i.e., the equivalent of one kilometer of habitat with optimal gradient, flow, and valley constraint), whereas only 9% of the Brown and Moyle streams had estimated IP values of 1 IP-km or less (Figure 2).

Watershed Summaries

In the sections that follow, we provide brief watershed-by-watershed summaries of streams for which we found evidence of coho salmon occurrence. For each county, we first devote subsections to larger basins, arranged north-to-south, and then follow with a subsection discussing smaller coastal watersheds. In our discussion, we focus primarily on those streams classified as Category 1 or 2 streams. Mention of Category 3 and 4 streams is generally limited to cases where our conclusions depart from the Brown and Moyle (1991) list. We do not discount the possibility that coho salmon may have once occurred in these streams, concluding only that the evidence supporting occurrence appears equivocal. In these cases, we present IP statistics to shed light on the potential for these streams to have once supported coho salmon. We also summarize the contribution of newly identified streams to overall basin estimates of IP-km to highlight the differences in character of these streams compared to those identified by Brown and Moyle (1991).

Humboldt County

The northern portion of the Central California Coast ESU lies in southern Humboldt County along a rugged stretch of coastline known as the Lost Coast on the western edge of the Kings Range National Conservation area. Little surveying of streams, most of which are quite steep, has been done along this remote stretch of the coast, and we know of no information placing coho salmon in streams of the Lost Coast area from Punta Gorda to the Mendocino County border near Shelter Cove prior to year 2000. However, in 2001, biologists with the National Marine Fisheries Service observed juvenile coho salmon in a small, unnamed tributary of Big Creek located about 0.5 km upstream of its mouth (Figure 3 inset). To our knowledge, this remains the only known observation of coho salmon in streams along this stretch of the coast.

Mendocino County

Ten Mile River basin

We found strong evidence of historical or recent coho salmon occurrence in 24 streams within the Ten Mile River basin (Figure 4). These include all 11 streams identified by Brown and Moyle

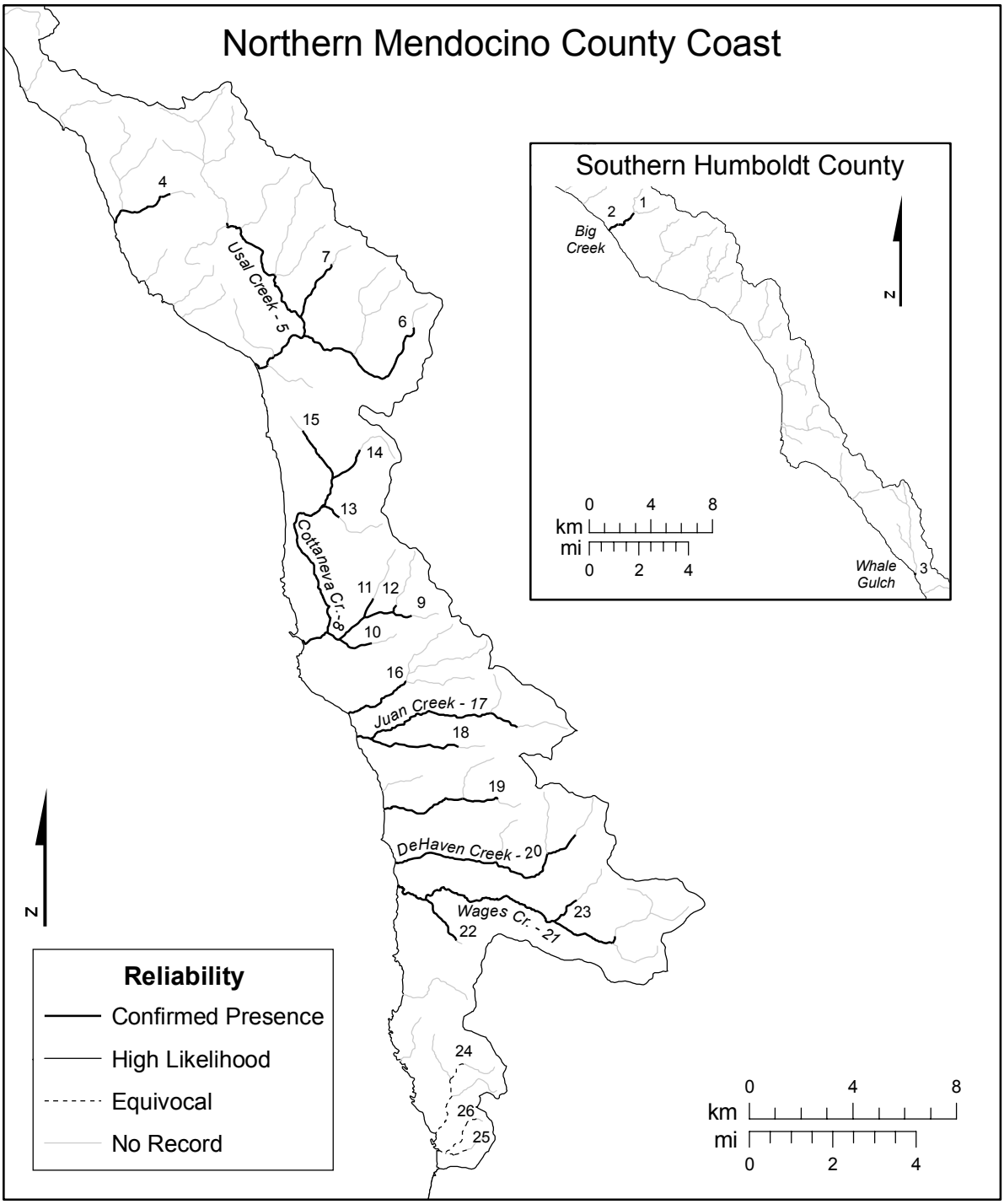

FIGURE 3. Historical distribution of coho salmon in streams of the southern Humboldt County and northern Mendocino County coasts. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include an unnamed tributary [2], Jackass Cr. [4], South Fk. Usal Cr. [6], Soldier Cr. [7], South Fk. Cottaneva Cr. [9], Rockport Cr. [10], Slaughterhouse Gulch [11], Kimball Gulch [12], Middle Fk. Cottaneva Cr. [13], North Fk. Cottaneva Cr. [14], Dunn Cr. [15], Hardy Cr. [16], Little Juan Cr. [18], Howard Cr. [19], Rider Gulch [22], North Fk. Wages Cr. [23], Abalobadiah Cr. [24], Seaside Cr. [25], and Frazer Cr. [26].

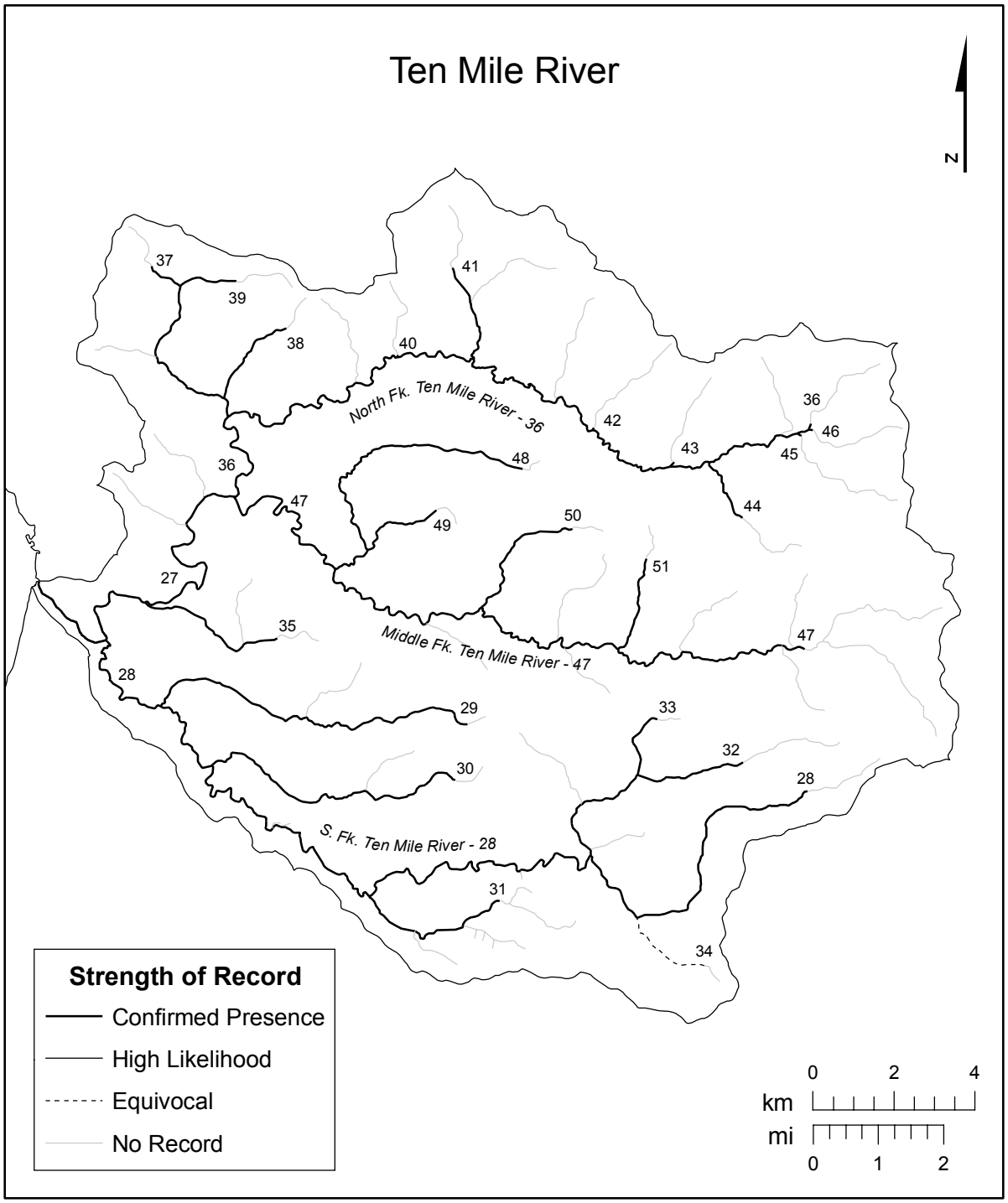

FIGURE 4. Historical distribution of coho salmon in the Ten Mile River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include the mainstem Ten Mile River [27], Smith Cr. [29], Campbell Cr. [30], Churchman Cr. [31], Redwood Cr. [32], unnamed trib. [33], Gulch Eleven [34], Mill Cr. [35], Little North Fk. Ten Mile River [37], Buckhorn Cr. [38], unnamed trib. [39], O'Conner Gulch [40], Bald Hill Cr. [41], unnamed tribs. [42–43], Patsy Cr. [44], unnamed trib. [45], Stanley Cr. [46], Bear Haven Cr. [48], South Fk. Bear Haven Cr. [49], Little Bear Haven Cr. [50], and Booth Gulch [51].

(1991) as coho salmon streams, as well as an additional 13 streams (Appendix A). Among the streams for which coho salmon occurrence has been confirmed include the mainstem Ten Mile River; the South Fork Ten Mile River and five tributaries; the North Fork Ten Mile River and 10 tributaries; the Middle Fork Ten Mile River and four tributaries; and one smaller tributary to the mainstem Ten Mile River (Figure 4). All but one of newly identified streams (Bald Hill Creek) are relatively small, with watersheds draining areas of less than 800 ha in size, and all but two (Bald Hill Creek and Little Bear Haven Creek) had estimated IP-km values of less than 1.5 km. In contrast, all 11 streams on the Brown and Moyle (1991) list for this watershed had IP-km values of greater than 2.5 km (Appendix A). Collectively, the 13 new streams accounted for slightly less than 10% of the total IP-km for the watershed.

Noyo River basin

Within the Noyo River basin, we identified 34 streams with strong evidence of historical or recent use by coho salmon (Figure 5). Thirteen of these streams were listed by Brown and Moyle (1991), and the addition of 21 new streams results largely from increased sampling of smaller tributaries since coho salmon were petitioned for listing under ESA in 1995 (Appendix A). Besides the mainstem Noyo River, coho salmon have been observed in the South Fork Noyo River and 14 tributaries; the North Fork Noyo River and six tributaries; and 11 smaller tributaries of the mainstem Noyo River. As with the Ten Mile Basin, the majority of newly identified coho salmon streams were in smaller watersheds with minimal habitat potential, as estimated by the IP model. All 21 of these streams drain watersheds of less than 900 ha in size, and eleven streams drain watersheds of less than 200 ha. Seventeen of the streams had estimated IP values of less than 1.5 IP-km, and only one (Gulch Seven) had greater than 2.0 IP-km (Appendix A). Overall, the 21 newly identified streams accounted for about 12% of the estimated IP-km for the Noyo Basin.

Big River basin

Historical and recent records indicate coho salmon have been observed in 34 streams within the Big River basin (Figure 6). This includes all 16 streams listed by Brown and Moyle (1991), as well as 18 new streams (Appendix A). In addition to the mainstem Big River, coho salmon have been reported in the Little North Fork Big River and four tributaries; the North Fork Big River and nine tributaries; the South Fork Big River and eight tributaries; and eight smaller tributaries of the mainstem Big River. All but three of the newly identified streams (Gates Creek, Russell Brook, and Martin Creek) drain watersheds of 1,000 ha of less. However, even though relatively small in size, 11 of the 18 new streams had estimated IP values of greater than 1.5 (Appendix A). Overall, new streams accounted for about 18% of the total IP-km for the basin.

Albion River basin

Coho salmon have been documented in 17 streams within the Albion River basin (Figure 7). We found evidence confirming occurrence in all five streams identified by Brown and Moyle (1991), as well as 12 new streams (Appendix A), most of which have been identified as coho streams based

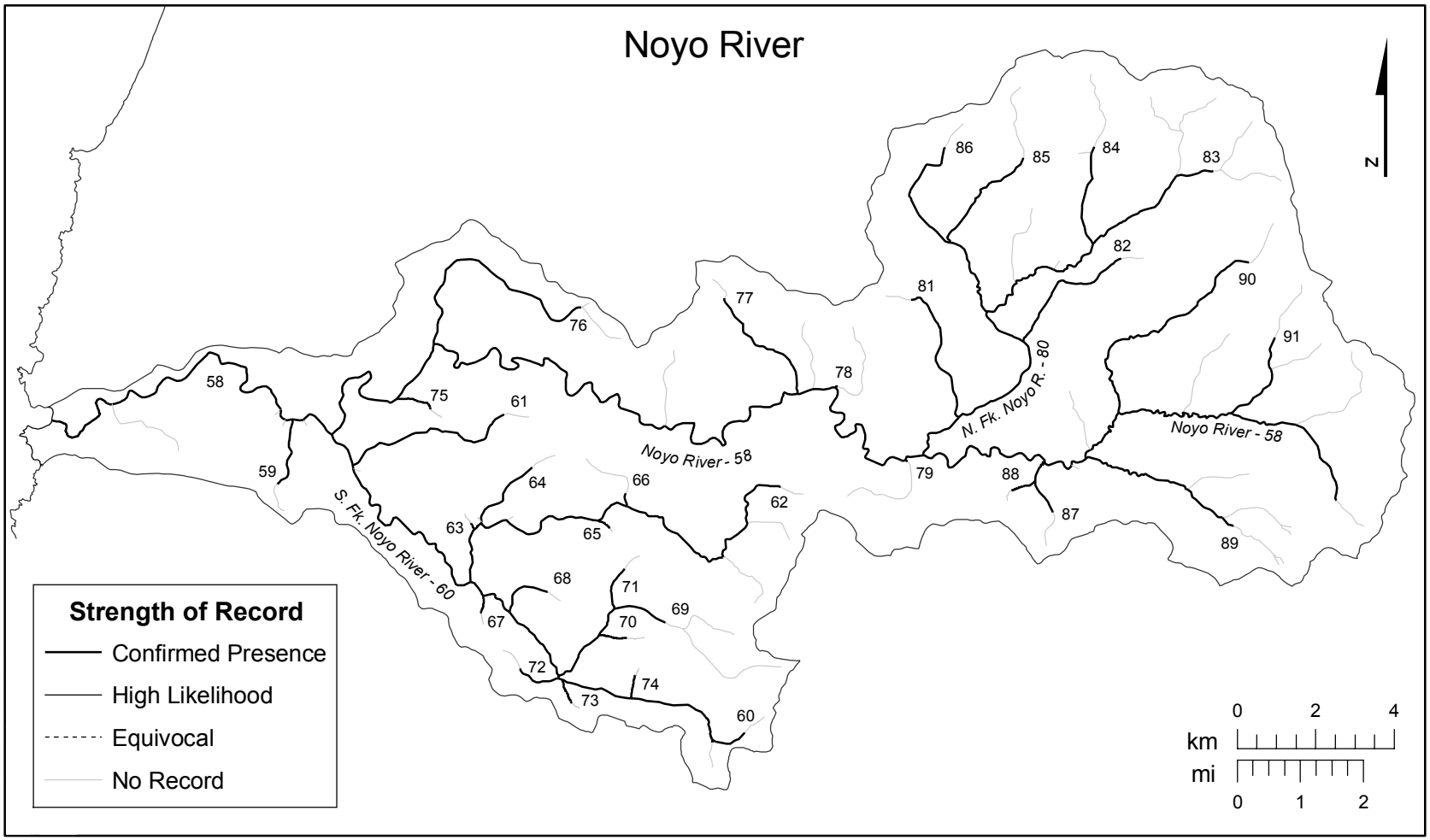

FIGURE 5. Historical distribution of coho salmon in the Noyo River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Hayshed Gulch [59], Kass Cr. [61], North Fk. South Fk. Noyo River [62], unnamed trib. [63], Brandon Gulch [64], unnamed tribs. [65–66], Peterson Gulch [67], Bear Gulch [68], Parlin Cr. [69], unnamed tribs. [70–75], Little North Fk. Noyo River [76], Duffy Gulch [77], Gulch Thirty-One [78], unnamed trib. [79], Marble Gulch [81], Gulch Seven [82], Hayworth Cr. [83], North Fk. Hayworth Cr. [84], Middle Fk. North Fk. Noyo River [85], Dewarren Cr. [86], unnamed tribs. [87–88], Olds Cr. [89], Redwood Cr. [90], and McMullen Cr. [91].

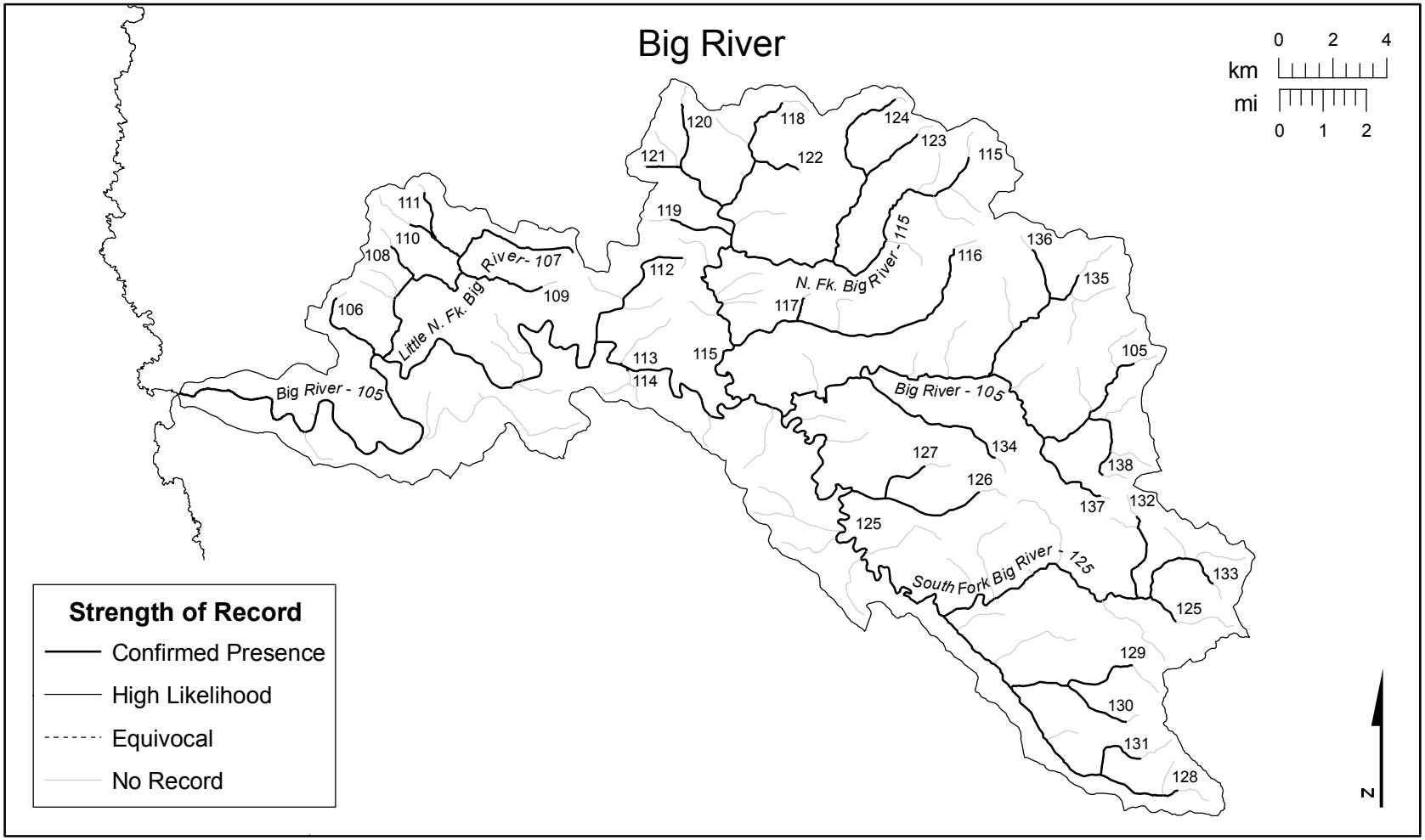

FIGURE 6. Historical distribution of coho salmon in the Big River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Railroad Gulch [106], Thompson Gulch [108], East Br. Little North Fk. Big River [109], Berry Gulch [110], unnamed trib. [111], Two Log Cr. [112], Tramway Gulch [113], unnamed trib. [114], East Br. North Fk. Big River [116], unnamed trib. [117], Chamberlain Cr. [118], Water Gulch [119], unnamed trib. [120], Gulch Sixteen [121], Arvola Gulch [122], James Cr. [123], North Fk. James Cr. [124], Ramon Cr. [126], unnamed trib. [127], Daugherty Cr. [128], Gates Cr. [129], Johnson Cr. [130], Snuffins Cr. [131], unnamed tribs. [132–133], Russell Brook [134], Martin Cr. [135], unnamed trib. [136], Valentine Cr. [137], and Rice Cr. [138].

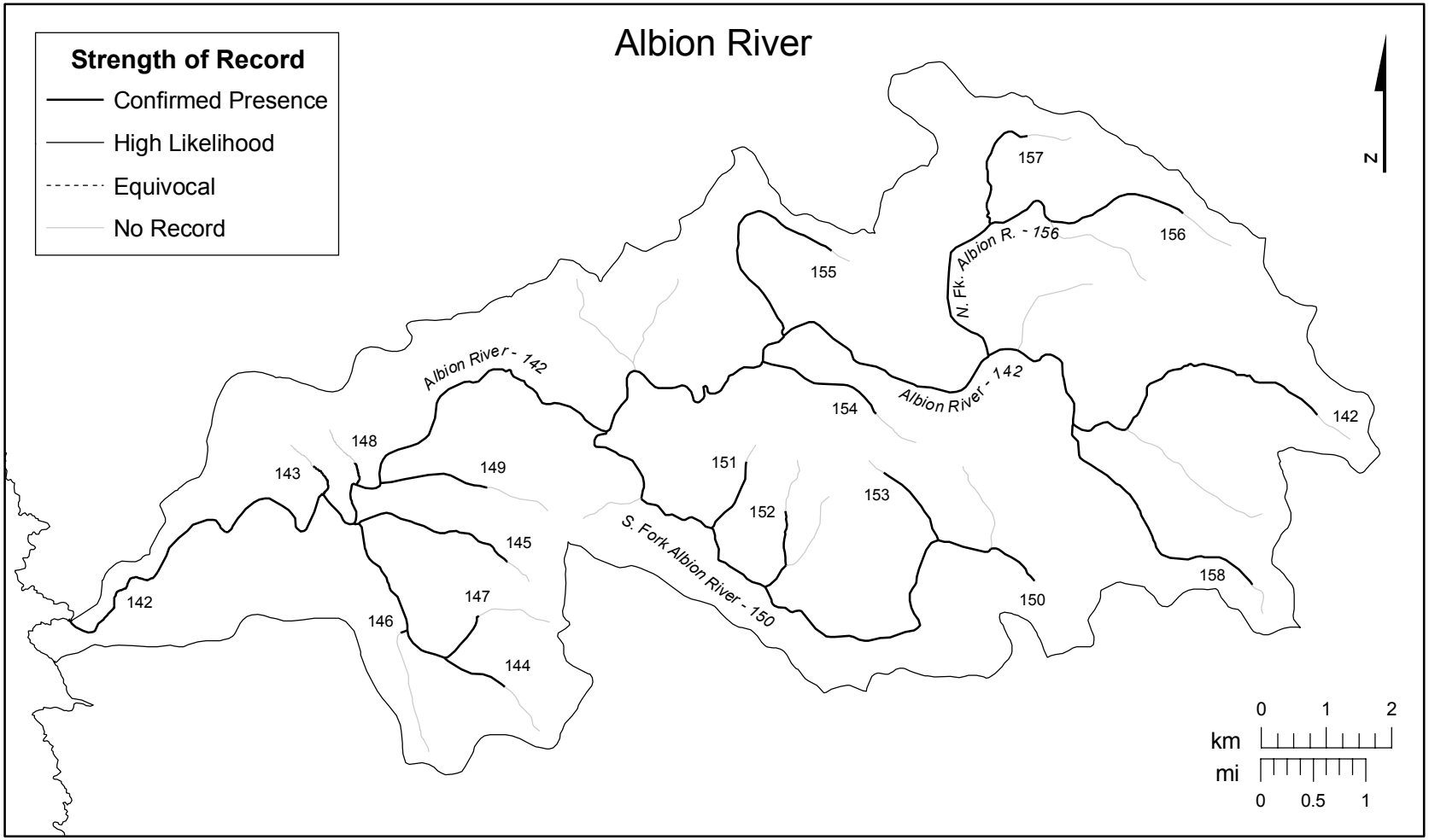

FIGURE 7. Historical distribution of coho salmon in the Albion River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Deadman Gulch [143], Railroad Gulch [144], Pleasant Valley Cr. [145], unnamed tribs. [146–148], Duck Pond Gulch [149], Norden Gulch [151], Little North Fk. South Fk. Albion River [152], Bull Team Gulch [153], Railroad Gulch (East)[154], Tom Bell Cr. [155], Soda Springs [157], and Marsh Cr. [158].

on surveys conducted within the past decade. Included on the list of streams are the mainstem Albion River, the South Fork Albion River and three of its tributaries; the North Fork Albion River and one of its tributaries; and ten smaller tributaries to the mainstem Albion River. All of the newly identified streams were in small watersheds of less than 400 ha, with the exception of Railroad Gulch, which drains an area of just over 1,100 ha. Four of the streams (Railroad Gulch, Pleasant Valley Creek, Tom Bell Creek, and Soda Springs) had estimated IP values of 1.5 IP-km or more. Collectively, the newly identified streams made up 20% of the total IP-km for the Albion Basin.

Navarro River basin

Overall, we found strong evidence of historical occurrence of coho salmon in 37 streams within the Navarro River basin (Figure 8), including 17 of the 18 streams identified by Brown and Moyle (1991)[6], and 20 newly identified coho salmon streams (Appendix A), all of which were identified as such based on relatively recent (1995–2002) surveys. Among the Navarro Basin streams where coho salmon are known to have occurred are the mainstem Navarro River; the North Fork Navarro River and 18 tributaries within this subbasin; Indian Creek and three tributaries; Rancheria Creek and six tributaries; and six smaller tributaries to the mainstem Navarro River. Of the 20 newly identified coho salmon streams, all but one (Dago Creek) drained areas of less than 1,000 ha. However, eight of these streams have estimated IP-km values exceeding 1.5 (Camp 16 Gulch, Redwood Creek, Bottom Creek, Sawyer Creek, Spooner Creek, Bridge Creek, Low Gap Creek, and Dago Creek)(Appendix A). Together, the newly identified coho streams accounted for about 11% of the total estimated IP-km in the basin.

Garcia River basin

We found evidence of occurrence of coho salmon in five streams within the Garcia River basin (Figure 9): the mainstem Garcia River, the North Fork Garcia River, the South Fork Garcia River and one of its tributaries, and one tributary to the upper mainstem Garcia River (Inman Creek)(Appendix A). Only the mainstem Garcia River was identified by Brown and Moyle (1991); all newly identified streams were added to the list based on recent (post-1990) observations of coho salmon occurrence. The North Fork Garcia River and Inman Creek subbasins are modest in size, encompassing areas of about 2,600 and 2,200 ha, respectively, while the South Fork Garcia River drains an area about 1,100 ha in size (Appendix A). Collectively, these three watersheds account for about 19% of the estimated IP-km for the Garcia River basin.

Other Mendocino County basins

In addition to the major Mendocino County watersheds listed above, coho salmon have been observed in a large number of small-to-moderate-sized watersheds (from about 300 to 7,500 ha) that drain directly into the Pacific Ocean. Overall, we found evidence of coho salmon occurrence

[6] Brown and Moyle (1991) listed an unnamed tributary to Indian Creek locally known as "Dick Creek" as a coho salmon stream; however, the evidence did not meet our criteria for Category 1 or 2 designation.

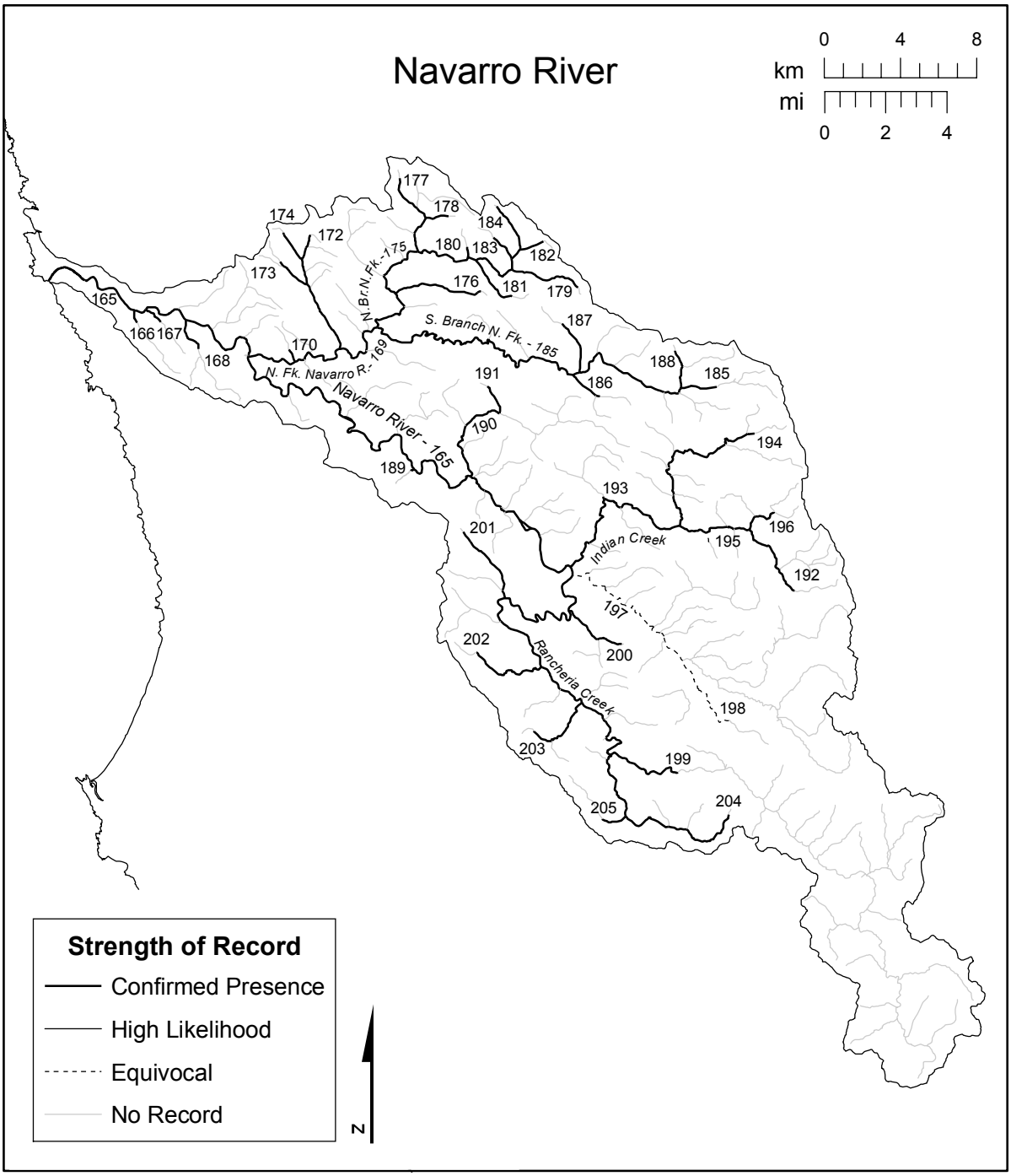

FIGURE 8. Historical distribution of coho salmon in the Navarro River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each strea m based on IP model predictions. Unlabeled streams include Marsh Gulch [166], Murray Gulch [167], Flume Gulch [168], Dead Horse Gulch [170], Flynn Cr. [172], Camp 16 Gulch [173], Tank 4 Gulch [174], Cook Cr. [176], John Smith Cr. [177], Gulch 15 [178], Little N. Fk. Navarro R. [179], Big Gulch [180], Redwood Cr. [181], Bottom Cr. [182], Sawyer Cr. [183], Spooner Cr. [184], Bear Cr. [186], Bridge Cr. [187], Low Gap Cr. [188], unnamed trib. [189], Mill Cr. [190], unnamed trib. [191], West Br. Indian Cr. [193], North Fk. Indian Cr. [194], unnamed trib. [195], Gut Cr. [196], Anderson Cr. [197], Robinson Cr. [198], Ham Canyon [200], Dago Cr. [201], Horse Cr. [202], Minnie Cr. [203], Camp Cr. [204], and German Cr. [205].

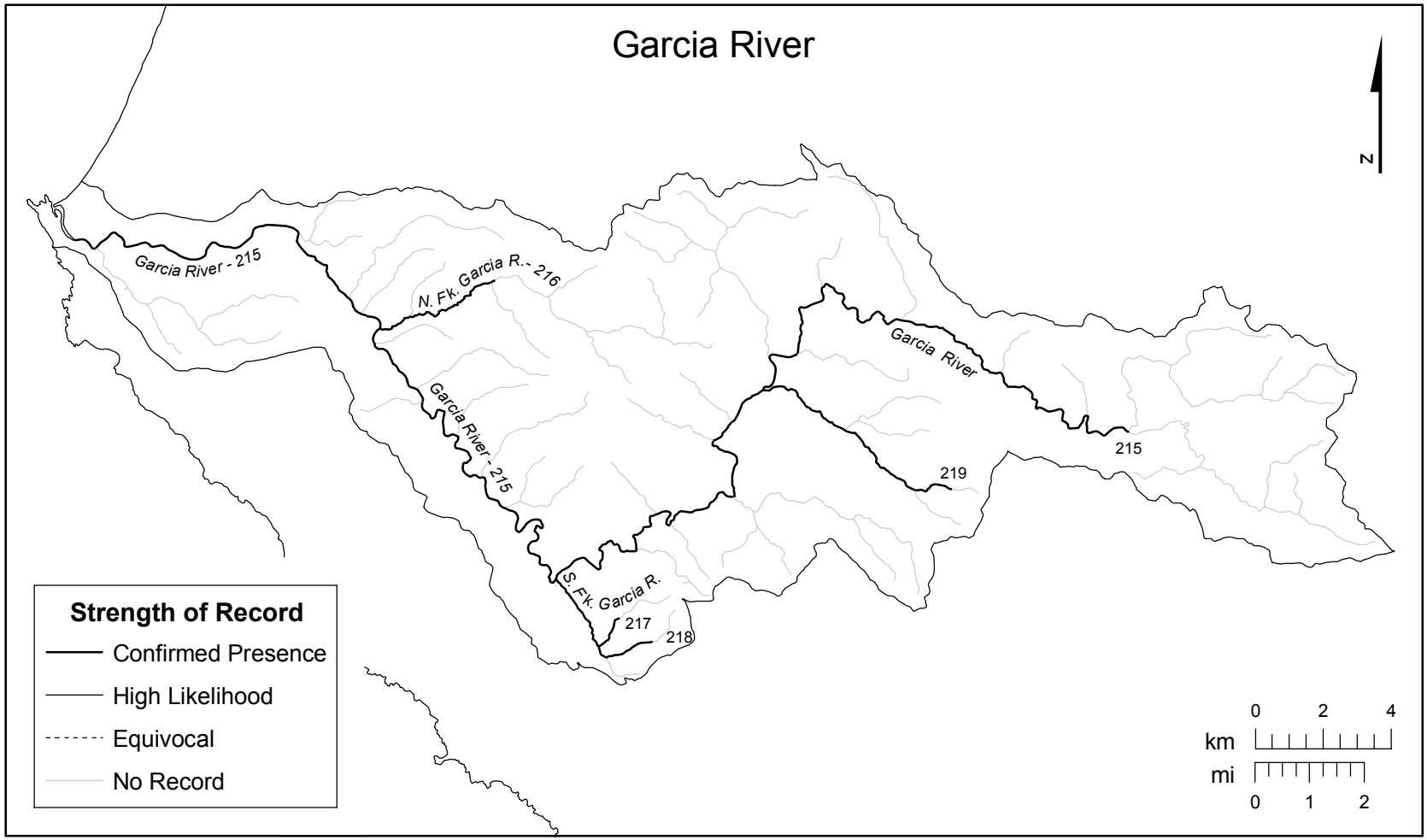

FIGURE 9. Historical distribution of coho salmon in the Garcia River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Fleming Creek [218], and Inman Cr. [219]

in 49 streams representing 24 smaller coastal watersheds in Mendocino County. North of the Ten Mile River basin, watersheds and tributaries for which we found strong evidence of coho salmon occurrence included, from north to south, Whale Gulch; Jackass Creek; Usal Creek and two of its tributaries; Cottaneva Creek and seven tributaries; Hardy Creek; Juan Creek and one tributary; Howard Creek; DeHaven Creek; and Wages Creek and two tributaries (Figure 3; Appendix A). In the coastal region between the Ten Mile River and the Big River, we found strong evidence of coho salmon in Pudding Creek and two tributaries; Hare Creek and four tributaries; Mitchell Creek; Jug Handle Creek; Caspar Creek and three tributaries; Doyle Creek; and Russian Gulch (Figure 10; Appendix A). From the Big River to the Gualala River, we found evidence of occurrence in Little River; Little Salmon Creek[7]; Big Salmon Creek and two tributaries; Greenwood Creek; Elk Creek and one tributary; Alder Creek; Brush Creek; Schooner Gulch; and Fish Rock Gulch (Figure 11; Appendix A).

Brown and Moyle (1991) identified two additional coastal watersheds as supporting coho salmon: Buckhorn Creek and Mallo Pass Creek. However, available evidence did not meet our criteria for designation of these streams as Category 1 or 2. For Mallo Pass Creek, the estimated IP-km exceeds 3 km. Given that several other coho-bearing coastal watersheds in this region are similar in character and have comparable habitat potential (e.g., Hardy, Howard, Doyle, and Little Salmon creeks), it seems entirely plausible that this stream also once supported coho salmon. Buckhorn Creek has somewhat less estimated IP-km (about 0.5 km). In addition, Brown and Moyle (1991) identified four other streams as historical coho salmon streams: three tributaries of Elk Creek (Three Springs Creek, Sulfur Fork, and Soda Fork) and the North Fork of Schooner Creek. We found the evidence equivocal for Three Springs Creek and North Fork Schooner Gulch and so classified these as Category 3 streams. When we traced the reference cited by Brown and Moyle (1991) for Soda Fork and Sulphur Fork back to original sources, we found no evidence of coho salmon occurrence and thus classified these as Category 4 streams. Estimated IP-km for these four streams ranged from about 0.7 km to 1.1 km, suggesting some potential for coho salmon use despite the equivocal evidence.

Overall, we identified seventeen streams in smaller coastal watersheds of Mendocino County that were not on the Brown and Moyle (1991) list. Of these, South Fork Usal Creek, Soldier Creek, Dunn Creek, Rider Gulch, North Fork Wages Creek, and an unnamed tributary to Pudding Creek had estimated IP-km values of greater than 1.2 IP-km; the remaining streams had estimated IP-km values of less than 0.9 IP-km.

[7] Brown and Moyle (1991) list Little Salmon Creek as a tributary of Big Salmon Creek, as the two streams enter into a common estuary. For our purposes, we considered it a separate watershed.

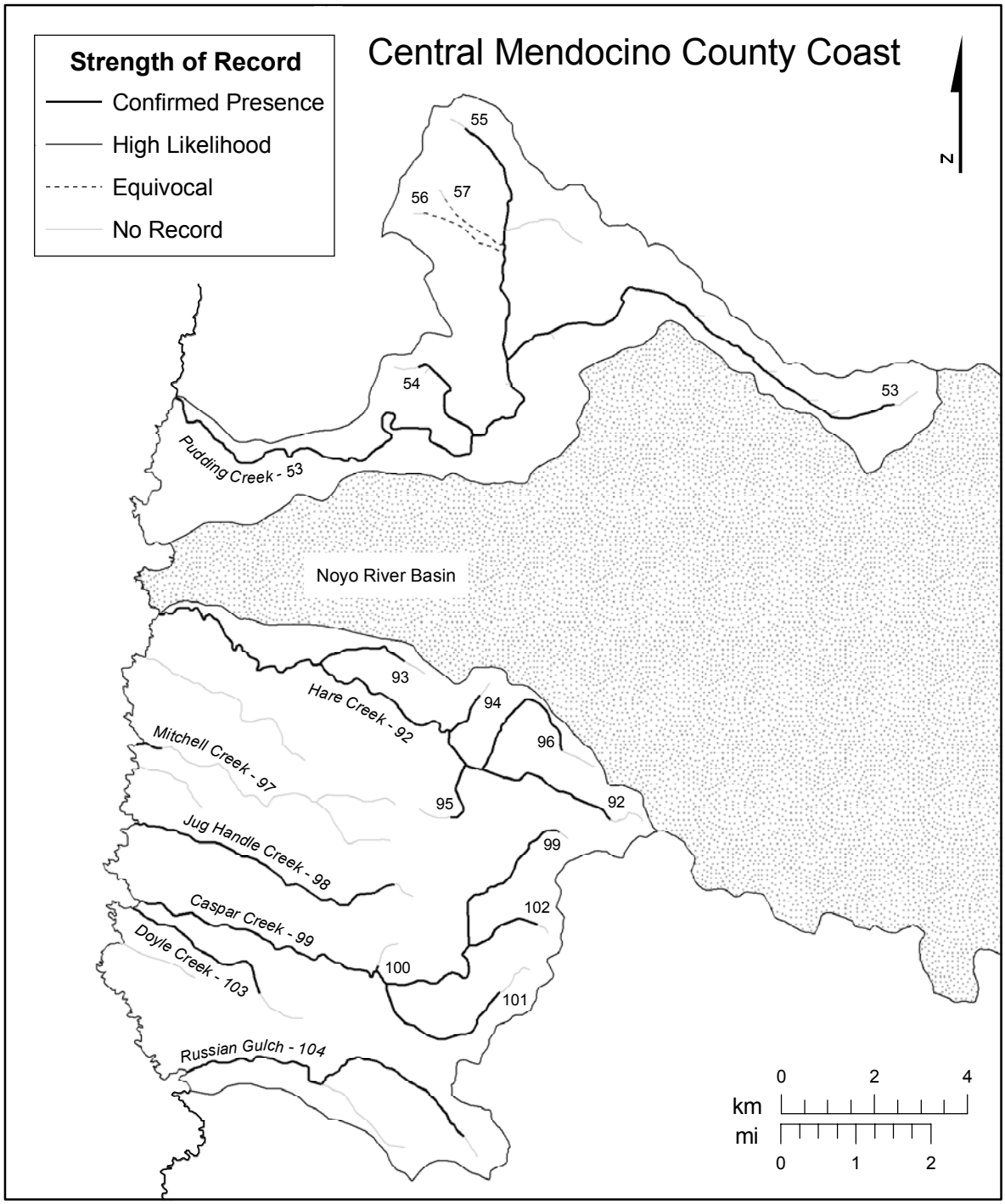

FIGURE 10. Historical distribution of coho salmon in streams of the central Mendocino County coast. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include an unnamed trib. [54], Little Valley Creek [55], unnamed tribs. [56–57], Covington Gulch [93], unnamed trib. [94], South Fk. Hare Cr. [95], Bunker Gulch [96], and unnamed tribs. [100–102].

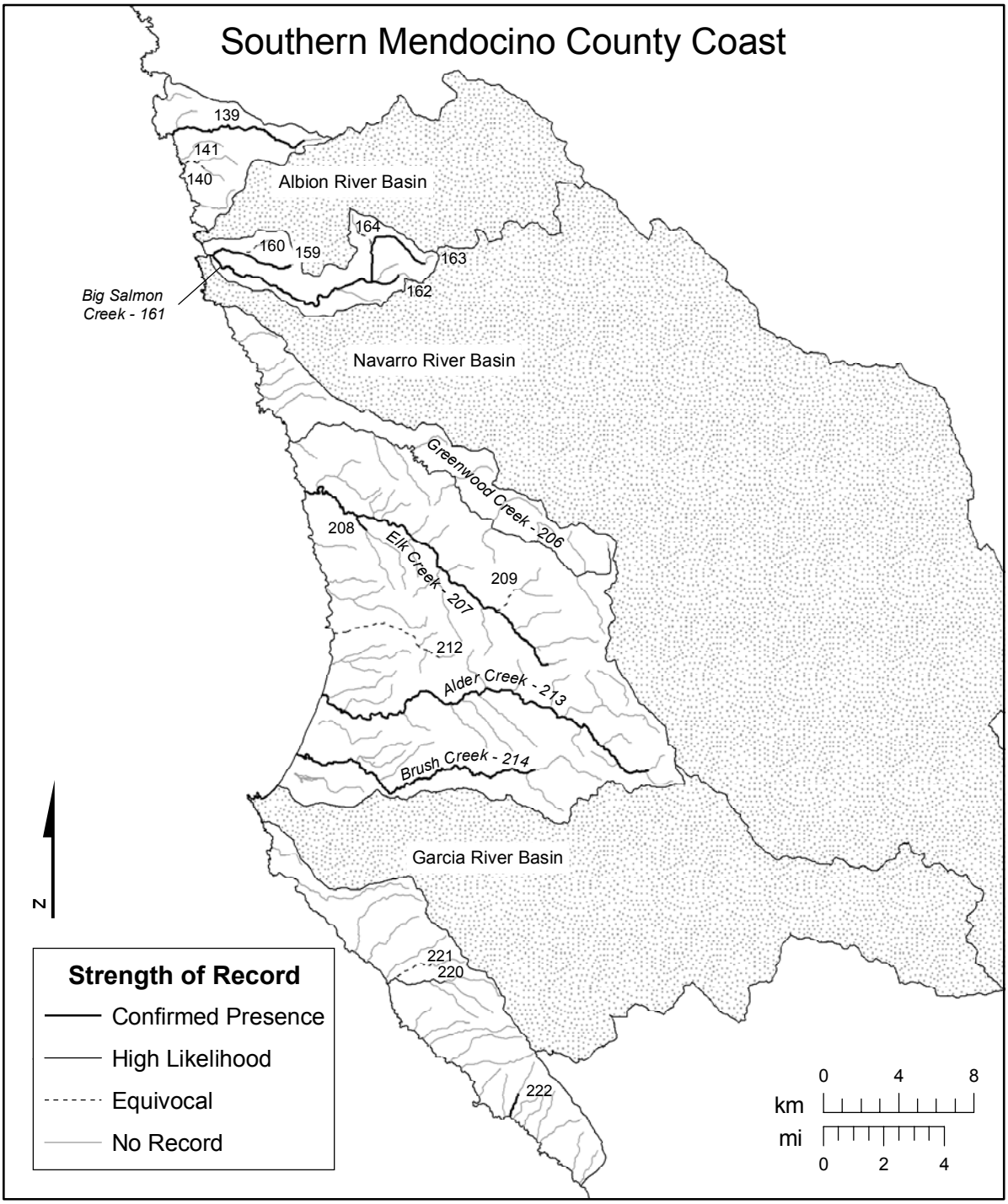

FIGURE 11. Historical distribution of coho salmon in streams of the southern Mendocino County coast. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Little River [139], Buckhorn Cr. [140], unnamed trib. [141], Little Salmon Cr. [159], unnamed trib. [160], Donnelly Cr. [162], Hazel Gulch [163], unnamed trib. [164], unnamed trib. [208], Three Springs Cr. [209], Mallo Pass Cr. [212], Schooner Gulch [220], North Fk. Schooner Gulch [221], and Fish Rock Gulch [222].

Sonoma County

Gualala River basin

The Gualala River basin includes portions of both Mendocino and Sonoma counties, with the lower reach constituting the boundary between these two counties; the North Fork Basin lies primarily in Mendocino County, while the larger South Fork and its tributaries lie within Sonoma County. We found strong evidence of occurrence in 18 streams within the Gualala River basin including the mainstem Gualala River; the North Fork Gualala River and five tributaries within the subbasin; and the South Fork Gualala River and 11 streams within this subbasin (Figure 12). The list includes 10 of 11 streams identified by Brown and Moyle (1991), the lone omission being House Creek, for which supporting evidence did not satisfy our criteria for designation as a Category 1 or 2 stream (Appendix A). However, House Creek drains a relatively large watershed (7,384 ha) and has an estimated IP-km of more than 30 km. Thus, it seems possible, if not probable that coho salmon once occurred in this stream. Of the newly identified coho streams, all but two had estimated IP-km of greater than 2 km. McGann Gulch and Robinson Creek have estimated IP-km values of 1.2 and 1.5, respectively (Appendix A). Collectively, the newly identified streams accounted for about 26% of the estimated IP-km for the basin.

Russian River basin

Of all of the basins within the Central California Coast ESU, the Russian River basin posed one of the more difficult challenges in identifying historical coho salmon streams. Although there is considerable anecdotal information indicating coho salmon occurred in a number of subwatersheds in the Russian River system, concrete documentation of occurrence in specific streams is scarce, as many local spawning populations were likely extirpated long before any formal stream surveys were conducted. Basin-wide, we found strong evidence of coho salmon occurrence for 39 streams (Figures 13 and 14). Among the larger watersheds and streams where coho salmon have been reported are Austin Creek and seven of its tributaries; Hulbert Creek and one tributary; Green Valley Creek and one tributary; Mark West Creek and two tributaries; Dry Creek and six tributaries; Maacama Creek and one tributary; and Forsythe Creek and four tributaries. Additionally, coho salmon have been reported in nine smaller tributaries to the mainstem Russian River (Willow, Sheephouse; Freezeout, Dutch Bill, Smith, Porter, Mariposa, and Fisher creeks, as well as an unnamed tributary known locally as Griffen Creek; Appendix A).

Our list includes 24 of 31 streams identified by Brown and Moyle (1991). For six streams on the Brown and Moyle list (East Fork Russian River, York Creek, Salt Hollow Creek, Rocky Creek, Corral Creek, and the unnamed tributary to Sheephouse Creek), we considered the evidence of occurrence to be insufficient for a Category 1 or 2 ranking. Five of the six streams (all but Sheephouse Creek) are located in the upper Russian River basin, where environmental conditions (summer temperatures and flows) may have been marginal for coho salmon. In each case, the IP model without the temperature mask predicts suitable habitat based on geomorphic and hydrologic characteristics; however, with the temperature mask applied, the estimated IP-km drop to zero or

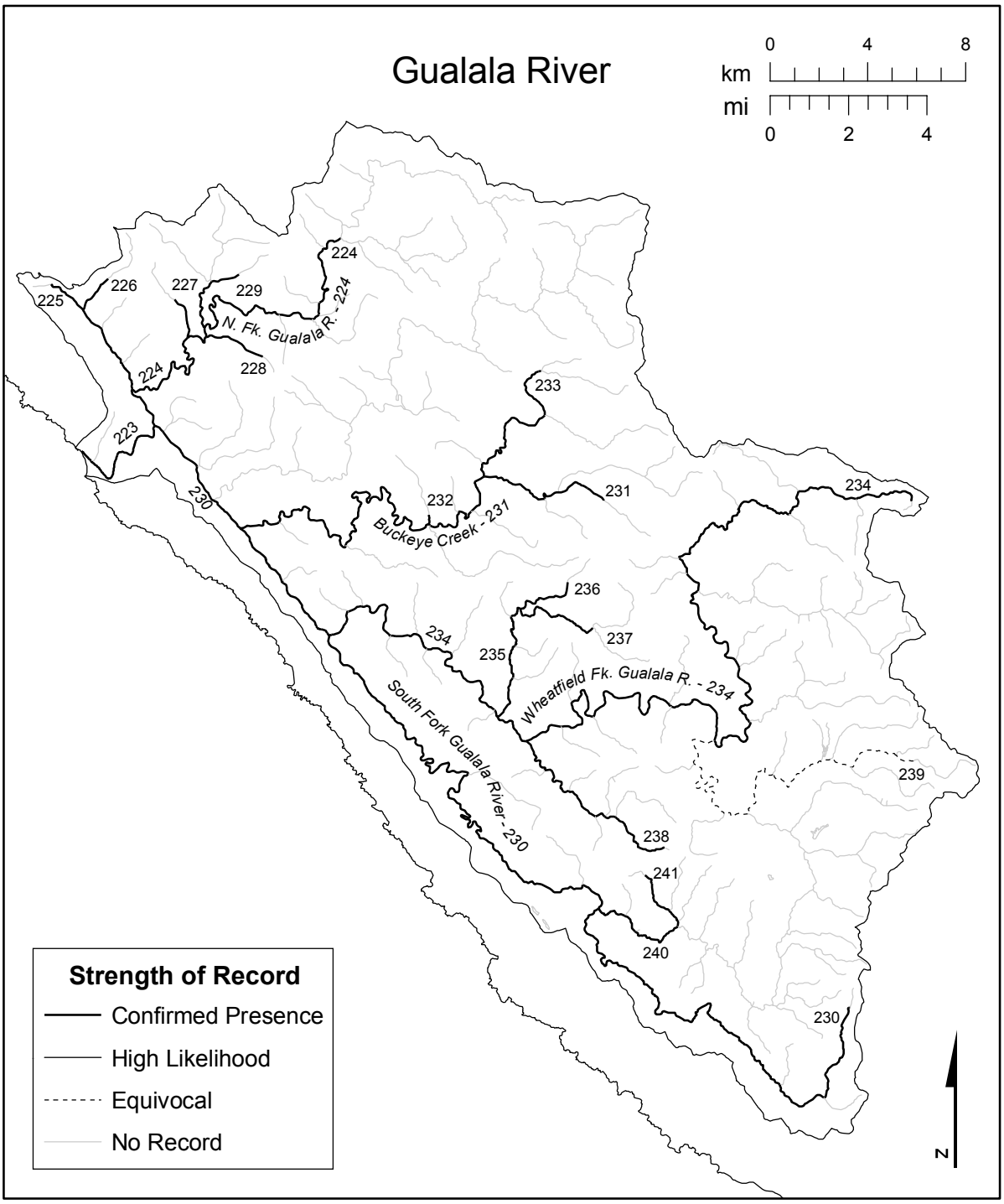

FIGURE 12. Historical distribution of coho salmon in the Gualala River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include the mainstem Gualala River [223], Little North Fk. Gualala River [225], Doty Cr. [226], Robinson Cr. [227], McGann Gulch [228], Dry Cr. [229], Franchini Cr. [232], North Fk. Buckeye Cr. [233], Fuller Cr. [235], North Fk. Fuller Cr. [236], South Fk. Fuller Cr. [237], Haupt Cr. [238], House Cr. [239], Marshall Cr. [240], and Sproule Cr. [241].

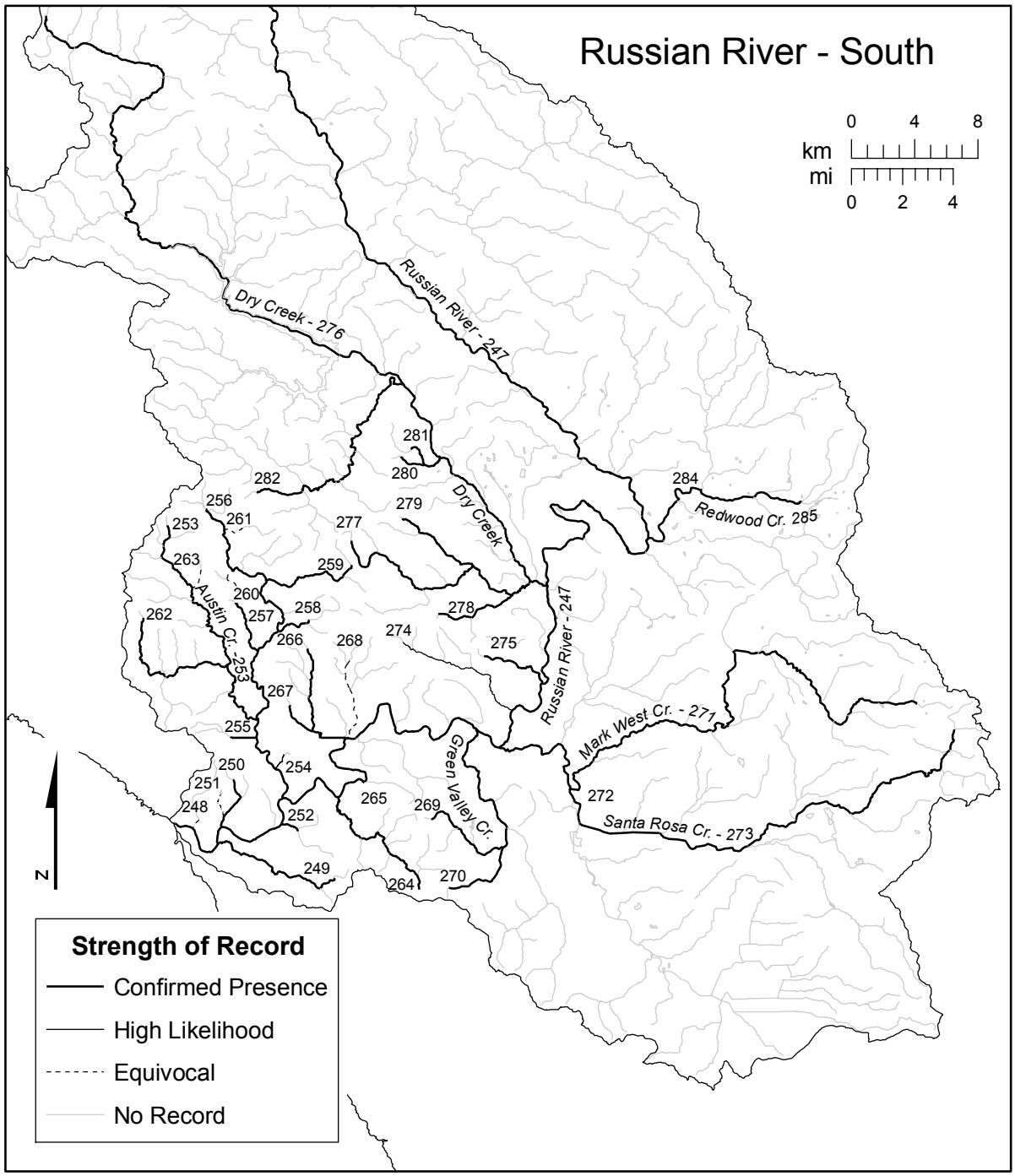

FIGURE 13. Historical distribution of coho salmon in the southern portion of the Russian River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Jenner Gulch [248], Willow Cr. [249], Sheephouse Cr. [250], unnamed trib. [251], Freezeout Cr. [252], Kohute Gulch [254], Kidd Cr. [255], East Austin Cr. [256], Black Rock Cr. [257], Gilliam Cr. [258], Gray Cr. [259], Conshea Cr. [260], Sulphur Cr. [261], Ward Cr. [262], Red Slide Cr. [263], Dutch Bill Cr. [264], Smith Cr. [265], Hulbert Cr. [266], Mission Cr. [267], Fife Cr. [268], Purrington Cr. [270], Laguna de Santa Rosa [272], Porter Cr. [274], unnamed trib. [275], Mill Cr. [277], Felta Cr. [278], Wallace Cr. [279], Grape Cr. [280], Wine Cr. [281], Pena Cr. [282], and Maacama Cr. [284].

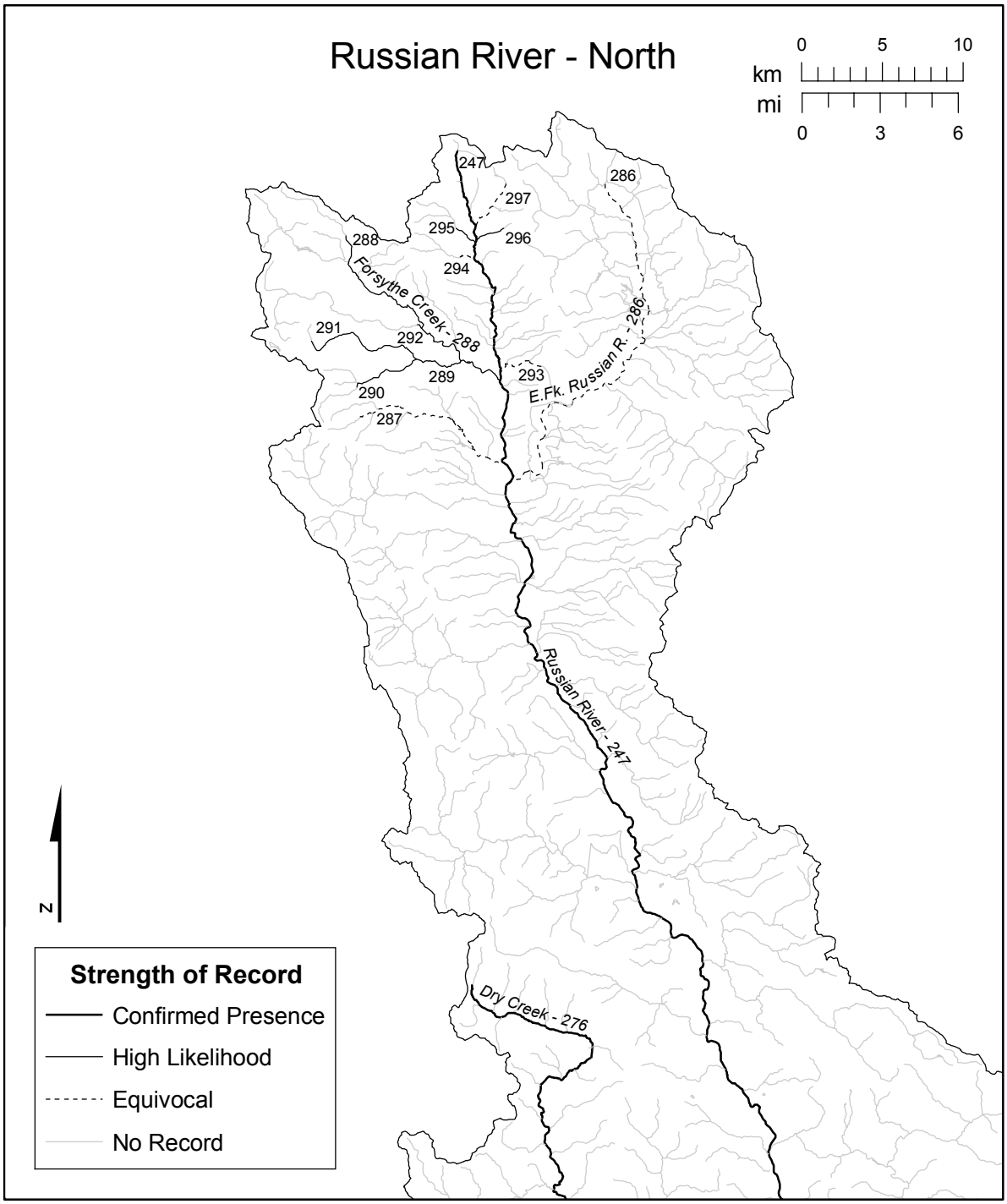

FIGURE 14. Historical distribution of coho salmon in the northern portion of the Russian River basin. Numbers correspond to stream numbers Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include York Cr. [287], Seward Cr. [289], Eldridge Cr. [290], Jack Smith Cr. [291], Mill Cr. [292], Salt Hollow Cr. [293], Rocky Cr. [294], Mariposa Cr. [295], Fisher Cr. [296], and Corral Cr. [297].

near zero. This suggests that, if coho salmon did occur in these streams, they either occurred sporadically as environmental conditions permitted or benefited from local conditions that are not captured by the coarse temperature mask we employed. We categorized a seventh stream identified by Brown and Moyle (1991), Warm Springs Creek, as a Category 4 stream when we failed to uncover evidence supporting occurrence[8].

Collectively, the 15 newly identified streams account for more than 50% of the total estimated IP-km (temperature adjusted) in the Russian River basin; however, this is largely due to the high IP-km estimated for three watersheds: Green Valley Creek (57.2 IP-km), Laguna de Santa Rosa (274.5 IP-km), and Maacama Creek (53.8 IP-km).

Other Sonoma County basins

In addition to the Gualala River and Russian River basins, several smaller coastal watersheds in Sonoma County have been reported to support coho salmon. Between the mouth of the Gualala River and the mouth of the Russian River, coho salmon have been observed in Fort Ross Creek, as well as the Russian Gulch watershed, including the East Branch, Middle Branch, and West Branch. Between the Russian River and Bodega Head, we found strong evidence of occurrence in Scotty Creek, as well as in Salmon Creek and four of its tributaries (Finley, Coleman Valley, Fay, and Tannery creeks)(Figure 15; Appendix A). All of these streams except West Branch Russian Gulch were listed by Brown and Moyle (1991).

Marin County

Bodega Bay and Tomales Bay tributaries

We found strong evidence of coho salmon occurrence in three watersheds that drain into Bodega and Tomales bays: Americano Creek, Walker Creek, and Lagunitas Creek. For Americano Creek, coho salmon have been reported only in the mainstem (Figure 15), and for Walker Creek, presence has been reported in the mainstem and two tributaries (Figure 16). In contrast, coho salmon have been observed in a substantial number of tributaries to Lagunitas Creek. Overall, we found evidence of occurrence in 19 Lagunitas Creek tributaries, including Olema Creek and seven of its unnamed tributaries; Nicasio Creek and one tributary; Devils Gulch Creek; San Gernonimo Creek and six of its unnamed tributaries; and an unnamed tributary to the mainstem Lagunitas Creek known locally as Cheda Creek (Figure 16). Included in this list are five named streams identified by Brown and Moyle (1991), as well as fourteen newly identified streams, all but one of which (Halleck Creek, tributary to Nicasio Creek) were identified based on relatively recent (since 1995) surveys (Appendix A). With the exception of Halleck Creek, which has an estimated 7.5 IP-km

[8] Brown and Moyle cited a personal communication with B. Cox, California Department of Fish and Game, for coho salmon presence; however, when we contacted Mr. Cox, he had no recollection of having observed coho salmon in Warm Springs Creek. The estimated IP-km for the Warm Springs watershed was almost 26 km without the temperature mask, but less than 0.8 km when the 21.5ºC temperature mask was applied, suggesting that environmental conditions for coho salmon may be marginal in most of this watershed.

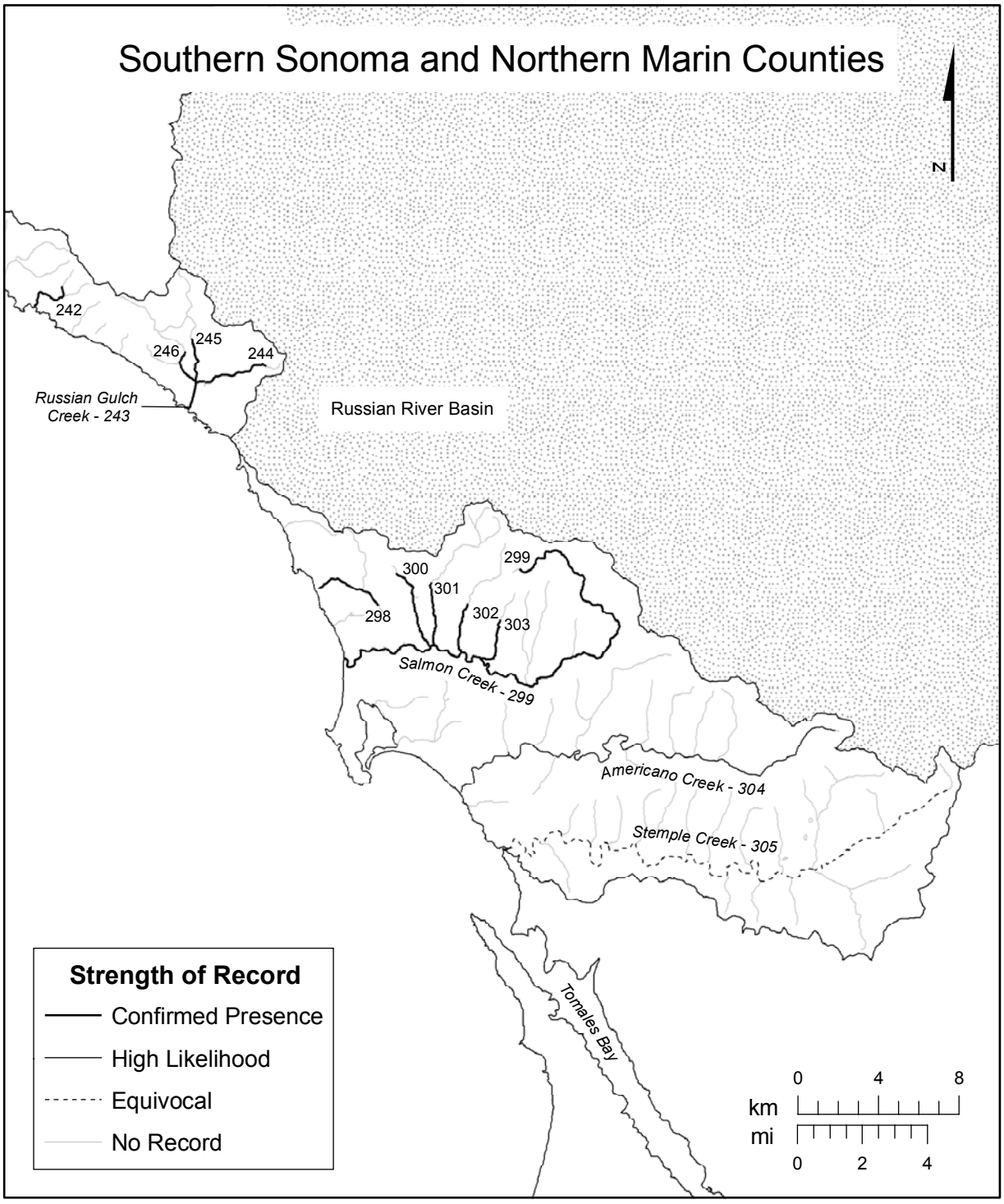

FIGURE 15. Historical distribution of coho salmon in streams of the southern Sonoma County and northern Marin County coasts. Numbers correspond to stream numbers listed in Appendix Table A-1. Upper distributional limit for each stream based on IP model predictions (see text for details). Unlabeled streams include Fort Ross Cr. [242], East Br. Russian Gulch [244], Middle Br. Russian Gulch [245], West Br. Russian Gulch [246], Scotty Cr. [298], Finley Cr. [300], Coleman Valley Cr. [301], Fay Cr. [302], Tannery Cr. [303], Americano Cr. [304], and Stemple Cr. [305].

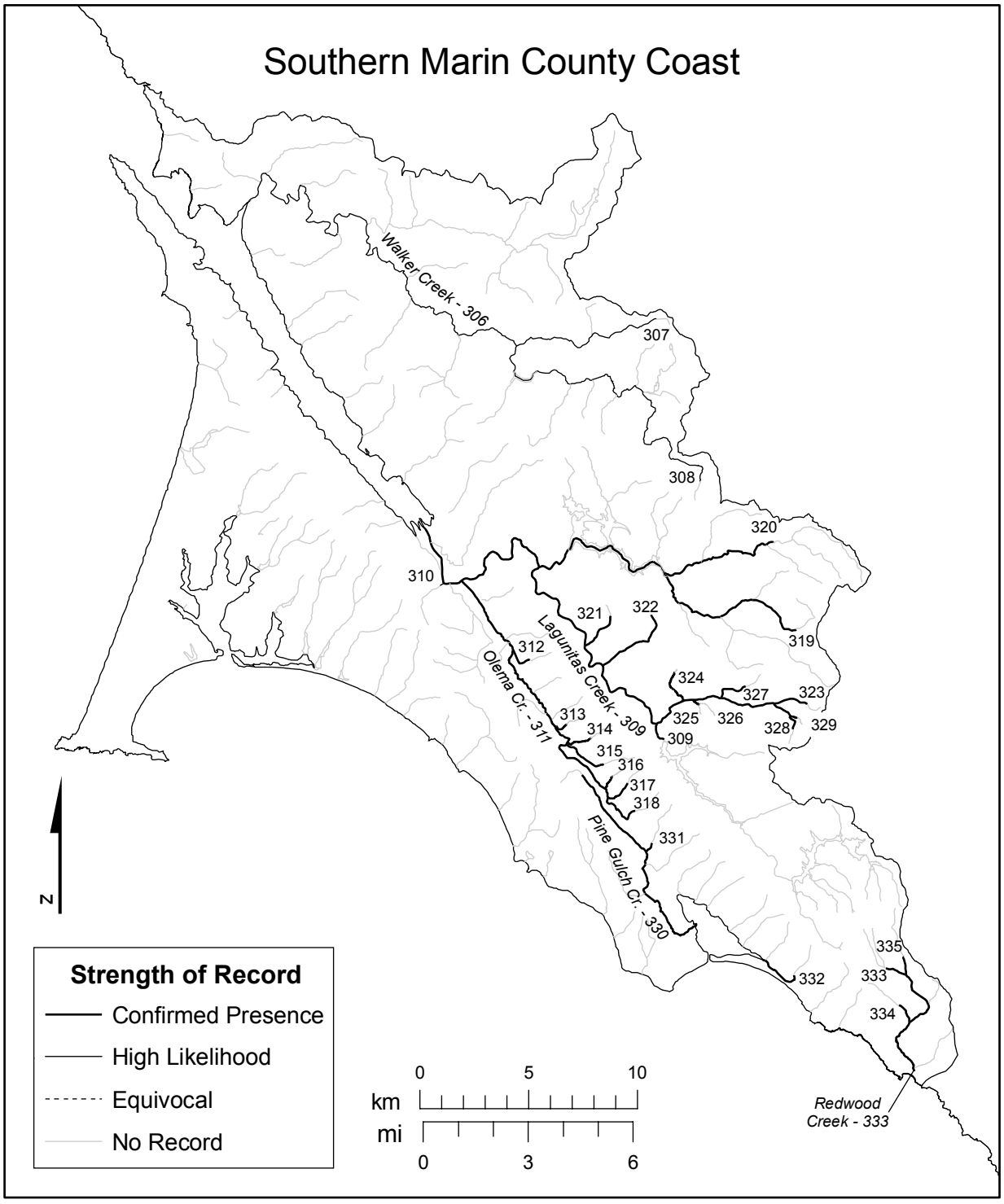

FIGURE 16. Historical distribution of coho salmon in streams of the southern Marin County coast. Numbers correspond to stream numbers listed in Appendix Table A-1. Upper distributional limit for each stream based on IP model predictions (see text for details). Unlabeled streams include Salmon Cr. [307], Arroyo Sausal Cr. [308], Haggerty Gulch [310], unnamed tribs. [312–318], Nicasio Cr. [319], Halleck Cr. [320], unnamed trib. [321], Devils Gulch Cr. [322], San Geronimo Cr. [323], unnamed tribs. [324–329], unnamed tribs. [331–332], Kent Cr. [334], and Fern Cr. [335].

(all now inaccessible due to an impassable dam), all of the newly identified streams drain small watersheds (< 400 ha) and have estimated IP-km values of less than 0.4 km. Collectively, these streams account for about 13% of the total IP for the watershed.

Other Marin County basins

Coho salmon have been observed in six streams representing three relatively small watersheds along the Marin County Coast between Tomales Bay and the Golden Gate: Pine Gulch Creek and an unnamed tributary; and unnamed tributary to Bolinas Lagoon (known locally as Easkoot Creek); and Redwood Creek and two tributaries (Kent and Fern creeks)(Figure 16; Appendix A). Both Pine Gulch and Redwood Creek were listed by Brown and Moyle (1991). The smaller tributaries have been added to the list based on recent (since 1994) observations of occurrence, and each of these new streams has relatively low intrinsic potential (0.6 IP-km or less).

San Francisco Bay tributaries

Documenting occurrence of coho salmon in tributaries of the San Francisco Bays proved enormously challenging due to the fact that coho salmon have been extirpated from most or all of their native streams, and much of the habitat alteration that led to their demise occurred well over a century ago, before many formal surveys of stream fauna had been conducted. Leidy et al. (in press) recently reviewed and synthesized information on historical occurrence of coho salmon in Bay Area streams, arriving at a stream categorization scheme that closely parallels our own[9]. We found what we considered to be strong evidence of coho salmon occurrence in 11 streams representing nine Bay Area watersheds. These included the Arroyo Corte Madera del Presidio watershed; Corte Madera Creek and one tributary (San Anselmo Creek[10]); Pacheco Creek and its tributary, Walnut Creek[11]; San Pablo Creek; Strawberry Creek; San Leandro Creek; Alameda Creek; Coyote Creek; and San Mateo Creek[12] (Figures 17 and 18; Appendix A). Included on our list were all six streams identified by Brown and Moyle (1991)[13].

San Mateo County streams

We found strong evidence of coho salmon occurrence in seven streams in five coastal watersheds in San Mateo County: Tunitas Creek; San Gregorio Creek; Pescadero Creek and one of its tributaries (Peters Creek); Butano Creek and one of its tributaries (Little Butano Creek); and Gazos

[9] Leidy et al.'s categorization of watersheds as "definitely," "probably," or "possibly" supporting coho salmon corresponds to our category 1, category 2, and category 3 designations, respectively.
[10] According to USGS topographic maps, Corte Madera Creek becomes San Anselmo Creek upstream of the confluence of Ross Creek. Fry (1936) observed coho salmon above this confluence.
[11] USGS topographic maps identify the lowest 2.8 km segment of the Walnut Creek drainage as Pacheco Creek; observations of coho salmon are reported for Walnut Creek, whereas Pacheco Creek is included by inference.
[12] Leidy et al. (in press) also identified Temescal Creek as "probably" supporting coho salmon on the strength of archeological evidence collected at the Emeryville shellmound near the mouth of Temescal Creek; however, we did not include this stream on our list because of the possibility that these remains were from were ocean-caught fish.
[13] Brown and Moyle (1991) referred to Arroyo Corte Madero del Presidio as Mill Valley Creek.

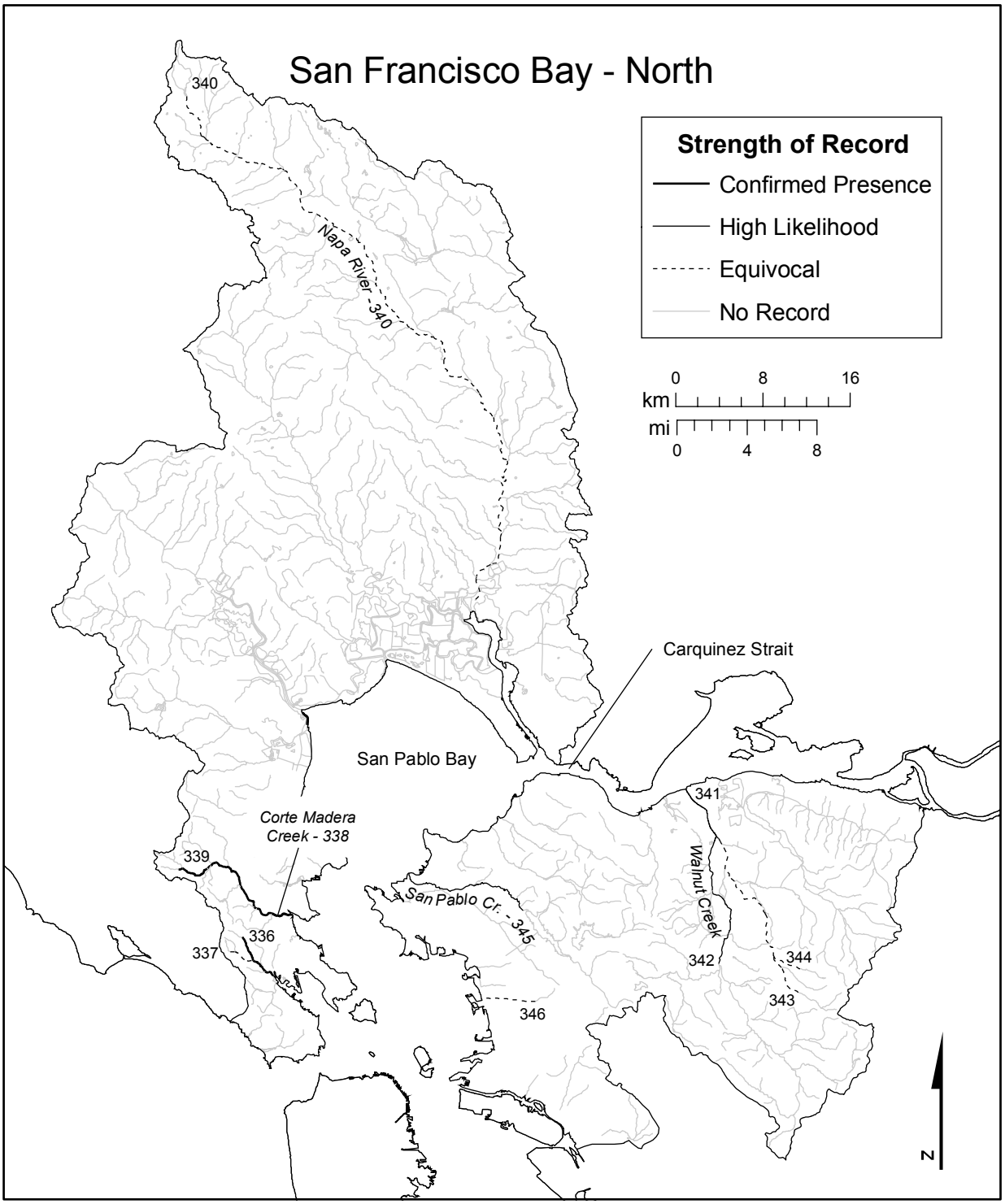

FIGURE 17. Historical distribution of coho salmon in streams of northern San Francisco Bay. Numbers correspond to stream numbers listed in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Arroyo Corte Madera del Presidio [336], Old Mill Cr. [337], San Anselmo Cr. [339], Pachecho Cr. [341], Pine Cr. [343], Arroyo del Cerro Cr. [344], and Strawberry Cr. [346].

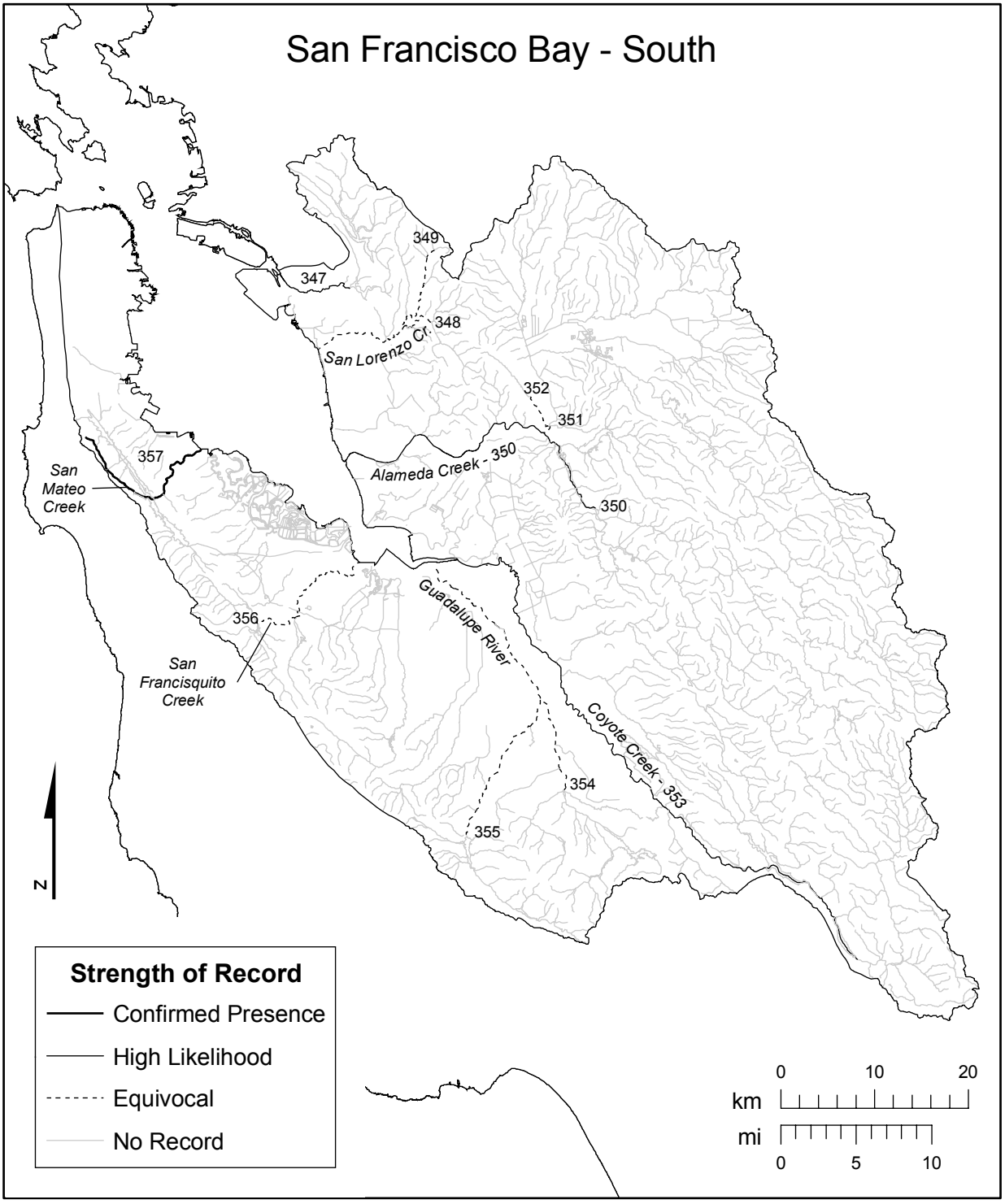

FIGURE 18. Historical distribution of coho salmon in streams of southern San Francisco Bay. Numbers correspond to stream numbers listed in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include San Leandro Cr. [347], Crow Cr. [349], Arroyo de la Laguna [351], Sinbad Cr. [352], and Los Gatos Cr. [355].

Creek (Figure 19; Appendix A). San Gregorio, Pescadero, Butano, and Gazos creeks had been previously identified by Brown and Moyle (1991), whereas the three remaining streams were new additions based on museum specimens (Tunitas Creek), historical surveys (Little Butano Creek), and recent observations (Peters Creek). Of the three new streams, all have modest estimated intrinsic habitat potential (4.1 to 8.3 IP-km). However, historical stream surveys suggest that a 15-foot waterfall less 1,000 feet from the mouth of Little Butano Creek forms a barrier to passage by anadromous fish.

Santa Cruz County streams

Coho salmon occurrence has been documented in 18 streams representing six different watersheds in Santa Cruz County[14] (Figure 19). We found strong evidence of coho salmon occurrence in Waddell Creek and three of its tributaries (East Waddell Creek, West Waddell Creek, and Henry Creek); Scott Creek and four tributaries (Big Creek, Little Creek, Mill Creek, and an unnamed tributary known locally as Quesaria Creek); San Vicente Creek; the San Lorenzo River and five of its tributaries (Zayante, Bean, Fall, Love, and Boulder creeks); Aptos Creek; and Soquel Creek (Appendix A). This list includes six of seven streams identified by Brown and Moyle (1991)[15], plus 14 newly identified streams. Of the newly identified streams, three in the San Lorenzo River basin had relatively large estimated IP-km values including Zayante Creek (29.8 IP-km), Bean Creek (11.5 IP-km), and Boulder Creek (11.5 IP-km). Of the remaining new streams, only two had IP-km values of greater than 1 IP-km: West Waddell Creek (2.7 IP-km), Mill Creek (1.9 IP-km), and Love Creek (3.5 IP-km).

Discussion

Our review of historical and recent information has resulted in an updated historical coho salmon stream list that represents a substantial increase in the total number of streams identified as coho salmon streams in the CCC ESU, with 335 streams identified based on confirmed presence or strong circumstantial evidence (Category 1 and 2 streams), and an additional 45 streams identified based on more equivocal evidence (Category 3). Roughly 80% of the new Category 1 and 2 streams on the list were added based on recent (post-1990) observations of coho salmon occurrence, reflecting increased sampling effort by private landowners, watershed groups, and agencies that has taken place since coho salmon were first proposed for listing under ESA in 1995. The vast majority of these newly identified streams are in subwatersheds within basins previously known to have supported coho salmon. Compared with previously identified coho salmon streams, new additions to the list tend to be smaller streams with relatively low habitat potential. Consequently, although the number of streams on the list has more than doubled since publication

[14] While this manuscript was being prepared for publication, researchers at NMFS Santa Cruz Laboratory documented juvenile coho salmon in Laguna Creek lagoon, a stream that enters the Pacific between San Vicente Creek and the San Lorenzo River (Ellen Freund, NMFS Southwest Fisheries Science Center, Fisheries Ecology Division, Santa Cruz, California). This stream is not included in our appendix table.

[15] Brown and Moyle (1991) also included Hare Creek, a tributary to the San Lorenzo River; however, the available evidence did not meet our criteria for designation as a Category 1 or 2 stream.

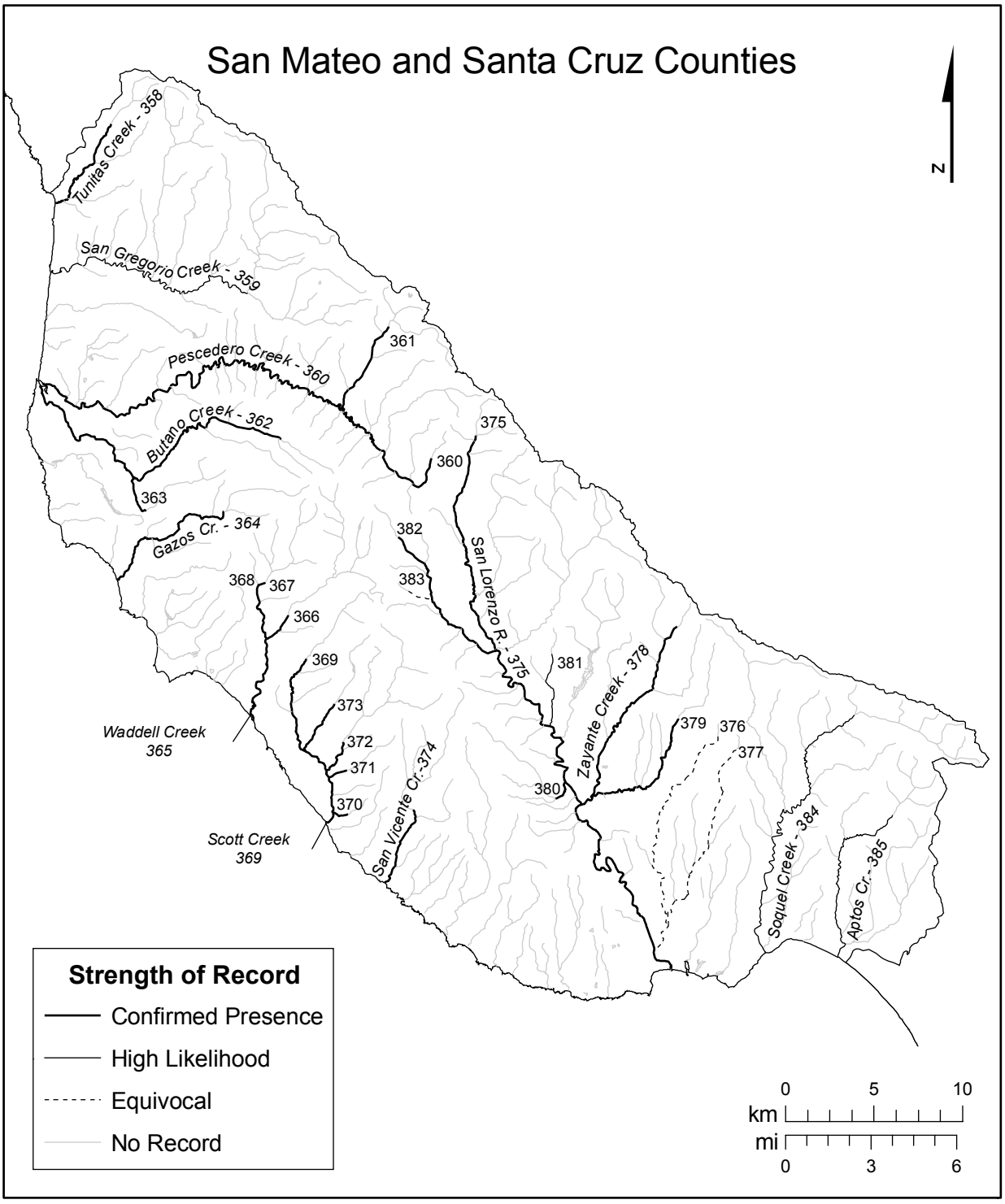

FIGURE 19. Historical distribution of coho salmon in streams of the San Mateo County and Santa Cruz County coasts. Numbers correspond to stream numbers listed in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include Peters Cr. [361], Little Butano Cr. [363], East Waddell Cr. [366], West Waddell Cr. [367], Henry Cr. [368], unnamed trib. [370], Little Cr. [371], Big Cr. [372], Mill Cr. [373], Carbonera Cr. [376], Branciforte Cr. [377], Bean Cr. [379], Fall Cr. [380], Love Cr. [381], Boulder Cr. [382], and Hare Cr. [383].

of the Brown and Moyle list, the contribution of these streams to the total production of coho salmon within various basins is likely disproportionately small. For most basins, we estimate that newly identified streams represent between 10% and 20% of the total estimated IP-km, reflecting the fact that many of these streams occur either in small watersheds with limited habitat or in larger watersheds where barriers or high gradients limit use by coho salmon to the lower reaches of the stream.

Implications for Inferring Status from Occupancy Data

Results from our investigation into the historical distribution of coho salmon in the CCC ESU have implications with respect to interpretation of occupancy statistics presented in previous status reviews, as well as presence-absence data collected in the future. Since publication of the Brown and Moyle stream list and analysis of occupancy rates (Brown et al. 1994), there have been several efforts to examine recent occurrence of coho salmon in streams within their historical range to determine if their have been trends in occupancy in the last 15 years. In some cases, occupancy rates have been calculated only for streams identified on the Brown and Moyle list (CDFG 2002), whereas in others, the entire suite of historical streams has been considered and contrasted with the Brown and Moyle subset (Adams et al. 1999; Good et al. 2005). In all of these analyses, occupancy rates have been expressed in terms of the proportion of surveyed streams within the historical distribution in which coho salmon remain present. Thus, streams have been given equal weight without regard to their size or capacity to support coho salmon.

We believe that analyses of presence-absence data need to take into account the fact that streams of different size and habitat capacity are likely to exhibit differing patterns of occupancy and production in response to environmental variability and year-class strength. Flow conditions may regulate the distribution of coho salmon within a watershed by affecting both accessibility to adult spawners and suitability of habitat for rearing juveniles. Consequently, smaller headwater streams may exhibit greater variability in occupancy rates than larger streams. Additionally, the distribution and abundance of coho salmon in streams with different productive potential may differ substantially, with fish being less abundant or more patchily distributed—and hence less likely to be observed—in streams with low habitat potential. Such biases may be particularly problematic in existing presence-absence datasets, where many surveys were limited to short (30–200 m) index reaches or a finite number of habitat units chosen based on ease of access or other logistical considerations. The consequence of lumping all identified coho salmon streams into analyses of occupancy rates, without regard for potential differences in occupancy dynamics that may exist between streams of different size or productive capacity, is that trends in occupancy through time may be more difficult to detect amid noise introduced by streams exhibiting inherently more variable occupancy patterns. This potential is compounded when there are systematic changes in the number and types of streams surveyed for coho salmon distribution through time, as has occurred in the CCC ESU (see Spence and Bjorkstedt, in prep.). These points argue for stratification of analysis based on size of streams or estimates of potential habitat capacity (such as

provided by our estimates of intrinsic habitat potential), which may improve the ability to detect trends in occupancy rates. Such an analysis of historical data is currently underway (Spence and Bjorkstedt, in prep.).

Despite their inherently variable nature, smaller streams may provide critical insights into understanding the dynamics and status of coho salmon populations. Less frequent but persistent occupancy of smaller streams within a watershed is suggestive that core areas continue to be occupied to a degree that allows expansion of distribution under favorable environmental conditions. Additionally, despite their size, smaller streams may play important roles in the persistence of coho populations. Such streams may provide refugia from large-scale disturbances (floods, debris torrents, redd scouring) in years of high flow—the years that they are most likely to be utilized.

Implications for Future Monitoring

The scarcity of data on the abundance and distribution of coho salmon in California has been identified as an important risk factor for the two ESUs currently listed under the federal and state endangered species acts (Weitkamp et al. 1995; CDFG 2002, Good et al. 2005). There exists a critical need for more rigorous monitoring of both the abundance and distribution of coho salmon populations within waters of the state (Brown et al. 1994).[16] An important step in designing a monitoring program for coho salmon in California will be defining an appropriate sampling universe for coho salmon from which to draw sample sites.

Our historical stream list, used in conjunction with the IP model results (Agrawal et al. 2005), can provide a useful basis for establishing or refining a sampling universe for monitoring coho salmon in the Central California Coast ESU. The IP model uses gradient criteria (maximum of 10% for reaches of approximately 50 to 200 m in length[17]) as well as thresholds for mean annual discharge, below which use by coho salmon is not expected to occur[18]. As such, IP provides an alternative that refines gradient-only approach employed elsewhere (FSP 2000). Upstream limits of distribution predicted by the IP model potentially can be transferred to a 1:24,000 hydrography manually or with automated procedures to provide a first cut at sample universe demarcation or to modify a universe defined based on gradient alone. The historical stream list and associated GIS coverages act as a first layer of local knowledge by identifying streams where coho salmon use has

[16] Currently, the California Department of Fish and Game and National Marine Fisheries Service are collaborating to develop a comprehensive monitoring plan for estimating the abundance and distribution of salmonids, including coho salmon, within coastal watersheds of the state (see www.calmonitor.org). Though not finalized, the plan will likely employ a sampling design similar to that currently used in Oregon (Overton and McDonald 1998; Stevens 2002), in which stream segments are randomly selected for inclusion in a sample frame.

[17] Although the IP model predicts coho salmon can occur at gradients as high as 10%, the suitability ratings for gradient and, hence, the overall IP values are low at gradients between 5% and 10%.

[18] The third component of the IP model, valley width index, cannot achieve a value of zero and thus does not influence the predicted distribution of coho salmon within a watershed.

been documented or is suspected; these data thus support inclusion of various streams or stream segments into a sampling frame. Although further refinements will be needed to identify areas where barriers to anadromy are not resolved by DEM-generated gradient estimates, historical knowledge summarized in this paper can substantially reduce the number of streams for which individual calls about accessibility need to be made. Moreover, IP estimates provide a basis for identifying stream reaches for which historical information on coho salmon occurrence is lacking, but where habitat may be suitable. The substantial increase in number of streams known to support coho salmon in the CCC ESU results in large part because of increased sampling of smaller streams, primarily on private lands that has occurred since coho salmon in California were first proposed for listing under ESA. Our examination of output from the IP model overlaid on the historical stream network indicates that within most large coastal basins in the CCC ESU, there are several streams that have appreciable intrinsic potential (greater than 1 IP-km) but for which there are no records of historical coho occurrence. Output from the IP model can direct surveys to provide a more complete assessment of coho salmon distribution. Finally, reach-based IP estimates may provide a basis for assessing whether sample sites randomly drawn from the sample frame are likely to be representative of conditions throughout a geographic area of interest. Although IP predictions do not reflect current conditions, they nevertheless can be used to ascertain whether randomly selected reaches represent geomorphic and hydrologic conditions within a particular watershed or region of interest. Likewise, IP predictions may provide a useful basis for stratifying streams for analysis of trends in occupancy rates or abundance.

Acknowledgements

This project benefited greatly from the generosity of numerous individuals, organizations, and agencies that provided documents or data that were used to develop the historical stream list. Although all contributors cannot possibly be acknowledged, we would like to express particular thanks to Eric Ettlinger (Marin Municipal Water District), Brannon Ketchum (National Park Service, Point Reyes National Seashore), Steve Levesque and David Wright (Hawthorne-Campbell Timber Company), Adam Wagschal (Mendocino Redwood Company), Bob Coey and Jennifer Nelson (California Department of Fish and Game), Jerry Smith (San Jose State University), Rob Leidy (Environmental Protection Agency), Reuven Walder (Salmon Protection and Watershed Network), and Dave Catania (California Academy of Sciences), all of whom provided data, reports, and other information that enabled us to construct the historical stream list. We would also like to thank our predecessors, Larry Brown and Peter Moyle, whose thorough review of historical information on coho salmon occurrence in streams of California provided the foundation upon which our effort was based.

We would also like to thank a number of individuals at the National Marine Fisheries Service Fisheries Ecology Division in Santa Cruz who assisted with this project. Charlene Bergeron and Morgan Kilgour spent countless hours perusing California Department of Fish and Game files, reviewing documents, and entering the survey data that were used to generate the stream list.

Charlene Bergeron, Kerrie Pipal, and Heidi Fish developed and maintained the literature database associated with the Appendix Table A2. We also thank Drs. Eric Bjorkstedt and Thomas Williams, who reviewed an earlier draft of our manuscript and whose thoughtful suggestions greatly improved the paper.

References

Adams, P. B., M. J. Bowers, H. E. Fish, T. E. Laidig, and K. R. Silberberg. 1999. Historical and current presence-absence of coho salmon (*Oncorhynchus kisutch*) in the Central California Coast Evolutionarily Significant Unit. National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz/Tiburon Laboratory, NOAA Administrative Report SC-99-02. 24 p.

Agrawal, A., R. Schick, E. P. Bjorkstedt, R. G. Szerlong, M. Goslin, B. C. Spence, T. H. Williams, and K. M. Burnett. 2005. Predicting the potential for historical coho, Chinook, and steelhead habitat in Northern California. National Marine Fisheries Service, Southwest Fisheries Science Center. NOAA Technical Memorandum NMFS-SWFSC-379. 25 p.

Bjorkstedt, E. P., B. C. Spence, J. C. Garza, D. Hankin, D. Fuller, W. Jones, J. Smith, and R. Macedo. 2005. An analysis of historical population structure for Evolutionarily Significant Units of Chinook salmon, coho salmon, and steelhead in the North-Central California Coast Recovery Domain. National Marine Fisheries Service, Southwest Fisheries Science Center. NOAA Technical Memorandum NMFS-SWFSC-382. 206 p. + plates.

Brown, L. R. and P. B. Moyle. 1991. Status of coho salmon in California. Report prepared for National Marine Fisheries Service, Southwest Fisheries Science Center. 134 p.

Brown, L. R., P. B. Moyle, and R. M. Yoshiyama. 1994. Historical decline and current status of coho salmon in California. North American Journal of Fisheries Management 14:237–261.

Burnett, K. M., G. H. Reeves, D. Miller, S. E. Clarke, K. C. Christiansen, and K. Vance-Borland. 2003. A first-step toward broadscale identification of freshwater protected areas for Pacific salmon and trout. Pages 144–154 *in* J. Beurner (ed.). Proceedings of the World Congress on Aquatic Protected Areas, Cairns, Australia, August 14–18, 2002. Australian Society for Fish Biology.

CDFG (California Department of Fish and Game). 2002. Status review of California coho salmon north of San Francisco: report to the California Fish and Game Commission. Candidate Species Status Review Report 2002-3. 232 p. + appendices.

Christy, T. and E. Haney. 2003. 1:100,000 hydrography, version 2003.4. California Department of Fish and Game and Pacific States Marine Fisheries Commission, Redding California. (Available at www.calfish.org).

Daly, C., R. P. Nielson, and D. L. Phillips. 1994. A statistical-topographic model for mapping climatological precipitation over mountainous terrain. Journal of Applied Meteorology 33: 140–158.

ESRI. 2002. Environmental Systems Research Insitute ArcGIS 8.3 software. Redlands, CA.

FSP (Forest Science Project). 2000. Regional juvenile coho salmon abundance survey. FSP Technical Report, April 2000. Humboldt State University, Arcata, CA.

Fry, D. H. Jr. 1936. Life history of *Hesperoleucus venustus* Snyder. California Fish and Game 22:65–98.

Good, T. P., R. S. Waples, P. Adams. (eds.). 2005. Updated status of Federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, National Marine Fisheries Service, NOAA Technical Memorandum, NMFS-NWFSC-66. 598 p.

Leidy, R. A., G. Becker, and B. N. Harvey. In press. Historical status of coho salmon in streams of the urbanized San Francisco Estuary, California. California Fish and Game 91(4): 000–000.

Overton, S. W. and T. L. McDonald. 1998. Regional estimation of juvenile coho abundance in streams. Final Report, West Technical Report #98-5, 2003 Central Ave., Cheyenne, WY 82001.

Spence, B. C., and E. P. Bjorkstedt. (In prep.). Recent occupancy of historical coho salmon streams in the Central California Coast Evolutionarily Significant Unit. National Marine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center, Santa Cruz, CA.

Stevens, D. L. 2002. Sampling design and statistical analysis methods for the integrated biological and physical monitoring of Oregon streams. U.S. Environmental Protection Agency, Western Ecology Division, Corvallis, OR. 13 p. + appendices.

USGS (United States Geological Survey). 2002. 1:24,000 scale digital elevation models (DEM). Available from USGS website (http://edc.usgs.gov/geodata/).

Weitkamp, L. A., T. C. Wainwright, G. J. Bryant, G. B. Milner, D. J. Teel, R. G. Kope, and R. S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. U. S. Department of Commerce, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NWFSC-24: 258 p.

Wood, C. C. 1995. Life history variation and population structure in sockeye salmon. Pages 195–216 *in* J. L. Nielsen and D. A. Powers (eds.). Evolution and the aquatic ecosystem: defining unique units in population conservation. American Fisheries Society Symposium 17. Bethesda, MD.

Appendix A

Historical Coho Salmon Stream List

In this appendix, we present a list of 385 streams within the Central California Coast Evolutionarily Significant Unit for which we found historical references indicating possible use by coho salmon. Each stream on the list has been categorized according to the strength of historical documentation asserting occurrence (see text and Table A1 below for elaboration), and references supporting their inclusion on the list are provided. The stream list (Table A2) is arranged hierarchically, with watersheds ordered north to south, based on point of ocean entry, and streams within watersheds ordered sequentially from the mouth of the stream to the headwaters.

In generating the stream list, we adopted several conventions to facilitate correct identification of streams. Stream names taken from the 1:24,000 USGS topographic maps were used as the primary name; however, we also included parenthetically other local or unofficial names used by biologists, local residents or reported in publications, as well as alternative spellings we encountered on various maps, stream surveys, or other documents. Geographic coordinates (UTM zone 10) near the mouth of the stream are provided to help locate streams. These coordinates were derived using ARC_VIEW software from a 1:100,000 hydrography produced by the Pacific States Marine Fisheries Commission and the California Department of Fish and Game (Christy and Haney 2003). Likewise, the GNIS numbers listed in Table A1 were taken from the 1:100,000 hydrography. Unnamed tributaries are included in the list; correct identification and geographic placement of these streams is aided by UTM coordinates, their position within the stream hierarchy, and a listing of "unofficial" names that we encountered in our survey of information, as well as maps produced in the text of this manuscript. Three watershed descriptors are also shown in the table; their derivation is described in the "methods" section of the text.

Two columns in the table identify sources that were used to justify the inclusion of the stream on the stream list. Historical sources are those based on observations that pre-date 1988. Recent sources represent observations made from 1988 to the present. The list of sources is not intended to be comprehensive, as for many of the larger rivers, there is a large number of documents documenting presence. For historical sources, we generally reported the earliest records of coho salmon that we encountered.

Table A1. Description of variables included in historical stream list (Appendix Table A2).

Variable	Description
Str. No. (Stream number)	Number assigned to stream; listed north to south among basins and hierarchically within basins
Cat. (Stream category)	1.1= **presence confirmed**; first-hand field observation of coho presence 1.2 = **presence confirmed**; first-hand field observation of coho presence, but fish observed near mouth of stream, suggesting use is possibly limited to lower-most reaches 1.3 = **presence confirmed**; first-hand field observation of coho presence, but possibly the progeny of hatchery plants 2.1 = **high likelihood of presence**; assertion of coho salmon occurrence made by professional biologists; assumed to be based on first-hand knowledge 3.1 = **equivocal**; presence implied in compilations showing miles of stream habitat available, but without direct evidence of actual occurrence 3.2 = **equivocal**; recent or historical presence asserted by local residents or unidentified sources (as indicated on field survey forms, planning documents, or other credible agency documents) 3.3 = **equivocal**; assertion by professional biologist that coho salmon presence was likely given habitat characteristics, but without direct evidence 3.4 = **equivocal**; field surveys identify streams as suitable for coho salmon without explicit mention of actual use 4.1 = **unsupported**; stream appears on historical stream lists, but documentation underlying their inclusion does not provide evidence of occurrence
Stream Name	Name on USGS 1:24,000 topographic maps. Names listed in parentheses include "local" or otherwise "unofficial" names, as well as any alternative spellings of the USGS name, reported in surveys or by local biologists. Names preceded by "<" indicate branching in the stream system where a new name is given to each tributary (e.g., the mainstem of Cottaneva Creek [stream no. 8] terminates at the confluence of the North Fork Cottaneva Creek [stream no. 13] and Middle Fork Cottaneva Creek [stream no. 14)
UTM Coordinates (Easting and Northing)	UTM coordinates (Zone 10) near the mouth of the stream, as derived from the 1:100,000 hydrography or, if the stream was not on this hydrography, from a NMFS-generated hydrography derived from a 10 m DEM
GNIS	Geographic Names Information System number. Unique stream identifier developed by the U.S Geologic Survey (http://geonames.usgs.gov/index.html) and contained in the 1:100,000 hydrography. If a stream did not appear on the hydrography or was given no GNIS number, it was assigned the GNIS of the stream into which it enters plus a decimal extension indicating its order (.1 = lowermost, .2 for the second lowest tributary) along the stream network. Additional decimal places are used to identify tributaries off of these unnumbered tributaries. For example, Thomson Gulch and Berry Gulch, two unnumbered tributaries of the Little North Fork Big River (GNIS = 227311) were assigned the GNIS numbers 227311.1 and 227311.2, respectively, indicating that they are the first and second unnumbered tributaries of the Little North Fork Big River. An unnamed tributary of Berry Gulch (aka North Fork Berry Gulch) was assigned the GNIS number 227311.21, with the second decimal place indicating that it is the first unnumbered tributary off of Berry Gulch
IP-km	Sum of all stream segment distances, weighted by their IP values, upstream of the creek or river mouth
Mean Annual Flow	Mean annual discharge in $m^3 \cdot s^{-1}$ based on a modeled regression relationship between discharge and both watershed area and mean annual precipitation
Watershed Area	Catchment area in hectares
Historical Sources	Sources documenting or asserting coho salmon occurrence prior to 1988
Recent Sources	Sources documenting or asserting coho salmon occurrence from 1988 to present

Table A2. Geographic reference information, watershed attributes, and information sources for known and suspected coho salmon streams in the Central California Coast ESU. See appendix introduction for description of variables. Names in **bold** indicates stream on Brown and Moyle (1991) list. An asterisk (*) under historical or recent sources indicates a stream where presence is inferred based on observations in upstream tributaries.

Str. No.	Cat.	Stream	UTM Coordinates Easting	Northing	GNIS	IP-km	Mean Annual Flow (m^3s^{-1})	Water-shed Area (ha)	Historical Sources	Recent Sources
1	1.1	Big Creek	396918	4445655	254616	0.7	0.448	936		*
2	1.1	unnamed trib.	397550	4446032	254616.1	0.0	0.009	24		312
3	1.1	**Whale Gulch**	416494	4423677	237585	0.0	0.366	935	36	
4	1.1	**Jackass Creek** (Wolf)	421836	4414715	226050	3.2	0.435	1349	106	
5	1.1	**Usal Creek**	427284	4409229	236939	15.8	2.371	7094	160, 161, 275	
6	1.1	South Fk Usal Creek	429302	4410291	235062	3.5	0.700	2050		124
7	1.1	Soldier Creek	428996	4411087	234860	1.4	0.203	596		124
8	1.1	**Cottaneva Creek** (Cottoneva)	429090	4398564	254782	13.8	1.258	4225	21	175
9	1.1	**South Fk Cottaneva Creek**	430229	4398768	1654960	4.0	0.406	1381		175
10	1.1	Rockport Creek	430534	4398594	255043	0.9	0.083	330		175
11	1.1	Slaughterhouse Gulch	431459	4399596	1654960.1	0.3	0.095	305		175
12	1.1	Kimball Gulch	432563	4399758	234110	0.1	0.079	242	148, 149	
13	1.1	<Middle Fk Cottaneva Creek	429831	4403748	228592	0.4	0.166	505		175
14	1.1	<**North Fk Cottaneva Creek**	429851	4403803	229655	3.0	0.397	1241		151, 175
15	1.1	Dunn Creek	430219	4404932	222733	1.6	0.162	538	287	140, 148, 149
16	1.1	**Hardy Creek**	430903	4395821	224927	3.0	0.378	1305	61	
17	1.1	**Juan Creek** (Big Juan; Alviso)	431204	4394893	226363	6.0	0.593	1939	274, 289	
18	1.1	**Little Juan Creek**	431719	4394764	227286	1.7	0.119	455	236	
19	1.1	**Howard Creek**	432280	4392109	225696	3.2	0.305	1129		117
20	1.1	**DeHaven Creek**	432720	4390008	222086	5.7	0.586	2057	187	
21	1.1	**Wages Creek**	432815	4389077	237147	9.8	0.944	3285		118, 124
22	1.1	Rider Gulch	433875	4388576	231565	1.6	0.112	462	66	
23	1.1	North Fk Wages Creek	438802	4387790	229727	1.3	0.109	351		120
24	3.2	Abalobadiah Creek (Abalobadiah Gulch)	434196	4379607	217934	3.5	0.181	805	267	
25	3.3	Seaside Creek	434344	4378913	232765	1.2	0.063	315	40	
26	3.1	Frazer Creek (Frazer Gulch)	434593	4378862	223846	0.6	0.030	140	40	
27	1.1	**Ten Mile River**	434307	4378201	255123	105.1	7.946	30916	31	
28	1.1	**South Fk Ten Mile River**	436028	4376690	1654964	43.8	2.420	10015	206, 255, 256, 314	124
29	1.1	**Smith Creek**	437410	4375217	233318	6.2	0.334	1421	1	124
30	1.1	**Campbell Creek**	438609	4373695	220504	4.7	0.258	1095	55, 204	124
31	1.1	**Churchman Creek** (Churchmans)	442559	4370320	221103	3.1	0.263	1024	50, 136, 313	124
32	1.1	**Redwood Creek**	447811	4371659	231431	6.4	0.505	1894	51, 233, 277	124
33	1.2	unnamed trib.	449107	4373519	231431.1	1.4	0.104	431	278	

Str. No.	Cat.	Stream	UTM Coordinates Easting	Northing	GNIS	IP-km	Mean Annual Flow (m^3s^{-1})	Water-shed Area (ha)	Historical Sources	Recent Sources
34	3.1	Gulch Eleven	449109	4369732	224724	1.4	0.153	619	40	
35	1.1	**Mill Creek**	436974	4377645	228672	2.6	0.157	694		123, 124
36	1.1	<**North Fk Ten Mile River**	439176	4380315	254986	23.0	2.834	10083	54, 232, 257, 291	124, 125
37	1.1	**Little North Fk Ten Mile River**	438946	4382471	227319	6.4	0.524	1998	21, 263, 303	124, 125, 151
38	1.1	Buckhorn Creek	438887	4382821	220054	1.3	0.124	475		124, 125
39	1.1	unnamed trib.	437862	4385569	227319.1	0.8	0.089	330	279	
40	1.2	O'Conner Gulch	443159	4383804	229824	0.0	0.059	197	158	
41	1.1	Bald Hill Creek	445025	4383764	218574	1.5	0.430	1332		123, 124, 125
42	1.1	unnamed trib. (TN8)	447979	4381964	254986.1	0.0	0.082	280	301	
43	1.1	unnamed trib. (TN12)	449957	4381138	254986.2	0.0	0.079	274	302	
44	1.1	Patsy Creek	450890	4381044	230405	0.8	0.167	672	127	124
45	1.2	unnamed trib.	453046	4381860	254986.3	0.0	0.123	425	57	
46	1.1	Stanley Creek	453330	4381963	235373	0.0	0.101	310	56	
47	1.1	<**Middle Fk Ten Mile River** (Clark Fk Ten Mile)	439173	4380230	228604	23.8	2.218	8659	128, 292, 299, 300	124, 125
48	1.1	**Bear Haven Creek**	441676	4378534	218855	6.1	0.431	1700		124, 125
49	1.1	South Fk Bear Haven Creek	442490	4379018	234969	0.9	0.106	421		169
50	1.1	Little Bear Haven Creek	445285	4377616	227190	2.4	0.194	775	262	123, 125
51	1.1	Booth Gulch	448665	4376579	219653	1.2	0.111	462	157	123, 124, 125
52	4.1	unnamed trib.	451015	4376242	228604.1	0.0	0.044	181		
53	1.1	**Pudding Creek**	430546	4367791	231080	28.4	0.954	4351	21, 228, 230, 241	117, 124, 125, 151, 191
54	1.1	unnamed trib. (Slaughterhouse Gulch)	436824	4367072	231080.1	1.2	0.055	252		123, 125
55	1.1	**Little Valley Creek**	437561	4368686	227402	9.4	0.320	1458	110, 130	123, 125
56	3.1	unnamed trib.	437420	4370973	227402.1	1.2	0.040	184	40	
57	3.1	unnamed trib.	437362	4371120	227402.2	1.1	0.032	146	40	
58	1.1	**Noyo River**	430467	4364313	229808	119.1	6.360	29133	31, 92, 93, 94, 95	*
59	1.1	Hayshed Gulch	436511	4364254	225077	1.1	0.070	333		123, 124, 125
60	1.1	**South Fk Noyo River**	437567	4363854	235032	33.4	1.438	7083	70, 98, 99, 186	107, 119, 151, 191, 192
61	1.1	**Kass Creek**	438076	4363185	226429	3.1	0.122	573	21, 90, 184, 247	124, 125, 151, 191
62	1.1	**North Fk South Fk Noyo River**	441053	4360234	234367	10.8	0.543	2577	91, 185	119, 124, 151, 191, 192
63	1.1	unnamed trib. (Gonzo Creek)	441151	4361525	234367.1	0.1	0.029	138		192
64	1.1	Brandon Gulch	441343	4361893	219775	1.6	0.079	372		192
65	1.1	unnamed trib. (Shooter Creek)	444370	4361781	234367.2	0.1	0.020	101		192
66	1.1	unnamed trib. (Grover Creek)	445036	4362210	234367.3	0.1	0.042	198		192
67	1.1	Peterson Gulch	441364	4359854	235032.1	0.2	0.024	121		119, 192
68	1.1	Bear Gulch	442066	4359451	218843	1.0	0.053	268	88, 135	119, 192
69	1.1	**Parlin Creek**	443386	4357807	230373	3.8	0.227	1151	97, 183	119, 192
70	1.1	unnamed trib. (Waldo Gulch)	444332	4358829	230373.1	0.2	0.017	87		119, 319

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71	1.1	unnamed trib. (trib. A; Moe Creek)	444721	4359528	230373.2	0.3	0.028	144		192
72	1.1	unnamed trib. (Pipe Creek)	443224	4357698	235032.2	0.4	0.031	165		119
73	1.1	unnamed trib. (Road 320 Creek)	443481	4357637	235032.3	0.2	0.017	93	100	119, 192
74	1.1	unnamed trib. (Culi Creek)	445171	4357201	235032.4	0.1	0.015	82		192
75	1.1	unnamed trib. (MRC #8)	439174	4364875	229808.1	0.4	0.029	133		175
76	1.1	**Little North Fk Noyo River**	440121	4366329	227317	4.1	0.208	954	21, 30	124, 125, 151, 191
77	1.1	**Duffy Gulch**	449381	4365131	222701	1.4	0.170	654	89, 246	124
78	1.1	Gulch Thirty-one	450382	4365191	224730	0.0	0.078	339	148, 149	
79	1.1	unnamed trib. (MRC #1)	452172	4363288	229808.3	0.0	0.090	448	148, 149	175
80	1.1	**North Fk Noyo River**	452605	4363458	229702	23.0	1.540	6495	248	175
81	1.1	**Marble Gulch** (Marble Creek)	453482	4364429	228069	2.3	0.116	551	67, 148, 149	
82	1.1	Gulch Seven	455195	4366451	224728	2.2	0.088	413	148, 149	
83	1.1	**Hayworth Creek**	454247	4367114	225083	8.1	0.734	2879	245	175
84	1.1	North Fk Hayworth Creek	456909	4368879	229681	1.1	0.224	836		175
85	1.1	**Middle Fk North Fk Noyo River**	453294	4368926	234285	1.8	0.200	782	69	175
86	1.1	Dewarren Creek	452482	4369614	222333	1.6	0.125	524	63	
87	1.1	unnamed trib. (MRC #5 and #7)	455554	4363079	229808.5	1.3	0.093	489		175
88	1.1	unnamed trib. (MRC #6)	455469	4362674	229808.51	0.2	0.033	171		175
89	1.1	**Olds Creek**	456763	4363350	229994	5.5	0.289	1437	96, 249	175
90	1.1	**Redwood Creek**	457587	4364585	231424	5.3	0.300	1362	250	175
91	1.1	McMullen Creek	460518	4364545	228432	1.9	0.164	720	68	175
92	1.1	**Hare Creek**	430176	4363167	224932	12.4	0.483	2400	21, 240	117, 118, 119, 151
93	1.1	Covington Gulch	433590	4362162	221687	0.7	0.037	183		151
94	1.1	unnamed trib. (Walton Gulch)	436396	4360698	224932.1	0.2	0.027	132		151
95	1.1	**South Fk Hare Creek**	436655	4359912	235014	0.8	0.071	347	133	3, 119
96	1.1	**Bunker Gulch**	437061	4359896	220158	1.7	0.055	264	131	119, 151
97	1.1	Mitchell Creek	429802	4360426	228865	0.3	0.139	734	243	
98	1.1	**Jug Handle Creek** (Jughandle)	429739	4358687	234098	4.6	0.141	757	132	
99	1.1	**Caspar Creek**	429812	4357007	220677	12.8	0.424	2160	21, 30, 254	117, 118, 119, 151, 189
100	1.2	unnamed trib. (Blue Gum Creek)	434782	4355521	220677.1	0.0	0.024	122		117
101	1.1	**unnamed trib.** (South Fk Caspar Creek)	435007	4355078	220677.2	2.4	0.083	426	30	119, 189, 202
102	1.1	unnamed trib. (Middle Fk Caspar Creek)	436852	4356084	220677.3	0.3	0.037	183		119
103	1.1	**Doyle Creek** (Boyle Creek)	429603	4356860	253689	2.4	0.061	340	52	35, 151
104	1.1	**Russian Gulch**	430711	4353376	232050	6.0	0.185	994	21, 242	3, 147, 151
105	1.1	**Big River**	431642	4350463	219234	193.6	8.866	46819	31	175
106	1.1	Railroad Gulch	438931	4351974	231177	2.7	0.084	441		37, 117, 119
107	1.1	**Little North Fk Big River**	439267	4351689	227311	17.3	0.631	3234	182	119, 125, 175

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108	1.1	Thompson Gulch	440387	4354747	227311.1	0.8	0.049	245		37, 119
109	1.1	**East Br Little North Fk Big River**	442248	4354829	222858	2.1	0.092	474		3, 119, 151
110	1.1	**Berry Gulch**	442059	4355469	227311.2	2.7	0.132	660		117, 119, 151
111	1.1	unnamed trib. (North Fk Berry Gulch)	441196	4356168	227311.21	0.9	0.054	262		37
112	1.1	**Two Log Creek**	447161	4352354	236728	4.9	0.232	1235	21, 265	119, 124, 125, 151, 175
113	1.1	**Tramway Gulch**	448072	4351460	236516	0.0	0.046	254	287	
114	1.1	unnamed trib. (Hatch Gulch Creek)	448347	4351330	219234.1	0.0	0.028	173		316
115	1.1	**North Fk Big River**	452529	4350151	229644	42.6	2.219	11253		37, 119, 175
116	1.1	**East Br North Fk Big River**	452294	4352171	222859	7.7	0.390	2086	64	175
117	1.1	unnamed trib. (Bull Team Gulch)	454760	4353060	222859.1	0.2	0.023	127		175
118	1.1	**Chamberlain Creek**	452157	4355871	220890	11.3	0.654	3180		37, 119, 151
119	1.1	Water Gulch	452081	4356292	237324	1.6	0.076	372		37, 119
120	1.1	unnamed trib. (West Chamberlain)	451659	4357453	220890.1	3.7	0.201	963		37, 119
121	1.1	Gulch sixteen	450248	4358749	220890.11	0.9	0.065	319		37
122	1.1	**Arvola Gulch**	453184	4358969	218419	0.7	0.084	408		37, 119
123	1.1	**James Creek**	455944	4355298	234080	7.1	0.364	1807	139, 141	119
124	1.1	**North Fk James Creek**	456968	4358704	229687	2.9	0.151	756		3
125	1.1	**South Fk Big River**	454040	4349398	234972	54.2	2.595	14080	65, 74	175
126	1.1	**Ramon Creek**	456646	4346792	231201	5.1	0.242	1373		175
127	1.1	unnamed trib. (North Fk Ramon Creek)	457874	4346617	231201.1	1.2	0.077	434		175
128	1.1	**Daugherty Creek** (Dougherty)	460128	4342029	222554	15.0	0.817	4303	181	175, 317
129	1.1	Gates Creek	462573	4339540	224100	4.6	0.271	1381		32, 117
130	1.1	**Johnson Creek**	464717	4339498	226299	1.4	0.088	439	287	
131	1.1	Snuffins Creek	465861	4336318	234794	1.5	0.086	428		175
132	1.1	unnamed trib. (Pruitt Creek)	467197	4342825	234972.1	2.2	0.110	556		4
133	1.1	unnamed trib.	467697	4342881	234972.2	3.3	0.199	957		4
134	1.1	Russell Brook	457001	4350963	232037	3.6	0.192	1049	203	175
135	1.1	Martin Creek	461714	4351065	228167	4.9	0.514	2401		175
136	1.1	unnamed trib.	463972	4353925	228167.1	0.9	0.123	562		4
137	1.1	Valentine Creek	463745	4348602	236954	1.9	0.123	652		4
138	1.1	Rice Creek	465495	4349437	231526	2.1	0.139	659		4
139	1.1	**Little River**	431855	4347238	227343	6.5	0.233	1365	21, 31, 187, 289	118, 151
140	3.1	**Buckhorn Creek**	432452	4345641	220053	0.5	0.067	390	*	
141	3.1	unnamed trib. (MRC #1)	433183	4345693	220053.1	0.0	0.033	178	40	
142	1.1	**Albion River**	433816	4341864	218079	59.2	1.801	11005	21, 174	151, 175
143	1.1	Deadman Gulch	437492	4343952	218079.1	0.3	0.024	127		175
144	1.1	Railroad Gulch	437986	4343501	231176	5.1	0.191	1122	174	175

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145	1.1	Pleasant Valley Creek	438058	4343524	231176.1	1.5	0.049	289	174	175
146	1.1	unnamed trib. (MRC #1)	438751	4341856	231176.2	0.0	0.023	138		175
147	1.1	unnamed trib. (MRC #2)	439422	4341469	231176.3	0.3	0.024	138		175
148	1.1	unnamed trib. (Slaughterhouse Gulch)	438025	4344106	218079.2	0.1	0.014	76		175
149	1.1	Duck Pond Gulch (Duckpond)	438484	4344148	222687	0.7	0.032	189		175
150	1.1	**South Fk Albion River**	441843	4344899	234962	10.4	0.377	2343	174	175, 191
151	1.1	Norden Gulch	443502	4343492	229583	0.4	0.028	169		175
152	1.1	Little North Fk South Fk Albion R (Little N. Fk)	444316	4342554	227310	0.6	0.038	230		175
153	1.1	Bull Team Gulch	446929	4343298	220127	0.4	0.031	189		175
154	1.1	**Railroad Gulch** (East Railroad Gulch)	444335	4345977	231179	0.7	0.042	250		175
155	1.1	Tom Bell Creek	444562	4346413	236425	2.4	0.064	398	174	175
156	1.1	**North Fk Albion River**	447703	4346145	229637	7.2	0.218	1343	174	175
157	1.1	Soda Springs (Soda Spring Creek)	447721	4348222	234846	1.5	0.055	330		117
158	1.1	**Marsh Creek** (March)	449000	4344986	228133	3.2	0.093	610	174	3
159	1.1	**Little Salmon Creek**	433987	4340751	227355	3.5	0.126	718		35
160	3.1	unnamed trib.	435675	4340862	227355.1	0.2	0.026	146	40	
161	1.1	**Big Salmon Creek**	434038	4340628	219249	13.4	0.448	2675	244	124, 125, 151
162	1.1	<Donnelly Creek (Donnelly Gulch; Donley Gulch)	442712	4339331	219249.1	0.6	0.033	205		123, 125
163	1.1	<**Hazel Gulch** (Hazel Creek)	442409	4339511	225088	4.8	0.140	860		123, 125
164	3.1	unnamed trib. (West Br Hazel Gulch)	442386	4341362	225088.1	0.5	0.033	200	40	
165	1.1	**Navarro River**	434354	4338134	229433	201.0	14.312	81456	83, 289	38, 188
166	1.1	Marsh Gulch	438858	4336519	228135	0.2	0.080	454		77, 172, 175
167	1.1	Murray Gulch	439545	4336582	229363	0.5	0.048	269		175
168	1.1	Flume Gulch (Flume Creek)	441581	4336006	223636	1.1	0.115	664		175
169	1.1	**North Fk Navarro River**	444931	4334148	234372	68.3	3.212	19182	31, 83, 227	117, 118
170	1.1	Dead Horse Gulch	447300	4333919	234372.1	0.2	0.019	114		171, 175
171	4.1	Tramway Gulch	447875	4333912	236515	0.4	0.025	160		
172	1.1	**Flynn Creek**	449707	4334623	223642	8.5	0.301	1926	21	151, 175, 177
173	1.1	Camp 16 Gulch	447958	4337969	255074	1.5	0.067	419		175
174	1.1	Tank 4 Gulch (Tank Ford)	447661	4339301	253963	0.9	0.038	236		175, 176
175	1.1	<**North Br North Fk Navarro River**	451704	4335862	1662310	26.7	1.161	7334		77, 175
176	1.1	Cook Creek	452665	4337492	221480	2.7	0.133	865		175
177	1.1	<**John Smith Creek**	453791	4339774	226280	6.7	0.236	1479	2, 21	77, 117, 151, 175
178	1.1	Gulch 15 (Sheep Gulch)	454264	4341455	224714	0.6	0.033	206		175
179	1.1	<**Little North Fk Navarro River**	453891	4339652	227314	12.6	0.475	2866		77, 175
180	1.1	Big Gulch	456449	4339399	219192	0.2	0.028	173		175
181	1.1	Redwood Creek	456918	4339154	231423	1.6	0.059	356		175

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182	1.1	Bottom Creek	458766	4339318	219677	2.9	0.106	640		175
183	1.1	Sawyer Creek	458775	4338765	232629	4.3	0.154	928		175
184	1.1	Spooner Creek	459214	4339821	235213	1.6	0.060	368		175
185	1.1	<**South Br North Fk Navarro River**	451818	4335644	234936	19.9	1.399	7614		175
186	1.1	Bear Creek	462026	4333116	218808	0.8	0.095	491		175
187	1.1	**Bridge Creek**	462330	4333445	219818	2.0	0.098	574		175
188	1.1	Low Gap Creek	467669	4332556	234204	0.0	0.147	701		175
189	1.1	unnamed trib. (Black Rock Creek; Blackrock)	453623	4328201	229433.1	0.0	0.058	339		173
190	1.1	**Mill Creek**	456624	4327876	228689	11.7	0.503	3143	40	
191	1.1	unnamed trib. (Little Mill Creek)	458121	4331186	228689.1	1.3	0.063	418		253
192	1.1	**Indian Creek**	461862	4323109	225867	6.9	2.018	10231	31, 152, 187, 224, 273	3
193	1.1	West Br Indian Creek	463611	4326679	237430	0.1	0.174	1007	226	
194	1.1	**North Fk Indian Creek**	467622	4325309	229684	0.0	0.753	3613	225	
195	3.1	**unnamed trib.** (Dick Creek)	469042	4324782	225867.1	0.0	0.057	309	40	
196	1.1	**Gut Creek**	471300	4325075	224748	0.0	0.237	1085	221	
197	3.1	<Anderson Creek	462018	4322584	233415	27.7	2.136	11809	*	
198	3.1	Robinson Creek	467784	4318040	231688	8.3	0.268	1489	40	
199	1.1	<**Rancheria Creek**	461829	4322467	234534	31.8	4.360	24042	83, 160	
200	1.1	**Ham Canyon**	461836	4320768	234534.1	2.6	0.126	803	222	
201	1.1	Dago Creek (Italian Creek)	458390	4321496	253654	4.2	0.198	1230	219	258
202	1.1	**Horse Creek**	460203	4317713	234032	2.4	0.183	1026	223	
203	1.1	**Minnie Creek**	462386	4315869	228805	2.1	0.164	882		3
204	1.1	**Camp Creek**	463882	4313089	220449	1.3	0.478	2740	218	
205	1.1	**German Creek**	464660	4309849	224129	0.0	0.099	564	220	
206	2.1	**Greenwood Creek**	438043	4330836	233960	21.8	1.186	6608	198	
207	1.1	**Elk Creek**	438891	4328181	223109	17.8	1.321	7133		175
208	1.1	unnamed trib. (South Fk Elk Creek)	441623	4326797	223109.1	0.4	0.130	716		175
209	3.1	**Three Springs Creek**	449100	4321861	236324	1.0	0.120	653	40	
210	4.1	**Sulphur Fk** (Sulphur Creek)	450011	4320808	235713	0.7	0.068	355		
211	4.1	**Soda Fk** (Soda Creek)	451081	4319872	234831	0.7	0.119	614		
212	3.2	**Mallo Pass Creek** (Malo Pass Creek)	440409	4320587	227983	3.2	0.208	1104	306	
213	1.1	Alder Creek	439786	4317298	218098	23.8	1.404	7442	31	
214	1.1	**Brush Creek**	438477	4314142	239744	17.9	0.858	4571	137, 187, 285	
215	1.1	**Garcia River**	437206	4310780	224039	76.0	5.534	29376	138, 159, 231, 289	
216	1.1	North Fk Garcia River	446270	4308161	229677	2.9	0.546	2649		123
217	1.1	South Fk Garcia River	451425	4300716	235007	3.2	0.204	1110		151, 175
218	1.1	Fleming Creek (Flemming Creek)	452640	4298690	223598	0.9	0.064	372		151

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219	1.1	Inman Creek	457458	4306376	225942	8.7	0.392	2205		53, 170
220	2.1	**Schooner Gulch**	443350	4301986	232695	4.7	0.215	1198	101, 178, 199	
221	3.1	**North Fk Schooner Gulch**	443663	4302305	229716	1.1	0.051	290	40	
222	1.1	**Fish Rock Gulch**	449747	4294857	223538	0.6	0.054	309	197	
223	1.1	**Gualala River**	453771	4291035	253221	252.1	16.196	77119	159, 231, 289	
224	1.1	**<North Fk Gualala River**	456738	4292109	229679	40.0	2.306	12352		*
225	1.1	Little North Fk Gualala River	455820	4293640	227313	6.4	0.315	1759		113, 115
226	1.1	**Doty Creek**	453861	4296900	227313.1	1.0	0.068	375		115, 121
227	1.1	Robinson Creek	458113	4295748	231684	1.5	0.102	553		112, 113
228	1.1	McGann Gulch (McGann Creek)	458923	4295737	228359	1.2	0.066	349		62
229	1.1	Dry Creek	458772	4296146	222608	3.3	0.305	1674		112, 113, 114
230	1.1	**<South Fk Gualala River**	456791	4292066	235010	207.8	13.790	64126	231	
231	1.1	Buckeye Creek	460329	4287873	220029	38.9	2.187	10422	235	
232	1.1	**Franchini Creek** (Francini)	468032	4288088	223795	0.2	0.081	466	215	
233	1.1	North Fk Buckeye Creek	470276	4290090	229647	9.0	0.732	3079	85	
234	1.1	**Wheatfield Fk Gualala River**	464035	4283501	237594	86.9	6.553	28931	*	
235	1.1	**Fuller Creek**	470891	4280157	223983	9.4	0.569	2841	212, 264	
236	1.1	<North Fk Fuller Creek	471896	4284579	229676	2.2	0.145	691	213, 266	
237	1.1	<South Fk Fuller Creek	471828	4284385	235005	2.8	0.243	1110	214	
238	1.1	**Haupt Creek**	472089	4279078	225023	6.8	0.500	2486	209, 216	
239	3.1	**House Creek**	479729	4279128	225688	31.0	1.788	7384	42	
240	1.1	**Marshall Creek**	475047	4272188	228139	16.8	1.242	5112	*	
241	1.1	**Sproule Creek**	478264	4271588	1654966	3.7	0.170	744	234	
242	1.1	**Fort Ross Creek**	478855	4262440	223705	1.4	0.075	438	208	
243	1.1	**Russian Gulch Creek**	486392	4257416	1772332	6.2	0.643	2485	271, 295, 307	
244	1.1	**East Br Russian Gulch**	486995	4258735	222861	3.3	0.225	1008	72, 237, 307	
245	1.1	**Middle Br Russian Gulch**	486843	4258814	1772332.1	0.7	0.225	921	207, 307	
246	1.1	West Br Russian Gulch	486824	4258798	237436	0.9	0.171	847	297, 307	
247	1.1	**Russian River**	488846	4255629	267200	761.4	72.608	384101	144, 200, 272	
248	3.2	Jenner Gulch	490091	4255456	226194	0.4	0.094	518	26	
249	1.1	**Willow Creek**	491684	4254406	237879	10.4	0.445	2221	21, 109, 111, 134	
250	1.1	**Sheephouse Creek**	491824	4255432	232916	3.7	0.151	861	109, 134, 163	43
251	3.1	**unnamed trib.** (Sheephouse Cr. SW Trib)	492022	4256132	232916.1	0.5	0.037	214	42	
252	1.1	**Freezeout Creek**	495813	4255587	223863	1.2	0.140	757	109, 134, 196	43
253	1.1	**Austin Creek**	495727	4257342	218466	52.4	4.286	18108	109, 111, 160	
254	2.1	Kohute Gulch	495300	4259086	218466.1	0.5	0.064	324	22, 109	
255	1.1	**Kidd Creek**	493979	4261091	226569	1.7	0.165	784	109, 134	

Str. No.	Cat.	Stream	UTM Coordinates Easting	Northing	GNIS	IP-km	Mean Annual Flow (m^3s^{-1})	Water-shed Area (ha)	Historical Sources	Recent Sources
256	1.1	**East Austin Creek**	494179	4262253	222846	25.0	2.016	8308	20, 24, 31, 59, 60, 102	
257	1.1	Black Rock Creek	494081	4266633	219403	2.4	0.131	615	109, 162	
258	1.1	**Gilliam Creek**	495509	4267820	224171	2.0	0.245	1054	59, 109	
259	1.1	**Gray Creek**	494755	4271072	224517	3.9	0.352	1424	59	
260	3.2	Conshea Creek	492546	4271647	221468	0.7	0.052	217	58	
261	3.2	Sulphur Creek (Sulfur)	492095	4274261	235703	0.5	0.133	508	59	
262	1.1	**Ward Creek**	491987	4265557	237225	6.1	0.756	3050	109	43
263	3.4	Red Slide Creek	490052	4270555	231390	0.9	0.101	406	23, 49	
264	1.1	**Dutch Bill Creek**	499270	4257221	222756	11.0	0.685	3113	109, 134, 160, 161	
265	2.1	Smith Creek	500842	4258273	233315	0.0	0.082	411	109	
266	1.1	**Hulbert Creek**	499637	4261087	253871	11.7	0.422	2085	161, 190, 210	
267	1.1	Mission Creek	497623	4261504	246001	1.6	0.084	407	211	
268	3.3	Fife Creek	499800	4261174	223491	9.7	0.353	1743	34	
269	1.1	Green Valley Creek	508017	4261535	224576	57.2	1.758	9835	34, 109, 134	43
270	1.1	Purrington Creek	509675	4254083	231100	4.5	0.186	935		43
271	1.1	**Mark West Creek**	509603	4260425	228118	400.9	9.723	65396	75, 164	35, 82
272	1.1	Laguna de Santa Rosa	513939	4257765	226766	274.5	8.635	43340		*
273	1.1	Santa Rosa Creek	514575	4255653	232563	132.8	3.439	21237		82
274	2.1	Porter Creek	510146	4262854	230951	9.8	0.396	1953	109	
275	1.1	unnamed trib. (Griffen Creek; Griffin Creek)	512150	4264639	267200.1	3.8	0.096	611		43
276	1.1	**Dry Creek**	512394	4270684	222623	32.3	12.053	56383	18, 31, 109, 111, 160, 298	
277	1.1	**Mill Creek**	511389	4270935	228686	24.4	1.247	5812	73, 109, 160, 161	
278	1.1	Felta Creek	510140	4269961	223436	4.4	0.180	919	109	43
279	1.1	**Wallace Creek**	507689	4272087	237193	3.4	0.284	1354	109, 161	
280	1.1	Grape Creek	505641	4278615	224441	0.0	0.175	908		*
281	1.1	Wine Creek	504647	4278474	238037	0.0	0.066	345		43
282	1.1	**Pena Creek**	503215	4283475	230478	5.0	1.396	5867	73, 109, 160, 161	
283	4.1	**Warm Springs Creek**	499353	4285243	237246	0.8	2.301	89		
284	1.1	Maacama Creek	518950	4273717	227883	47.8	3.368	17951	31, 268	34, 82, 261
285	1.1	Redwood Creek	522244	4276656	231421	14.1	1.458	3533	268	82, 261
286	3.1	**East Fk Russian River**	482907	4337703	222895	0.0	5.190	27165	111	
287	3.2	**York Creek**	482554	4339075	238270	0.0	0.557	2991	201	
288	2.1	**Forsythe Creek**	482414	4344202	223693	23.9	2.613	12471	27, 148	
289	2.1	**Seward Creek**	480020	4345384	232831	7.1	0.677	3379	27, 148, 260	
290	2.1	**<Eldridge Creek**	477172	4345485	223079	1.9	0.308	1510	27, 148	
291	2.1	**<Jack Smith Creek**	477258	4345556	226042	5.2	0.272	1321	27, 148	
292	2.1	**Mill Creek**	477565	4347494	228670	0.2	0.610	2874	15, 27, 148	

Str. No.	Cat.	Stream	UTM Coordinates Easting	Northing	GNIS	IP-km	Mean Annual Flow (m^3s^{-1})	Water-shed Area (ha)	Historical Sources	Recent Sources
293	3.1	**Salt Hollow Creek**	482497	4344675	232322	0.0	0.174	1005	259	
294	3.1	**Rocky Creek**	480743	4351899	231765	0.0	0.129	612	40	
295	2.1	**Mariposa Creek** (Lane)	480893	4352813	228108	0.0	0.189	871	28	
296	2.1	**Fisher Creek**	481031	4352907	223542	0.0	0.077	407	29	
297	3.1	**Corral Creek**	480993	4353857	221582	0.0	0.179	890	40	
298	1.1	**Scotty Creek**	492819	4248291	232742	3.8	0.198	1101	146	
299	1.1	**Salmon Creek**	494234	4245027	232281	46.8	1.716	8106	31, 145, 179	
300	1.1	**Finley Creek**	498455	4245625	223507	3.6	0.142	731	81, 239	
301	1.1	**Coleman Valley Creek** (Coleman)	498643	4245704	221373	2.8	0.286	1314	294	
302	1.1	**Fay Creek**	500000	4245386	232281.1	2.1	0.164	801	71, 238	
303	1.1	**Tannery Creek**	501057	4245001	236018	2.2	0.104	529	21, 180, 296	
304	2.1	Americano Creek (Valley Ford Creek)	500000	4238400	254563[1]	60.5	1.477	9775	16	
305	3.2	Stemple Creek	503187	4235412	253932[2]	77.3	1.701	13161	19	
306	1.3	**Walker Creek**	507084	4230362	255208	102.7	3.029	19208	7, 76, 150, 154, 318	
307	2.1	**<Salmon Creek**	519264	4223587	232280	7.0	0.222	1334	6	
308	2.1	**<Arroyo Sausal Creek**	519220	4223552	254577	28.7	0.879	4981	5, 150	
309	1.1	**Lagunitas Creek** (Papermill)	515234	4214719	254865	114.8	4.554	28087	21, 31	79
310	3.1	Haggerty Gulch (Haggerty Gulch Creek)	515853	4212655	224778	0.0	0.025	175	39	
311	1.1	**Olema Creek**	516722	4212736	234410	22.2	0.581	4351	47	155, 191
312	1.1	unnamed trib. (Quarry Gulch)	519106	4209514	234410.1	0.3	0.014	105		155
313	1.1	unnamed trib. (Horse Camp Gulch or Creek)	521082	4205894	234410.2	0.1	0.017	114		155
314	1.1	unnamed trib. (Giacomini Creek)	521575	4205363	234410.3	0.4	0.026	187		155
315	1.1	unnamed trib. (Blueline Creek; John West Fk)	521620	4205171	234410.4	1.3	0.047	312		155, 191
316	1.1	unnamed trib. (Randall Gulch)	523327	4203217	234410.5	0.2	0.016	106		155
317	1.1	unnamed trib. (North Hagmaier Creek)	523489	4202794	234410.6	0.4	0.016	106		155
318	1.1	unnamed trib. (Headwaters Tributary)	524330	4201831	234410.7	0.2	0.016	109		155
319	1.1	**Nicasio Creek**	520286	4213402	229534	45.6	1.665	9557	31	3
320	1.1	Halleck Creek	526015	4213143	224814	7.5	0.413	2211	251	
321	1.1	unnamed trib. (Cheda Creek)	522400	4209794	254865.1	0.9	0.042	291		155
322	1.1	**Devils Gulch Creek**	523198	4208889	222308	2.9	0.108	699	13, 47, 80	79
323	1.1	**San Geronimo Creek** (Parkington)	525716	4206227	232400	11.0	0.441	2439	47	79, 293, 309, 310, 311
324	1.1	unnamed trib. (Arroyo Road Creek)	526942	4207268	232400.1	1.0	0.058	348		9, 78, 309, 310, 311
325	1.1	unnamed trib. (Montezuma Creek)	527435	4207306	232400.2	0.1	0.017	97		25, 293, 309
326	1.1	unnamed trib. (Candellero Creek)	527595	4207319	232400.21	0.0	0.008	45		308

[1] Americano Creek enters into Estero Americano (GNIS 223257), an estuarine slough.
[2] Stemple Creek enters into Estero de San Antonio (GNIS 253212), an estuarine slough.

Str. No.	Cat.	Stream	UTM Coordinates Easting	Northing	GNIS	IP-km	Mean Annual Flow (m^3s^{-1})	Water-shed Area (ha)	Historical Sources	Recent Sources
327	1.1	unnamed trib. (Larsen Creek)	528665	4207425	232400.3	0.7	0.034	183		78, 293, 309, 310, 311
328	1.1	unnamed trib. (Woodacre Creek)	531122	4207060	232400.4	1.5	0.069	364		25, 78, 309, 311
329	1.1	unnamed trib. (East Fk Woodacre Creek)	531953	4206533	232400.41	0.0	0.006	30		25, 311
330	1.1	**Pine Gulch Creek**	527499	4196992	234476	11.6	0.281	2024		48, 156
331	1.1	unnamed trib. (McCurdy Creek)	525207	4200338	234476.1	0.6	0.046	311		156
332	1.1	unnamed trib. (Easkoot Creek)	531218	4194766	1000000[3]	0.4	0.054	426		84
333	1.1	**Redwood Creek**	537228	4190154	231428	8.0	0.304	2199	31	31, 155, 281
334	1.1	Kent Creek (Kent Canyon)	537293	4192516	1800598	0.6	0.033	254		155
335	1.1	Fern Creek	537152	4194708	223455	0.2	0.048	280		155
336	1.1	Arroyo Corte Madera Del Presidio	541422	4194079	254575	10.6	0.244	1826	167, 168	
337	3.2	**Old Mill Creek** (Mill Valley Creek; Mill Creek)	539883	4195167	229976	1.7	0.086	487	168, 270	
338	1.1	**Corte Madera Creek**	543514	4199349	258743	34.8	1.091	6183	116, 167, 168	
339	1.1	**San Anselmo Creek**	538780	4202037	232364	20.0	0.666	3716	86	
340	3.2	Napa River	566023	4214815	255110	466.0	6.388	1026	168, 305	
341	2.1	Pacheco Creek	579731	4210875	230192	78.5	0.901	37680	*	
342	2.1	**Walnut Creek**	582645	4206417	255848	77.4	0.876	32126	104, 105, 166, 168	
343	3.2	Pine Creek	583459	4203334	237199	0.0	0.154	7487	168, 252	
344	3.2	Arroyo del Cerro Creek	587877	4195417	254576	0.0	0.015	399	44, 168	
345	2.1	**San Pablo Creek**	554272	4203121	232457	18.4	0.474	11152	167, 168, 193	
346	2.1	Strawberry Creek	562010	4188428	235581	4.9	0.055	1047	105, 168	
347	2.1	San Leandro Creek	570372	4176664	232428	10.4	0.508	11844	168, 193	
348	3.2	San Lorenzo Creek	574022	4169456	232434	57.6	0.418	14720	168	
349	3.2	Crow Creek	582974	4171985	233742	8.5	0.178	4512	168	
350	2.1	**Alameda Creek**	575844	4160938	1654946	105.5	3.234	177524	168	
351	3.2	Arroyo de la Laguna	598077	4160520	218389	NA[4]	1.886	108156	*	
352	3.2	Sinbad Creek	598655	4161216	233170	2.7	0.050	1659	168	
353	2.1	Coyote Creek	589515	4146496	255083	145.4	1.818	932	168, 280, 284	
354	3.2	Guadalupe River	586431	4146224	253236	151.4	2.318	44817	168	
355	3.2	Los Gatos Creek	597603	4132142	227672	21.2	1.512	13630	142, 168	
356	3.2	San Francisquito Creek	578272	4196696	232397	46.9	0.720	12302	142, 168	
357	1.1	San Mateo Creek	561429	4158644	1655002	42.1	0.926	8727	122	
358	1.1	Tunitas Creek	553274	4134411	236624	8.3	0.341	2993	31	

[3] The unnamed tributary known as Easkoot Creek has no associated USGS GNIS number and was assigned an arbitrary number.

[4] Arroyo de la Laguna drains a large watershed with a drainage network that has been substantially altered by human activities. A short portion of the lower reach links Sinbad Creek to Alameda Creek and is included to provide connectivity. Most of the upper watershed is in hot interior regions and was not likely inhabited by coho salmon. For these reasons, IP-km were not calculated.

Str. No.	Cat.	Stream	UTM Coordinates Easting	Northing	GNIS	IP-km	Mean Annual Flow (m^3s^{-1})	Water-shed Area (ha)	Historical Sources	Recent Sources
359	2.1	**San Gregorio Creek**	553109	4130439	232403	39.4	1.695	13305	11, 45, 46	
360	1.1	**Pescadero Creek**	552684	4124153	234452	69.1	2.645	20905	33	3, 33, 165
361	1.1	Peters Creek	569448	4122855	230562	4.2	0.355	2549		194
362	1.1	**Butano Creek**	552653	4124126	220266	21.1	0.637	5209	8, 10	
363	1.1	Little Butano Creek	557611	4118897	227209	5.1	0.120	1049	205	
364	1.1	**Gazos Creek**	556698	4113130	224105	8.1	0.381	2963	31	3, 282
365	1.1	**Waddell Creek**	564335	4105460	237142	8.9	0.971	6091	31, 103, 276	282
366	1.1	<East Waddell Creek (East Fk Waddell)	565224	4109798	222935	0.9	0.500	3074		282
367	1.1	<West Waddell Creek (West Fk Waddell)	565131	4109833	237537	2.7	0.388	2434		282
368	1.1	Henry Creek	564702	4112828	225182	0.0	0.037	245		282
369	1.1	**Scott Creek**	568714	4099468	232722	14.8	1.392	7690	31, 276	126, 191, 282
370	1.1	unnamed trib. (Quesaria Creek)	568980	4099939	232722.1	0.3	0.024	178		126, 194
371	1.1	Little Creek	568791	4101980	227236	0.4	0.099	537		33, 126
372	1.1	**Big Creek**	568609	4102386	219170	1.4	0.627	2919		126, 282
373	1.1	Mill Creek	567293	4103537	234300	1.9	0.175	973		126, 282
374	1.1	**San Vicente Creek**	571934	4096083	232480	3.0	0.604	2798	31, 33, 283, 288	194, 195
375	1.1	**San Lorenzo River**	588011	4091332	248894	132.7	6.397	35811	31, 229, 286, 290	
376	3.2	Carbonera Creek	587171	4092272	222590	28.7	0.664	4558	*	
377	3.2	Branciforte Creek	587844	4093694	219771	15.2	0.358	2534	217	
378	1.1	Zayante creek	583030	4100424	238308	29.8	1.276	6939	153, 290	
379	1.1	Bean Creek	583576	4100865	218782	11.5	0.449	2569	283, 288, 290	
380	1.1	Fall Creek	581958	4101598	223367	0.9	0.266	1121	283, 288	
381	2.1	Love Creek	581172	4104888	227731	46.4	2.946	15768	315	
382	1.1	Boulder Creek	578000	4109076	219687	11.5	0.545	2949	12, 129	
383	3.1	**Hare Creek**	574433	4112013	224931	0.9	0.039	215	41	
384	2.1	**Soquel Creek**	593294	4092139	253912	33.0	1.772	10969	87, 108, 269, 304	
385	2.1	**Aptos Creek**	597431	4091828	254571	27.3	0.890	6325	14, 17, 143	

Table A3. Summary of coho salmon museum specimens from the California Academy of Sciences Ichthyological Collection (Source 31) and Harvard University Museum of Comparative Zoology Ichthyology Department (Source 122) online databases cited in Appendix Table A2).

Location (stream no.)	County	Specimen ID	Coll. Date	Collectors
California Academy of Sciences				
Ten Mile River	Mendocino	SU 54775	6/26/1919	Snyder et al.
Noyo River	Mendocino	SU 54870	6/24/1900	Gilbert et al.
Big River	Mendocino	SU 59856	No date	Anonymous
Little River	Mendocino	CAS 19046	10/26/1945	Simpson and Simpson
North Fork Navarro River	Mendocino	CAS 19060	10/25/1945	Simpson and Simpson
Indian Creek	Mendocino	CAS 19065	10/25/1945	Simpson and Simpson
Alder Creek	Mendocino[1]	CAS 20813 CAS 20829	12/9/1931 5/18/1932	Wales and Rogers Taft and Wales
East Austin Creek	Sonoma	CAS 21164	8/12/1955	CDFG
Dry Creek	Sonoma	CAS 23531	3/26/1964	Hopkirk and Kuris
Maacama Creek	Sonoma	CAS 21087 CAS 21095	8/2/1955 8/3/1955	CDFG CDFG
Salmon Creek	Sonoma	CAS 210272	9/26/1965	Kuris and Born
Lagunitas Creek	Marin	CAS 40713 CAS 210270 CAS 26252 CAS 66239	3/1/1950 4/18/1953 2/14/1957 3/4/1962	Westfall and Christman Freihofer Follett and Follett Follett and Follett
Nicasio Creek	Marin	CAS 210264 CAS 209395 CAS 210257 CAS 210255	5/11/1961 4/1/1966 5/28/1968 5/6/1970	Evans Hopkirk et al. Strohschein Crunk
Redwood Creek	Marin	CAS 210114 CAS 210256 CAS 66238 CAS 66307	3/14/1951 2/8/1953 March 1960 3/10/1989	Needham et al. Freihofer et al. Behnke et al. Behnke
Tunitas Creek	San Mateo	CAS 210273	5/25/1939	Shapovalov
Gazos Creek	San Mateo	SU 4686 CAS 210251	June 1895[2] 4/24/1970	Rutter and Pierson Strohschein
Waddell Creek	Santa Cruz	SU 4667 CAS 20832 CAS 20841 CAS 20910	6/5/1895 7/12/1932 2/6/1934 April-May 1942	Rutter and Scofield Wales Shapovalov Moore
Scott Creek	Santa Cruz	SU 4797 CAS 20840	6/5/1895 1/30/1934	Rutter and Seale Anonymous
San Vicente Creek	Santa Cruz	SU 4685	1895[2]	Rutter and Scofield
San Lorenzo River	Santa Cruz	CAS 21044 CAS 21048 CAS 210259	7/20/1955 7/20/1955 June 1955	CDFG CDFG Anonymous
Harvard Museum of Comparative Zoology				
San Mateo Creek	San Mateo[3]	MCZ 68471	1860	Agassiz

[1] The CAS database does not provide a specific geographic reference for Alder Creek, a name shared by several streams in Mendocino County; however, several other specimens collected by the same collecting party on or about the same date indicate that the collection was made in the Alder Creek between Mallo Pass Creek and Brush Creek.

[2] No collection dates are listed for these specimens; however, other specimens collected by the same collecting party indicate that the date of collection was early June, 1895.

[3] The Harvard Museum lists the county of collection as San Diego County; however, several other specimens collected by the same collecting party indicate that collections were made in San Francisco Bay. Thus, we believe this specimen to have come from San Mateo Creek in San Mateo County. Leidy et al. (in press) reached a similar conclusion.

Appendix References

1. Adams, H. and W. Jones (California Department of Fish and Game). 1961. Stream survey: Smith Creek (South Fork Ten Mile River tributary), 5–6 September 1961. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/tenmile_cdfg_jones_1961_smith.pdf).

2. Adams, H. and D. Stewart (California Department of Fish and Game). 1962. Stream survey: John Smith Creek (North Fork Navarro River tributary), 16 July 1962. California Department of Fish and Game, Yountville, CA. 3 p.

3. Adams, P. B., M. J. Bowers, H. E. Fish, T. E. Laidig, and K. R. Silberberg. 1999. Historical and current presence-absence of coho salmon (*Oncorhynchus kisutch*) in the Central California Coast Evolutionary Significant Unit. National Marine Fisheries Service, Southwest Fisheries Science Center, Administrative Report SC-99-02: 24 p.

4. Albin, D. (California Department of Fish and Game). 2004. Unpublished data: summary of salmonid presence-absence surveys in Big River watershed, 2002. California Department of Fish and Game, Fort Bragg, CA.

5. Allen, J. T. (California Department of Fish and Game). 1959. Stream survey: Arroyo Sausal Creek (Walker Creek tributary), 9 and 14 December 1959. California Department of Fish and Game, Yountville, CA. 4 p.

6. Allen, J. T. (California Department of Fish and Game). 1959. Stream survey: Salmon Creek (Walker Creek tributary), 9 December 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/walker_cdfg_allen_1959_salmoncrk.pdf). 3 p.

7. Allen, J. T. (California Department of Fish and Game). 1959. Stream survey: Walker Creek (Tomales Bay tributary), 14 December 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/walker_cdfg_allen_1959_survey.pdf). 3 p.

8. Anderson, K. R. and I. L. Paulsen (California Department of Fish and Game). 1979. Memorandum: winter and spring instream flow requirement for lower Pescadero and Butano creeks, San Mateo County; results of the 1978 transect study. California Department of Fish and Game, Yountville, CA. 8 p.

9. Andrew, G. M., E. Ettlinger, J. Goin, and B. Irons. 2001. Lagunitas Creek coho salmon spawner survey report, 1999–2000. Marin Municipal Water District, Corte Madera, CA. 10 p. + appendices.

10. Anonymous (California Department of Fish and Game). 1953. File memo: Butano Creek, San Mateo County, 7 July 1953. California Department of Fish and Game, Yountville, CA. 4 p.

11. Anonymous (California Department of Fish and Game). 1953. File memo: San Gregorio Creek, San Mateo County, 9 July 1953. California Department of Fish and Game, Yountville, CA. 2 p.

12. Anonymous (California Department of Fish and Game). 1954. Field note: Boulder Creek (San Lorenzo River tributary), 27 and 30 May 1954. California Department of Fish and Game, Yountville, CA. 1 p.

13. Anonymous (California Department of Fish and Game). 1956. File memo: compilation of field notes for Devils Gulch Creek (Lagunitas Creek tributary), 4 July 1953 to 4 October 1956. California Department of Fish and Game, Yountville, CA. Electronic copy available from Klamath Resource Information System web page (www.krisweb.com/biblio/ lagunitas_cdfg_xxxx_1956_compilation.pdf). 2 p.

14. Anonymous (California Department of Fish and Game). 1972. Memorandum: prime salmonid spawning areas on state-owned lands, Region 3. Code section 1505 proposals. California Department of Fish and Game, Monterey, CA. 1 p.

15. Arnold, P. 1982. Preliminary report: Mill Creek watershed rehabilitation survey. Pan American Timber Services. Available from California Department of Fish and Game, Yountville, CA. 5 p.

16. Atkinson, C. J., J. Rose, and T. Duncan. 1967. Pacific salmon in the United States. Salmon of the North Pacific Ocean—Part IV. Spawning populations of North Pacific salmon. International North Pacific Fisheries Commission Bulletin 23: 43–224.

17. Baker, P. and F. Reynolds. 1986. Life history, habitat requirements, and status of coho salmon in California. California Department of Fish and Game Report to the California Fish and Game Commission. 37 p.

18. Baker, P. H. (California Department of Fish and Game). 1980. Steelhead and salmon rescue, Dry Creek, Sonoma County. California Department of Fish and Game, Yountville, CA. 1 p.

19. Baracco, A. and T. Charters (California Department of Fish and Game). 1976. Stream survey: Stemple Creek (Estero de San Antonio tributary), 14 July 1976. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/ stemple_cdfg_baracco_1976_stempless.pdf). 5 p.

20. Baracco, A. and D. Fong (California Department of Fish and Game). 1977. Stream survey: East Austin Creek (Austin Creek tributary), 21 April 1977. California Department of Fish and Game, Yountville, CA. 3 p.

21. Bartley, D. M., B. Bentley, P. G. Olin, and G. A. E. Gall. 1992. Population genetic structure of coho salmon (*Oncorhynchus kisutch*) in California. California Fish and Game 78: 88–104.

22. Boccone, V. (California Department of Fish and Game). 1977. Stream survey: Kohute Gulch (Austin Creek tributary), 6 September 1977. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/ russian_cdfg_baracco_1977_kohutegulch.pdf). 3 p.

23. Boccone, V. and D. Fong (California Department of Fish and Game). 1977. Stream survey: Red Slide Creek (Big Austin Creek tributary), 14 July 1977. California Department of Fish and Game, Yountville, CA. 3 p.

24. Boccone, V., B. Rowser, and D. Fong (California Department of Fish and Game). 1977. Stream survey: East Austin Creek (Austin Creek tributary), 23 June and 13 July 1977. California Department of Fish and Game, Yountville, CA. 6 p.

25. Bouley, P. (Salmon Protection and Watershed Network). 2005. Unpublished data: summary of coho salmon spawning surveys in San Geronimo Creek tributaries, 2004–2005. Salmon Protection and Watershed Network, Forest Knolls, CA. 2 p.

26. Brackett, G. and D. Netherby (California Department of Fish and Game). 1966. Stream survey: Jenner Gulch Creek (Russian River tributary), 24 February 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_netherby_1966_jennergulchss.pdf). 3 p.

27. Brackett, G. K. (California Department of Fish and Game). 1963. Stream survey: Forsythe Creek (Russian River tributary), 20–23 July 1963. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_brackett_1963_forsythe.pdf). 6 p.

28. Brackett, G. K. (California Department of Fish and Game). 1966. Field note: Mariposa Creek (aka Lane Creek; West Branch Russian River tributary), 24 June 1966. California Department of Fish and Game, Yountville, CA. 2 p.

29. Brackett, G. K. (California Department of Fish and Game). 1966. Memorandum: Fisher Creek (West Branch Russian River tributary) 25 May 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_brackett_1966_fisherfn.pdf). 1 p.

30. Burns, J. W. 1971. The carrying capacity for juvenile salmonids in some northern California streams. California Fish and Game 57: 44–57.

31. California Academy of Sciences. 2003. Ichthyology collection database. San Francisco, CA. Online searchable database available at CAS web site (www.calacademy.org/research/ichthyology/).

32. California Department of Fish and Game 1988. Salmon carcass surveys, Mendocino County 1987–88. California Department of Fish and Game, Yountville, CA. 9 p.

33. California Department of Fish and Game. 1998. Strategic plan for the restoration of endangered coho salmon south of San Francisco Bay (Draft). California Department of Fish and Game, Sacramento, CA. 44 p. + appendices.

34. California Department of Fish and Game. 2001. Russian River restoration plan. Element: coho salmon supplementation (April 2001 Draft). Prepared by California Department of Fish and Game in collaboration with the National Marine Fisheries Service and the U.S. Army Corps of Engineers. 27 p.

35. California Department of Fish and Game. 2002. Status review of California coho salmon north of San Francisco: report to the California Fish and Game Commission. Candidate Species Status Review Report 2002-3. 232 p. + appendices.

36. California Department of Fish and Game. 1968. Stream survey: Whale Gulch. California Department of Fish and Game, Yountville, CA.

37. California Department of Forestry and Fire Protection, Jackson Demonstration State Forest. 1998. 1997 field season annual report, July 1, 1997–June 30, 1998. Section 10 Permit for takes of a threatened species, Permit 1040. Jackson Demonstration State Forest, Fort Bragg, CA. 3 p. + attachments.

38. Cannata, S. P. (Humboldt State University). 1998. Observations of steelhead trout (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*) and water quality of the Navarro River estuary/lagoon, May 1996 to December 1997. Humboldt State University, Arcata, CA. 48 p. + appendices.

39. Cherr and Griffin (California Department of Fish and Game). 1979. Stream inventory: Marin County. California Department of Fish and Game, 24 p.

40. Cherr and Griffin (California Department of Fish and Game). 1979. Stream inventory: Mendocino County. California Department of Fish and Game, Yountville, CA. 230 p.

41. Cherr and Griffin (California Department of Fish and Game). 1979. Stream inventory: Santa Cruz County. California Department of Fish and Game, Yountville, CA.

42. Cherr and Griffin (California Department of Fish and Game). 1979. Stream inventory: Sonoma County. California Department of Fish and Game, Yountville, CA. 63 p.

43. Coey, R. (California Department of Fish and Game). 2001. Unpublished data: electrofishing data for Sonoma and Mendocino County streams. California Department of Fish and Game, Healdsburg, CA. 8 p.

44. Cogger, M. and R. Reineck (California Department of Fish and Game). 1977. Stream survey: Arroyo del Cerro Creek (Pine Creek tributary), 16–17 August 1977. California Department of Fish and Game, Yountville, CA. 3 p.

45. Coots, M. (California Department of Fish and Game). 1971. Report on a study of juvenile steelhead in San Gregorio Creek and Lagoon, San Mateo County, 1971. California Department of Fish and Game, Yountville, CA. 8 p.

46. Coots, M. 1973. A study of juvenile steelhead, *Salmo gairdnerii gairdnerii* Richardson, in San Gregorio Creek and lagoon, San Mateo County, March through August, 1971. California Department of Fish and Game, Anadromous Fisheries Branch Report No. 73-4: 21 p.

47. Cox, B. (California Department of Fish and Game). 1986. Memorandum to files: Lagunitas Creek, Marin County, 1986 electrofishing survey. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/lagunitas_cdfg_cox_1986_efish.pdf). 4 p.

48. Cox, B. 2002. Memorandum: Pine Gulch Creek (Bolinas Lagoon tributary), Marin County, 23 September 2002. Sent to B. Sanford, Marin County Open Space District. California Department of Fish and Game, Yountville, CA. 2 p.

49. Cox, W. (California Department of Fish and Game). 2000. Unpublished report: Major streams in Sonoma County, 1 March 2000. California Department of Fish and Game, Available from Klamath Resource Information System web site (www.krisweb.com/biblio/ marinsonoma_cdfg_cox_2000_streamsofsonoma.pdf).

50. Crowdus, J. and J. Santos (California Department of Fish and Game). 1961. Stream survey: Churchman Creek (aka Churchman's Gulch; South Fork Ten Mile tributary), 8 September 1961. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/ tenmile_cdfg_crowdus_1961_chrchmn.pdf). 3 p.

51. Crowdus, J. and J. Santos (California Department of Fish and Game). 1961. Stream survey: Redwood Creek (South Fork Ten Mile River tributary), 18 September 1961. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/ tenmile_cdfg_crowdus_1961_redwood.pdf). 3 p.

52. Crowdus, J., J. Santos, E. Dieden, and W. Jones (California Department of Fish and Game). 1961. Stream survey: Boyle [sic] Creek (Pacific Ocean tributary), 14 and 17 July 1961. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_jones_1961_boyle.pdf). 3 p.

53. Daugherty, T. (National Marine Fisheries Service). 2002. Personal communication: phone conversion with B. Spence (NMFS Santa Cruz Laboratory) on 24 October 2002 regarding observations of coho salmon on Louisiana-Pacific Corporation lands during the mid-1990s.

54. Davis, M. and D. Plumb. (Mendocino Fisheries Program). 1982. Stream habitat survey: North Fork Ten Mile River (Ten Mile River tributary), 25 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

55. Davis, M. and G. Sibbald (Mendocino Fisheries Program). 1982. Stream habitat survey: Campbell Creek (South Fork Ten Mile River tributary), 8 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

56. Davis, M. and G. Sibbald (Mendocino Fisheries Program). 1982. Stream habitat survey: Stanley Creek (North Fork Ten Mile River tributary), 7 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

57. Davis, M. and G. Sibbald (Mendocino Fisheries Program). 1982. Stream habitat survey: unnamed tributary (aka Section 17 Creek; North Fork Ten Mile tributary), 6 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

58. Day, J. S. (California Department of Fish and Game). 1962. Stream survey: Canshea [sic] Creek (East Austin Creek tributary), 26 April 1962. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_day_1962_cansheass.pdf). 3 p.

59. Day, J. S. 1962. The Upper East Austin Creek Drainage survey, Sonoma County. California Department of Fish and Game, Yountville, CA. 11 p.

60. Day, J. S. and W. Jones (California Department of Fish and Game). 1962. Stream survey: East Austin Creek (Austin Creek tributary), 11 April- 18 May 1962. California Department of Fish and Game, Yountville, CA. 4 p.

61. Dieden, E. and W. Jones (California Department of Fish and Game). 1961. Stream survey: Hardy Creek. California Department of Fish and Game, Yountville, CA. 5 p.

62. Dingman, R. (Gualala River Steelhead Project). 2002. Rescue rearing program, annual report. Gualala River Steelhead Project, Gualala, CA. 4 p.

63. Edie, B. (California Department of Fish and Game). 1966. Stream survey: Dewarren Creek (North Fork Noyo River tributary), 23 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1966_dewarren.pdf). 2 p.

64. Edie, B. (California Department of Fish and Game). 1966. Stream survey: East Branch North Fork Big River (North Fork Big River tributary), 29 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_edie_1966_ebnfbig.pdf). 2 p.

65. Edie, B. (California Department of Fish and Game). 1966. Stream survey: South Fork Big River (Big River tributary), 25 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_edie_1966_sfbig.pdf). 5 p.

66. Edie, B. (California Department of Fish and Game). 1966. Stream survey: Wages Creek (Pacific Ocean tributary), 25–26 July 1966. California Department of Fish and Game, Mendocino, CA. 2 p.

67. Edie, B. (California Department of Fish and Game). 1967. Stream survey: Marble Gulch Creek (North Fork Noyo River tributary), 16 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_edie_1966_marblegulch.pdf). 3 p.

68. Edie, B. (California Department of Fish and Game). 1967. Stream survey: McMullen Creek (Noyo River tributary), 10 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_edie_1966_mcmullen.pdf). 4 p.

69. Edie, B. (California Department of Fish and Game). 1967. Stream survey: Middle Fork North Fork Noyo River (Noyo River tributary), 18 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_edie_1966_mfofnfnoyo.pdf). 3 p.

70. Edie, B. (California Department of Fish and Game). 1967. Stream survey: South Fork Noyo River (Noyo River tributary), 19 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_edie_1966_sfnoyo.pdf). 3 p.

71. Edwards, R. and R. Klamt (California Department of Fish and Game). 1970. Stream survey: Fay Creek (Salmon Creek tributary), 5 August 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/southsonoma_cdfg_klamt_1970_fayss.pdf). 4 p.

72. Edwards, R. and R. Klamt (California Department of Fish and Game). 1971. Stream survey: East Branch Russian Gulch (Russian Gulch tributary), 3 August 1970. California Department of Fish and Game, Yountville, CA. 4 p.

73. Elwell, R. (California Department of Fish and Game). 1960. Memorandum to files: Dry Creek (Russian River tributary), 16 March 1960. California Department of Fish and Game, Yountville, CA. 2 p.

74. Elwell, R. F. (California Department of Fish and Game). 1958. Stream survey: South Fork Big River (Big River tributary), 8 August 1957 and 8 November 1958. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_elwell_1958_sfbig.pdf). 4 p.

75. Elwell, R. F. (California Department of Fish and Game). 1959. Field note: Mark West Creek (Russian River tributary), 5 March 1959. California Department of Fish and Game, Yountville, CA. 1 p.

76. Emig, J. W. 1984. Fish population survey, Walker Creek, Marin County, 1981. California Department of Fish and Game, Anadromous Fisheries Branch, Administrative Report 84-02: 14 p.

77. Entrix, Inc. , Pacific Watershed Associates, Circuit Rider Productions, The Navarro Watershed Community Advisory Group, and D. T. Sicular. 1998. Navarro River Watershed Restoration Plan. Prepared for Mendocino County Water Agency, California State Coastal Conservancy and Anderson Valley Land Trust Incorporated, Ukiah, CA. 544 p.

78. Ettlinger, E. and G. M. Andrew. 2002. Lagunitas Creek salmon spawner survey report, 2001–2002. Marin Municipal Water District, Corte Madera, CA. 14 p. + appendices.

79. Ettlinger, E., J. Riley, and G. Andrew. 2003. Juvenile salmonid population monitoring report, Lagunitas Creek, Marin County, California, Fall 2002. Marin Municipal Water District, Corte Madera, CA. 37 p.

80. Evans, W. A. (California Department of Fish and Game). 1955. Stream survey: Devils Gulch Creek (Lagunitas Creek tributary), 2 June 1955. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/lagunitas_cdfg_evans_1955_devilsurvey.pdf). 2 p.

81. Farmer, E. and W. J. Peelen (California Department of Fish and Game). 1968. Adult migrant and spawning activity survey: Finley Creek (Salmon Creek tributary), Sonoma County. California Department of Fish and Game, Yountville, CA. 1 p.

82. Fawcett, M. H., J. C. Roth, M. L. Commins, and R. W. Maddox. 1996. Santa Rosa sub-regional long-term wastewater project: anadromous fish migration study program, 1991–1995. Prepared by Merritt Smith Consulting, Environmental Science and Communication, Lafayette, CA for City of Santa Rosa, U. S. Army Corps of Engineers and Harland Bartholomew & Associates Inc., 21 p.

83. Fisk, L. O. (California Department of Fish and Game). 1955. Recommendation for the development of the Navarro River Basin to benefit anadromous fishes. California Department of Fish and Game, Yountville, CA. 12 p.

84. Fong, D. (National Park Service). 2002. Personal communication: email dated 28 August 2002 to P. Adams (NMFS, Santa Cruz Laboratory) regarding coho salmon in unnamed tributary (aka Easkoot Creek) to Bolinas Lagoon, Marin County.

85. Fox, B. and W. Quinn (California Department of Fish and Game). 1964. Stream survey: North Fork Buckeye Creek (Buckeye Creek tributary), 15 September 1964. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/gualala_cdfg_quinn_1964_nfbuckeyess.pdf). 3 p.

86. Fry, D. H., Jr. 1936. Life history of *Hesperoleucus venustus* Snyder. California Fish and Game 22: 65–98.

87. Fullerton, E. C. (California Department of Fish and Game). 1973. Letter dated 5 January 1973 to D. W. Sabiston (State Water Resources Control Board, Sacramento) regarding statement of fish and wildlife resources in Soquel Creek drainage, Santa Cruz County, regarding water rights ajudication. Available from California Department of Fish and Game, Monterey, CA. 2 p.

88. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Bear Gulch (South Fork Noyo River tributary), 9 August 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_beargulch.pdf). 2 p.

89. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Duffy Gulch (Noyo River tributary), 12 August 1957. California Department of Fish and Game, Yountville, CA. 2 p.

90. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Kass Creek (South Fork Noyo River tributary), 10 August 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_kass.pdf). 2 p.

91. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: North Fork South Fork Noyo River (South Fork Noyo River tributary), 9 August 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_nfsfnoyo.pdf). 1 p.

92. Gallagher, J. (California Department of Fish and Game). 1957? Stream survey: Noyo River (headwaters). California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_fromburbeck.pdf). 2 p.

93. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Noyo River (Pacific Ocean tributary), 12 August 1957. California Department of Fish and Game, Yountville, CA. 1 p.

94. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Noyo River (Pacific Ocean tributary), 13 August 1957. California Department of Fish and Game, Yountville, CA. 1 p.

95. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Noyo River (Pacific Ocean tributary), 14 August 1957. California Department of Fish and Game, Yountville, CA. 1 p.

96. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Olds Creek (Noyo River tributary), 13 August 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagheretal_1957_olds.pdf). 4 p.

97. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: Parlin Creek (South Fork Noyo River tributary), 9 August 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_parlin.pdf). 2 p.

98. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: South Fork Noyo River-lower section (Noyo River tributary), 10 August 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_sfnoyol.pdf). 2 p.

99. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: South Fork Noyo River (Noyo River tributary), 9 August 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_sfnoyou.pdf). 2 p.

100. Gallagher, J. (California Department of Fish and Game). 1957. Stream survey: unnamed tributary to the South Fork Noyo River, 10 August 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_gallagher_1957_unnmsfnotrib.pdf). 3 p.

101. Garrett, F. H. 1983. Letter dated 24 August 1983 to A. Grass (California Department of Fish and Game) regarding Schooner Creek restoration efforts. Point Arena, CA. Available from California Department of Fish and Game, Yountville, CA. 2 p.

102. Gibbs, E. (California Department of Fish and Game). 1966. Field note: East Austin Creek (Austin Creek tributary), 11 October 1966. California Department of Fish and Game, Yountville, CA. 1 p.

103. Gilbert, C. H. 1914. Age at maturity of the Pacific coast salmon of the genus *Oncorhynchus*. Bulletin of the United States Bureau of Fisheries 32:1–22 + plates.

104. Gillespie, M. and L. Richardson (California Department of Fish and Game). 1977. Stream survey: Walnut Creek (Suisun Bay tributary), 20–21 July 1977. California Department of Fish and Game, Yountville, CA. 5 p.

105. Gobalet, K. W., P. D. Schultz, T. A. Wake, and N. Siefkin. 2004. Archaeological perspectives on Native American fisheries of California, with emphasis on steelhead and salmon. Transactions of the American Fisheries Society 133: 801–833.

106. Grass, A. (California Department of Fish and Game). 2004. Personal communication: email dated 28 December 2004 to W. Jones (Pacific States Marine Fisheries Commission) regarding historical observations of coho salmon in Jackass Creek.

107. Grass, A. F. 2002. Annual report, Noyo River egg collecting station, 2001–2002. California Department of Fish and Game, Lands and Facilities Branch, Administrative Report. 9 p.

108. Greenwald, W. (California Department of Fish and Game). 1964. Letter dated 26 February 1964 to G. Harn (Olive Springs Quarry) regarding erosion problems at quarry and adverse effects on fishery resources. Available from California Department of Fish and Game, Monterey, CA. 2 p.

109. Greenwald, W. (California Department of Fish and Game). 1966. Memorandum: Russian River drainage investigation. Sent to C. A. McCullogh, San Francisco Bay District, 21 November 1966. California Department of Fish and Game, Yountville, CA. 7 p.

110. Greenwald, W. (California Department of Fish and Game). 1968. Letter dated 26 January 1968 to J. L. Melo (Union Lumber Company) regarding need for fishway on Little Valley Creek. San Francisco, CA. Available from California Department of Fish and Game, Yountville, CA. 2 p.

111. Greenwald, W. (California Department of Fish and Game). 1970. Letter dated 24 June 1970 to Mr. Eugene P. Crummey, Jr. regarding the Russian River and its fishery resources. Available from California Department of Fish and Game, Yountvlle, CA. 2 p.

112. Gualala Redwoods, Inc. 2004. Unpublished data: summary of juvenile survey information for the Gualala River and its tributaries, 1998–2002. Gualala Redwoods, Inc., Gualala, CA. 5 p.

113. Halligan, D. 1998. Salmonid underwater survey report. Prepared by Natural Resources Management Corporation, Eureka, CA for Gualala Redwoods, Inc., Gualala, CA. 3 p.

114. Halligan, D. 2002. Salmonid underwater survey report. Prepared by Natural Resources Management Corporation, Eureka, CA for Gualala Redwoods, Inc., Gualala, CA. 3 p.

115. Halligan, D. (Natural Resources Management Corporation). 2004. Personal communication: email dated 30 April 2004 to B. Spence (NMFS Santa Cruz Laboratory) regarding observations of coho salmon in the Gualala River basin (Sonoma County).

116. Hallock, R. J. and Fry, D. H. J. 1967. Five species of salmon, (*Oncorhynchus*), in the Sacramento River, California. California Fish and Game 53: 5-22.

117. Harris, S. (California Department of Fish and Game). 2001. Unpublished data: electrofishing records for Mendocino County streams, 1983–2001. California Department of Fish and Game, Willits, CA.

118. Harris, S. (California Department of Fish and Game). 2002. Unpublished data: downstream migrant smolt trapping data for Mendocino County streams, 1987–2002. California Department of Fish and Game, Willits, CA.

119. Harris, S. (California Department of Fish and Game). 2003. Unpublished data: list of streams and recent coho salmon occurrence within Jackson Demonstration State Forest. California Department of Fish and Game, Willits, CA. 1 p.

120. Harris, S. (California Department of Fish and Game). 2004. Personal communication: email dated 3 May 2004 to B. Spence (NMFS Santa Cruz Laboratory) regarding coho salmon presence-absence observations in Mendocino County.

121. Harris, S. and M. McNeil. (California Department of Fish and Game). 2002. Electroshocking data sheet: Little North Fork Gualala River (Gualala River tributary), 17 September 2002. California Department of Fish and Game, Yountville, CA. 1 p.

122. Harvard University, Ichthyology Department. 2005. Museum of Comparative Zoology. Cambridge, MA. Online searchable database available at Harvard University Museum of Comparative Zoology web site (www.mcz.harvard.edu/Departments/Fish/).

123. Hawthorne-Campbell Timber Company. 2002. Unpublised data: summary of 2002 coho observations on Hawthorne-Campbell lands. Campbell Timberland Management, Fort Bragg, CA.

124. Hawthorne-Campbell Timber Company. 2002. Unpublished data: electrofishing records for sampling on Hawthorne-Campbell lands from 1993–2002. Hawthorne-Campbell Timber Company, Fort Bragg, CA.

125. Hawthorne-Campbell Timber Company. 2003. Unpublished data: distribution of juvenile coho salmon (*Oncorhynchus kisutch*) on the Hawthorne Timber Company ownership, August–October 2003. Hawthorne-Campbell Timber Company, Fort Bragg, CA.

126. Hayes, S. (National Marine Fisheries Service). 2003. Personal communication: letter dated 11 December 2003 to B. Spence (NMFS Santa Cruz Laboratory) regarding coho salmon observations in the Scott Creek watershed, 2002–2003.

127. Heckel, J. (Mendocino Fisheries Program). 1982. Stream habitat survey: Patsy Creek (North Fork Ten Mile River tributary), 6 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA.

128. Heckel, J. and M. Wilson. (Mendocino Fisheries Program). 1982. Stream habitat survey: Middle Fork Ten Mile River (Ten Mile River tributary), 28 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

129. Holbert, A. G. and R. Lang. (California Department of Fish and Game). 1966. Stream survey: Boulder Creek (San Lorenzo River tributary), 6–16 August 1966. California Department of Fish and Game, Yountville, CA. 4 p.

130. Holman, G. (California Department of Fish and Game). 1965. Field note: Little Valley Creek (Pudding Creek tributary), 2 September 1965. California Department of Fish and Game, Yountville, CA. 1 p.

131. Holman, G. (California Department of Fish and Game). 1965. Stream survey: Bunker Gulch Creek (Hare Creek tributary), 9 September 1965. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_holman_1965_bunkrglch.pdf). 2 p.

132. Holman, G. (California Department of Fish and Game). 1965. Stream survey: Jug Handle Creek (Pacific Ocean tributary), 8 September 1965. California Department of Fish and Game, Yountville, CA. 3 p.

133. Holman, G. (California Department of Fish and Game). 1965. Stream survey: South Fork Hare Creek (Hare Creek tributary), 9 September 1965. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_holman_1965_sfhare.pdf). 2 p.

134. Holman, G. (California Department of Fish and Game). 1968. Memorandum: silver salmon—Russian River drainage, Sonoma County. California Department of Fish and Game, Yountville, CA. 2 p.

135. Holman, G. R. (California Department of Fish and Game). 1959. Stream survey: Bear Gulch (South Fork Noyo River tributary), 18 August 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_holman_1959_beargulch.pdf). 3 p.

136. Holman, G. R. (California Department of Fish and Game). 1965. Field note: Churchman Creek (South Fork Ten Mile tributary), 3 February 1965. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/tenmile_cdfg_holman_1965_chrchmn.pdf). 1 p.

137. Hunter, B. (California Department of Fish and Game). 1982. Letter dated 2 March 1982 to N. deVall (Mendocino County Supervisor) regarding Brush Creek (Pacific Ocean tributary). California Department of Fish and Game, Yountville, CA. Electronic copy of available from Klamath Resource Information System web page (www.krisweb.com/biblio/ garcia_cdfg_hunter_1982_brushletter.pdf). 2 p.

138. Hunter, B. (California Department of Fish and Game). 1987. Letter dated 18 February 1987 to N. deVall (Mendocino County Supervisor) regarding fishery resources in Hutton Gulch (Garcia River tributary). California Department of Fish and Game, Yountville, CA. Electronic copy of available from Klamath Resource Information System web page (www.krisweb.com/biblio/ garcia_cdfg_hunter_1987_ltr2devallfeb.pdf). 2 p.

139. Hunter, B. (California Department of Fish and Game). 1994. Letter dated 29 March 1994 to Hal Slack (California Department of Forestry) regarding fishway repair on James Creek, Mendocino County. Available from California Departmento fo Fish and Game, Yountville, CA. 1 p.

140. Hunter, B. (California Department of Fish and Game). 1996. Letter to Rick Knapp (CalTrans District Office) regarding assistance with fishway construction on Dunn Creek, Mendocino County. Available from California Department of Fish and Game, Yountville, CA.

141. Hunter, B. (California Department of Fish and Game). 1998. Letter dated 14 July 1998 to R. Knapp (CalTrans District Office) regarding concrete barrier on James Creek, Mendocino County. Available from California Department of Fish and Game, Yountville, CA 1 p.

142. Johmann, L. (Guadalupe Coyote Resource Conservation District). 2002. Reported accountings of salmonids in South Bay waters. Unpublished report. Available from National Matine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center, Santa Cruz, CA. 4 p.

143. Johnson, M. L. (California Department of Fish and Game). 1968. Memorandum: Aptos Creek (Pacific Ocean tributary). California Department of Fish and Game, Monterey, CA. 1 p.

144. Johnson, W. C. 1957. A progress report on the Russian River fish population study: 1954-1956. California Department of Fish and Game, Inland Fisheries Administrative Report 57-16: 11 p.

145. Jones, W. (California Department of Fish and Game). 1964. Stream survey: Salmon Creek (Pacific Ocean tributary), 29 April, 1964. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/southsonoma_cdfg_jones_1964_salmonss.pdf). 4 p.

146. Jones, W. (California Department of Fish and Game). 1965. Stream survey: Scotty Creek (Pacific Ocean tributary), 18 March 1965. California Department of Fish and Game, Yountville, CA. 4 p.

147. Jones, W. (California Department of Fish and Game). 1988. Field note: Russian Gulch (Pacific Ocean tributary), Mendocino County. California Department of Fish and Game, Available from W. Jones, Pacific State Marine Fisheries Commission, Ukiah, CA. 1 p.

148. Jones, W. 2001. California coastal salmon and steelhead current stream habitat and distribution table, Mendocino County. for National Marine Fisheries Service, Southwest Region, Santa Rosa, CA. 133 p.

149. Jones, W. E. (California Department of Fish and Game). 2004. Personal communication: phone conversation with B. Spence (NMFS Santa Cruz Laboratory) on 6 February 2004 regarding observations of coho salmon in Mendocino County streams.

150. Jones, W. E. (California Department of Fish and Game). 1969. Memorandum: Arroyo Sausal Creek, Walker Creek drainage, Marin County. California Department of Fish and Game, California. 3 p.

151. Jones, W. E. (California Department of Fish and Game). 1991. Juvenile salmon and steelhead standing crop, Mendocino County. California Department of Fish and Game, Ukiah, California. 11 p.

152. Keller, R. and R. Moore. (California Department of Fish and Game). 1962. Stream survey: Indian Creek (Navarro River tributary), 7–16 August 1962. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_moore_1962_indianss.pdf). 6 p.

153. Kelley, D. W. and D. H. Dettman. 1981. Zayante dam project measures to make it compatible with fish and wildlife resources. Prepared by D. W. Kelley and David H. Dettman in cooperation with H. Esmaili & Associates, Inc Jones and Stokes Associates Inc. and Linsley Kraeger Associates. 76 p. + appendices.

154. Kelley, D. W. and R. C. Reineck, Jr. 1978. Relationship between streamflow and salmonid rearing habitat in Walker and Lagunitas creeks, Marin County. Pp. 127-146 *in* Raising Kent Lake, Focused Environmental Impact Report—Final. Prepared by D. W. Kelley, Aquatic Biologist, Sacramento, CA for Marin Municipal Water District, Corte Madera, CA.

155. Ketcham, B. (National Park Service). 2001. Unpublished data: presence-absence of coho salmon in Marin County coastal streams. National Park Service, Point Reyes Station, CA. 4 p.

156. Ketcham, B. J. and G. G. Brown. 2003. Coho salmon (*Oncorhynchus kisutch*) in Pine Gulch Creek, Marin County, California. National Park Service, Point Reyes National Seashore, Coho Salmon and Steelhead Trout Restoration Program, 2002 monitoring report PORE-NR-WR-03/01: 18 p. + appendices.

157. Kidd, M. 1983. Letter dated 14 June 1983 to A. Grass (California Department of Fish and Game) regarding Booth Gulch (Tributary to Middle fork of Ten Mile River). California Department of Fish and Game, Yountville, CA. Electronic copy available at Klamath Resource Information System website (www.krisweb.com/biblio/tenmile_cdfg_kidd_1983_booth.pdf). 3 p.

158. Kidd, M (California Department of Fish and Game). 1983. Letter dated 15 June 1983 to A. Grass (California Department of Fish and Game) regarding O'Conner Gulch (North Fork Ten Mile River tributary). California Department of Fish and Game, Yountville, CA. Electronic copy available at Klamath Resource Information System website (www.krisweb.com/biblio/ tenmile_cdfg_kidd_1983_oconner.pdf). 1 p.

159. Kimsey, J. B. (California Department of Fish and Game). 1952. Electrofishing: Gualala River, Sonoma County. California Department of Fish and Game, Bureau of Fish Conservation, Eureka, CA.

160. Kimsey, J. B. 1952. Fish rescue and stream improvement work in the North Coast area in 1951. California Department of Fish and Game, Bureau of Fish Conservation Administrative Report. 19 p.

161. Kimsey, J. B. 1953. Fish rescue and stream improvement work in the North Coast in 1952. California Department of Fish and Game, Anadromous Fisheries Branch Administrative Report 53-9: 29 p.

162. Klamt, R. and R. Edwards (California Department of Fish and Game). 1970. Stream survey: Black Rock Creek (East Austin Creek tributary), 11 August 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/ russian_cdfg_xxxx_1970_blackrockss.pdf. 4 p.

163. Klamt, R. and R. Edwards (California Department of Fish and Game). 1970. Stream survey: Sheephouse Creek (Russian River tributary), 13 August 1970. California Department of Fish and Game, Yountville, CA. 4 p.

164. Klamt, R. and R. Edwards (California Department of Fish and Game). 1971. Stream survey: Mark West Creek (Russian River tributary), 17 August 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/ russian_cdfg_klamt_1971_markwestss.pdf). 4 p.

165. Laidig, T. (National Marine Fisheries Service). 2003. Field notes: Pescadero Creek (Pacific Ocean tributary), 10 October 2002. National Marine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center, Santa Cruz, CA.

166. Leidy, R. A. 1983. Distribution of fishes in streams of the Walnut Creek basin, California. California Fish and Game 69: 23–32.

167. Leidy, R. A. 1984. Distribution and ecology of stream fishes in the San Francisco Bay drainage. *Hilgardia* 52: 1–175.

168. Leidy, R. A., G. Becker, and B. N. Harvey. (in press). Historical status of coho salmon in streams of the urbanized San Francisco Estuary, California. California Fish and Game 91(4): 000–000

169. Maahs, M. (Salmon Trollers Marketing Association). 1996. Letter dated 4 March 1996 to Humboldt County Resource Conservation District regarding salmon spawning survey status report. Salmon Trollers Marketing Association, Fort Bragg, CA. 5 p.

170. Maahs, M. 1997. Salmonid spawning survey for portions of the Ten Mile River, Garcia River, and Caspar Creek, 1996–1997. Salmon Trollers Marketing Association, Inc., Fort Bragg, CA. 28 p.

171. MacMillan, A. and D. Jones. (California Conservation Corps). 1996. Electrofishing field form: Dead Horse Gulch (North Fork Navarro River tributary), 9 July 1996. California Department of Fish and Game, Fortuna, CA. 1 p.

172. MacMillan, A. and D. Jones (California Conservation Corps). 1996. Electrofishing field form: Marsh Gulch (Navarro River tributary), 16 July 1996. California Department of Fish and Game, Fortuna, CA. 1 p.

173. MacMillan, A. and D. Jones (California Conservation Corps). 1996. Electrofishing field form: unnamed tributary aka Blackrock Creek (Navarro River tributary), 18 July 1996. California Department of Fish and Game, Fortuna, CA. 1 p.

174. Mendocino Redwood Company. 1999. Section F. Fish Habitat Assessment. Pp. F1-F34 *in* Albion River watershed analysis. Mendocino Redwood Company, Calpella, CA.

175. Mendocino Redwood Company, LLC. 2002. Aquatic species distribution on Mendocino Redwood Company forestlands: 1994–1996 and 2000–2002. Mendocino Redwood Company, LLC, Watershed and Fisheries Department, Fort Bragg, CA. 6 p. + appendices.

176. Mesman, C. (California Conservation Corps). 1996. Electrofishing field form: Tank 4 Gulch (Flynn Creek tributary), 3 July 1996. California Department of Fish and Game, Fortuna, CA. 2 p.

177. Mesman, C., C. Coyle, A. MacMillan, and D. Jones (California Conservation Corps). 1996. Electrofishing field form: Flynn Creek (North Fork Navarro River tributary), 3–12 July 1996. California Department of Fish and Game, Fortuna, CA. 3 p.

178. Michaels, J. and J. Thompson (California Department of Fish and Game). 1966. Stream survey: Schooner Gulch Creek (Pacific Ocean tributary), 26 August 1969. California Department of Fish and Game, Yountville, CA. 4 p.

179. Moore, R. L. (California Department of Fish and Game). 1961. Stream survey: Salmon Creek (Pacific Ocean tributary), 28–29 December 1961. California Department of Fish and Game, Yountville, CA. 3 p.

180. Moore, R. L. (California Department of Fish and Game). 1962. Field note: Tanner [sic] Creek (Salmon Creek tributary). California Department of Fish and Game, Yountville, CA. 1 p.

181. Morehouse, J. (California Department of Fish and Game). 1959. Stream survey: Daugherty Creek (South Fork Big River tributary), 11 August 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_morehouse_1959_daugcrk.pdf). 6 p.

182. Morehouse, J. (California Department of Fish and Game). 1959. Stream survey: Little North Fork Big River (Big River tributary), 8 March 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_morehouse_1959_lnfbig.pdf). 5 p.

183. Morehouse, J. (California Department of Fish and Game). 1959. Stream survey: Parlin Creek (South Fork Noyo River tributary). California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_morehouse_1959_parlin.pdf). 4 p.

184. Morehouse, J. and S. Nye (California Department of Fish and Game). 1959. Stream survey: Kass Creek (South Fork Noyo River tributary), 26 August 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_nye_1959_kass.pdf). 3 p.

185. Morehouse, J. and S. Nye (California Department of Fish and Game). 1959. Stream survey: North Fork South Fork Noyo River (Noyo River tributary), 20-24 August 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_nye_1959_nfsfnoyo.pdf). 4 p.

186. Morehouse, J. and S. Nye (California Department of Fish and Game). 1959. Stream survey: South Fork of the Noyo River (Noyo River tributary), 24–25 August 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_nye_1959_sfnoyo.pdf). 3 p.

187. Murphy, G. I. 1950. Returns from marked fall spawning rainbow trout planted in several Mendocino County coastal streams in 1948. California Department of Fish and Game , Unpublished report to the Bureau of Fish Conservation. 6 p.

188. Nakamoto, R. 1999. 1998–1999 Annual report: Section 10 Permit Number 1071. USDA Forest Service, Pacific Southwest Research Station, Arcata, CA. 21 p.

189. Nakamoto, R. J. 1998. Effects of timber harvest on aquatic vertebrates and habitat in the North Fork Casper Creek. U. S. Department of Agriculture, USDA Forest Service General Technical Report PSW-GTR-168: 87–95.

190. Namba, L., J. Lee, and A. Florendo (California Department of Fish and Game). 1978. Stream survey: Hulbert Creek (Russian River tributary), 16 and 19 June 1978. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_namba_1978_hulbertss.pdf). 3 p.

191. National Marine Fisheries Service. 2001. Unpublished data: coho observations made during NMFS 2001 steelhead genetics survey. National Marine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center, Santa Cruz, CA.

192. National Marine Fisheries Service. 2003. Unpublished data: summary of coho and steelhead observed during snorkel surveys of the South Fork Noyo River and tributaries, 2000–2002. National Marine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center, Santa Cruz, CA. 2 p.

193. Needham, P. R. and R. Gard. 1959. Rainbow trout in Mexico and California with notes on the cutthroat series. University of California Publications in Zoology 67: 1–124.

194. Nelson, J. (California Department of Fish and Game). 2001. Personal communication: phone conversion with B. Spence (NMFS Santa Cruz Laboratory) on 9 March 2001 regarding observations of coho salmon in Santa Cruz and San Mateo counties.

195. Nelson, J., T. Laidig, T. Anderson, A. Renger, and D. Fisher. (California Department of Fish and Game, NMFS, WSP/Americorps, California Conservation Corps). 1996. Stream inventory report: San Vicente Creek (Pacific Ocean tributary), 16–21 October 1995. California Department of Fish and Game, Monterey, CA. 11 p.

196. Netherby, D. (California Department of Fish and Game). 1966. Stream survey: Freezeout Creek (Russian River tributary), 4 March 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_netherby_1966_freezeoutss.pdf. 3 p.

197. Netherby, D. and K. Rockwood (California Department of Fish and Game). 1966. Stream survey: Fish Rock Gulch (Pacific Ocean tributary), 6 April 1966. California Department of Fish and Game, Yountville, CA. 3 p.

198. Netherby, D. and K. Rockwood (California Department of Fish and Game). 1966. Stream survey: Greenwood Creek (Pacific Ocean tributary), 13–14 April 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_xxxx_1966_greenwoodss.pdf). 2 p.

199. Netherby, D. and K. Rockwood (California Department of Fish and Game). 1966. Stream survey: Schooner Gulch Creek (Pacific Ocean tributary), 5 April 1966. California Department of Fish and Game, Yountville, CA. 3 p.

200. Netherby, D. and K. Rockwood (California Department of Fish and Game). 1966. Stream survey: West Branch Russian River. California Department of Fish and Game, Yountville, CA.

201. Netherby, D. and K. Rockwood (California Department of Fish and Game). 1966. Stream survey: York Creek (West Branch Russian River tributary), 15 March 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_netherbyetal_1966_yorkss.pdf). 3 p.

202. Nielsen, J. L., M. Maahs, and G. Balding. 1990. Anadromous salmonid resources of Mendocino coastal and inland rivers, 1989–1990: an evaluation of rehabilitation efforts based on carcass recovery and spawning activity. Work Progress Report, Contract No. FG9364. Prepared for California Department of Fish and Game. 110 p.

203. Nye, S. N. (California Department of Fish and Game). 1959. Stream survey: Russell Brook Creek (Big River tributary), 5 August 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_nye_1959_russellbrook.pdf). 4 p.

204. Nye, S. N. and H. Adams (California Department of Fish and Game). 1961. Stream survey: Campbell Creek, Ten Mile River. California Department of Fish and Game, 3 p.

205. Nye, S. N. and G. Apsley (California Department of Fish and Game). 1962. Stream survey: Little Butano Creek (Butano Creek tributary), 10–17 August 1962. California Department of Fish and Game, Yountville, CA. 6 p.

206. Nye, S. N., W. Jones, J. Crowdus, H. Adams, and J. Santos. (California Department of Fish and Game). 1961. Stream survey: South Fork Ten Mile River (Ten Mile River tributary), 16–20 September 1961. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/tenmile_cdfg_nye_1961_sften.pdf). 6 p.

207. Parke, C. W. and R. Klamt (California Department of Fish and Game). 1971. Stream survey: Middle Branch Russian Gulch (Russian Gulch tributary), 2 July 1970. California Department of Fish and Game, Yountville, CA. 4 p.

208. Parke, C. W. and R. R. Klamt (California Department of Fish and Game). 1970. Stream survey: Fort Ross Creek (Pacific Ocean tributary), 25 June 1970. California Department of Fish and Game, Yountville, CA. 4 p.

209. Parke, C. W. and R. R. Klamt (California Department of Fish and Game). 1970. Stream survey: Haupt Creek (Wheatfield Fork Gualala River tributary), 24 June 1970. California Department of Fish and Game, Yountville, CA. 3 p.

210. Parke, C. W. and R. R. Klamt (California Department of Fish and Game). 1970. Stream survey: Hulburt [sic] Creek (Russian River tributary), 6 July 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_parkeetal_1970_hulbertss.pdf). 3 p.

211. Parke, C. W. and R. R. Klamt (California Department of Fish and Game). 1970. Stream survey: Mission Creek (aka tributary #1 to Hulburt [sic] Creek), 8 July 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/ussian_cdfg_parkeetal_1970_missionss.pdf). 3 p.

212. Parke, C. W. and R. R. Klamt (California Department of Fish and Game). 1971. Stream survey: Fuller Creek (Wheatfield Fork Gualala River tributary), 22 June 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/gualala_cdfg_klamtetal_1970_fullerss.pdf). 4 p.

213. Parke, C. W. and R. R. Klamt (California Department of Fish and Game). 1971. Stream survey: North Fork Fuller Creek (Fuller Creek tributary), 19 June 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/gualala_cdfg_klamtetal_1970_nffullerss.pdf). 4 p.

214. Parke, C. W. and R. R. Klamt (California Department of Fish and Game). 1971. Stream survey: South Fork Fuller Creek (Fuller Creek tributary), 18 June 1970. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/gualala_cdfg_klamtetal_1970_nffullerss.pdf). 4 p.

215. Parker, C. A. (California Department of Fish and Game). 1964. Stream survey: Franchini Creek (Buckeye Creek tributary), 29 August 1964. California Department of Fish and Game, Yountville, CA. 3 p.

216. Parker, C. J. and R. L. Pool (California Department of Fish and Game). 1964. Stream survey: Haupt Creek (Wheatfield Fork Gualala River tributary), 25 August 1964. California Department of Fish and Game, Yountville, CA. 3 p.

217. Pereksta, D. M. 1996. Fish and Wildlife coordination act report: San Lorenzo habitat restoration study Santa Cruz County, California. U. S. Fish and Wildlife Service, 14 p.

218. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: Camp Creek (Rancheria Creek tributary), 27 June 1969. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_peters_1969_camp.pdf). 2 p.

219. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: Dago Creek (Rancheria Creek tributary), 24 June 1969. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_peters_1969_dago.pdf). 1 p.

220. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: German Creek (Camp Creek tributary), 25 June 1969. California Department of Fish and Game, Yountville, CA. 1 p.

221. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: Gut Creek (Indian Creek tributary), 16 July 1969. California Department of Fish and Game, Yountville, CA. 1 p.

222. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: Ham Canyon Creek (Rancheria Creek tributary), 2 July 1969. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_peters_1969_hamcanyon.pdf). 1 p.

223. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: Horse Creek (Rancheria Creek tributary), 29 July 1969. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_peters_1969_horsess.pdf). 2 p.

224. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: Indian Creek (Navarro River tributary), 8 July 1969. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_peters_1969_indianss.pdf). 2 p.

225. Peters, D. and D. Ayers (California Department of Fish and Game). 1969? Stream survey: North Fork Indian Creek (Indian Creek tributary). California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_peters_1969_nfindianss.pdf). 2 p.

226. Peters, D. and D. Ayers (California Department of Fish and Game). 1969. Stream survey: West Branch Indian Creek (Indian Creek tributary), 8 July 1969. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_peters_1969_wbindianss.pdf). 2 p.

227. Pintler, H. E. (California Department of Fish and Game). 1954. Field note: North Fork Navarro River (Navarro River tributary), 5 June 1954. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_pintler_1954_efishingfn.pdf). 1 p.

228. Pintler, H. E. (California Department of Fish and Game). 1954. Field note: Pudding Creek. California Department of Fish and Game, Yountville, CA. 3 p.

229. Pintler, H. E. 1956. The results of a fish population sampling program on the San Lorenzo River, Santa Cruz County, California. California Department of Fish and Game, Inland Fisheries Administrative Report 56-26: 20 p.

230. Pintler, H. E. (California Department of Fish and Game). 1957. Stream survey: Pudding Creek (Pacific Ocean tributary), 27–28 May 1957. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_pintler_1957_pudding.pdf). 4 p.

231. Pister, E. P. 1965. Population sampling on three north coastal streams closed to summer trout fishing—1955 season. California Department of Fish and Game, Inland Fisheries Administrative Report 65-12: 8 p.

232. Plumb, D. and M. Davis (Mendocino Fisheries Program). 1982? Stream habitat survey: North Fork Ten Mile River (Ten Mile River tributary). Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

233. Plumb, D. and R. Ubry (Mendocino Fisheries Program). 1982. Stream habitat survey: Redwood Creek (South Fork Ten Mile River tributary), 14 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

234. Pool, R. L. and C. J. Parker (California Department of Fish and Game). 1964. Stream survey: Sproule Creek. California Department of Fish and Game, Yountville, CA. 3 p.

235. Primbs, E. and B. Fox (California Department of Fish and Game). 1964. Stream survey: Buckeye Creek (Gualala River tributary), 27–28 August 1964. California Department of Fish and Game, Yountville, CA. 2 p.

236. Primbs, E. N. G. [sic] (California Department of Fish and Game). 1966. Stream survey: Little Juan Creek (Juan Creek tributary), 29 July 1966. California Department of Fish and Game, Yountville, CA. 2 p.

237. Primbs, E. R. J. (California Department of Fish and Game). 1965. Stream survey: East Branch Russian Gulch Creek (Russian Gulch tributary), 23 and 27 July 1965. California Department of Fish and Game, Yountville, CA. 4 p.

238. Primbs, E. R. J. (California Department of Fish and Game). 1965. Stream survey: Fay Creek (Salmon Creek tributary), 4 August 1965. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/southsonoma_cdfg_primbs_1965_fayss.pdf). 4 p.

239. Primbs, E. R. J. (California Department of Fish and Game). 1965. Stream survey: Finley Creek (Salmon Creek tributary), 2 August 1965. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/southsonoma_cdfg_primbs_1965_finleyss.pdf). 4 p.

240. Primbs, E. R. J. (California Department of Fish and Game). 1965. Stream survey: Hare Creek (Pacific Ocean tributary), 9 September 1965. California Department of Fish and Game, Yountville, CA. 5 p.

241. Primbs, E. R. J. (California Department of Fish and Game). 1965. Stream survey: Pudding Creek (Pacific Ocean tributary), 2 Sept 1965. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1965_pudding.pdf). 6 p.

242. Primbs, E. R. J. (California Department of Fish and Game). 1965. Stream survey: Russian Gulch Creek (Pacific Ocean tributary), 31 August 1965. California Department of Fish and Game, Yountville, CA. 4 p.

243. Primbs, E. R. J. (California Department of Fish and Game). 1966. Field note: Mitchell Creek (Pacific Ocean tributary), 31 March 1966. California Department of Fish and Game, Yountville, CA. 3 p.

244. Primbs, E. R. J. (California Department of Fish and Game). 1966. Stream survey: Big Salmon Creek (Pacific Ocean tributary), 24 July 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_primbs_1966_bigsalmonss.pdf). 3 p.

245. Primbs, E. R. J. (California Department of Fish and Game). 1966. Stream survey: Hayworth Creek (North Fork Noyo River tributary), 22 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1966_hayworth.pdf). 4 p.

246. Primbs, E. R. J. (California Department of Fish and Game). 1967. Stream survey: Duffy Gulch (Noyo River tributary), 26 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1966_duffygulch.pdf). 2 p.

247. Primbs, E. R. J. (California Department of Fish and Game). 1967. Stream survey: Kass Creek (South Fork Noyo River tributary), 24 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1966_kass.pdf). 4 p.

248. Primbs, E. R. J. (California Department of Fish and Game). 1967. Stream survey: North Fork Noyo River (Noyo River tributary), 17 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1966_nfnoyo.pdf). 4 p.

249. Primbs, E. R. J. (California Department of Fish and Game). 1967. Stream survey: Olds Creek (Noyo River tributary), 9 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1966_olds.pdf). 3 p.

250. Primbs, E. R. J. (California Department of Fish and Game). 1967. Stream survey: Redwood Creek (Noyo River tributary), 14 August 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_primbs_1966_redwood.pdf). 4 p.

251. Regnart, R. and K. Middleton (California Department of Fish and Game). 1958. Stream survey: Halleck Creek (Nicasio Creek tributary), 8 and 14 August 1958. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/lagunitas_cdfg_middleton_1958_halleck.pdf). 3 p.

252. Reineck, R. and M. Cogger. 1977. Stream Survey: Pine Creek (Walnut Creek tributary), Contra Costa County, 16 August 1977. California Department of Fish and Game,

253. Retherford, P., T. Behm, and D. Albin (WSP/Americorps and California Department of Fish and Game). 1998. Stream inventory report: Little Mill Creek (Mill Creek tributary), 8 August and 28 September 1998. California Department of Fish and Game, Yountville, CA. 10 p. + appendices.

254. Rhodes, R. and M. Wilson (Mendocino Fisheries Program). 1982. Stream habitat survey: mainstem Caspar Creek (aka North Fork Caspar Creek; Pacific Ocean tributary), 13 August 1982. Available from California Department of Fish and Game, Yountville, CA. 1 p.

255. Rhodes, R. and J. Heckel (Mendocino Fisheries Program). 1982. Stream habitat survey: South Fork Ten Mile River (Ten Mile River tributary), 8 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

256. Rhodes, R. and J. Heckel (Mendocino Fisheries Program). 1982. Stream habitat survey: South Fork Ten Mile River (Ten Mile River tributary), 8 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

257. Rhodes, R. and J. Steffens (Mendocino Fisheries Program). 1982. Stream habitat survey: North Fork Ten Mile River (Ten Mile River tributary), 25 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

258. Rich, A. A. 1990. The impacts of timber harvest practices on the fishery resources of the Navarro River watershed, Mendocino County, California. Phase III: fishery resources and baseline surveys, 1989–1990. Prepared by A. A. Rich and Associates, San Anselmo, CA for Louisiana-Pacific Corporation, Samoa, CA.

259. Rockwood, K. and D. Netherby (California Department of Fish and Game). 1966. Stream survey: Salt Hollow Creek (Russian River tributary), 18 March 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_rockwood_1966_salthollowss.pdf). 3 p.

260. Rockwood, K. and D. Netherby (California Department of Fish and Game). 1966. Stream survey: Seward Creek (Forsythe Creek tributary), 16 March 1966. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_rockwood_1966_sewardss.pdf). 2 p.

261. Roth, J. C., M. H. Fawcett, M. L. Commins, and R. W. Maddox. 1995. Santa Rosa sub-regional long-term wastewater project: anadromous fish migration study program, 1991–1994. Prepared by Merritt Smith Consulting, for Harland Bartholomew Associates and the City of Santa Rosa, Santa Rosa, CA. 84 p.

262. Rowell, J. and H. Adams (California Department of Fish and Game). 1961. Stream survey: Little Bear Haven Creek (Middle Fork Ten Mile River tributary), 21 July 1961. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/tenmile_cdfg_adams_1961_ltlbearhvn.pdf). 3 p.

263. Rowell, J. and H. Adams (California Department of Fish and Game). 1961. Stream survey: Little North Fork Ten Mile (North Fork Ten Mile tributary), 14–15 August 1961. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/tenmile_cdfg_xxxx_1961_lnften.pdf). 2 p.

264. Rowell, J. and B. Fox (California Department of Fish and Game). 1964. Stream survey: Fuller Creek (Wheatfield Fork Gualala River tributary), 18–19 August 1964. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/gualala_cdfg_rowell_1964_fullerss.pdf). 3 p.

265. Rowell, J. and D. Lollock (California Department of Fish and Game). 1959. Stream survey: Two Log Creek (Big River tributary), 28 July 1959. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_rowell_1959_twolog.pdf). 6 p.

266. Rowell, J., C. Parker, and B. Fox (California Department of Fish and Game). 1964. Stream survey: North Fork Fuller Creek (Fuller Creek tributary), 18–19 August 1964. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/gualala_cdfg_parker_1964_nffullerss.pdf). 3 p.

267. Santos, J. (California Department of Fish and Game). 1961. Stream survey: Abalobadiah Gulch (Pacific Ocean tributary), 28 August 1961. California Department of Fish and Game, Yountville, CA. 3 p.

268. Santos, J. (California Department of Fish and Game). 1962. Stream survey: Maacama Creek (Russian River tributary), 18–20 September 1962. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_santos_1963_maacamass.pdf). 4 p.

269. Shannon, W. T. (California Department of Fish and Game). 1962. Letter dated 12 April 1962 to Col. J. A. Morrison (U. S. Army Corps of Engineers) regarding studies of feasibility to construct dams and reservoirs on Soquel Creek. Available from California Department of Fish and Game, Monterey, CA. 1 p.

270. Shapovalov, L. Recommendations for the management of Arroyo Corte Madera del Presidio and Old Mill Creek, Marin County, CA. California Department of Fish and Game, Inland Fisheries Branch Administrative Report No 46-5: 7 p.

271. Shapovalov, L. (California Department of Fish and Game). 1940. Stream survey: Russian Gulch (Pacific Ocean tributary), 21 May 1940. California Department of Fish and Game, Yountville, CA. 1 p.

272. Shapovalov, L. 1944. Preliminary report on the fisheries of the Russian River system, California. Bureau of Fish Conservation, California Division of Fish and Game, Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/krisrussian/krisdb/html/krisweb/biblio/russian_cdfg_shapovalov_1944.pdf. 8 p.

273. Shapovalov, L. (California Department of Fish and Game). 1948. Field note: Indian Creek (Navarro River tributary), 18 August 1948. California Department of Fish and Game, Bureau of Fish Conservation, Yountville, CA. Electronic copy of memo available from Klamath Resource Information System web page (www.krisweb.com/biblio/navarro_cdfg_shapovalov_1948_indianfn.pdf). 2 p.

274. Shapovalov, L. (California Department of Fish and Game). 1948. Juan Creek (Pacific Ocean tributary), Mendocino County. California Department of Fish and Game, Bureau of Fish Conservation, Stanford, CA. Available from California Department of Fish and Game,Yountville, CA. 1 p.

275. Shapovalov, L. 1949. Fish rescue and stream improvement work in the North Coast area in 1945. California Department of Fish and Game, Bureau of Fish Conservation Administrative Report 49-26: 11 p.

276. Shapovalov, L. and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*) with special reference to Waddell Creek, California, and recommendations regarding their management. California Department of Fish and Game Fish Bulletin 98: 375 p.

277. Sibbald, G. and M. Davis (Mendocino Fisheries Program). 1982. Stream habitat survey: Redwood Creek (South Fork Ten Mile River tributary), 14 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

278. Sibbald, G. and M. Davis (Mendocino Fisheries Program). 1982. Stream habitat survey: unnamed tributary to Redwood Creek (South Fork Ten Mile River tributary), 14 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

279. Sibbald, G. and S. Heckel (Mendocino Fisheries Program). 1982. Stream habitat survey: unnamed tributary (aka Section 2 Creek; Little North Fork Ten Mile River tributary), 22 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

280. Smith, J. J. 1998. Steelhead and other fish resources of western Mt. Hamilton streams. Department of Biological Sciences, San Jose State University, San Jose, CA. 17 p.

281. Smith, J. J. 2001. Distribution and abundance of juvenile coho and steelhead in Redwood Creek in fall 2001. San Jose State University, Department of Biological Sciences, San Jose, CA. 10 p.

282. Smith, J. J. 2002. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell, and Scott Creeks in 2002. San Jose State University, Department of Biological Sciences, San Jose, CA. 30 p.

283. Smith, J. J (San Jose State University). 2003. Personal communication: email dated 21 October 2003 to M. Kilgour (NMFS Santa Cruz Laboratory) regarding observations of coho salmon in tributaries of the San Lorenzo River and surrounding area during the 1980s.

284. Smith, J. J. (San Jose State University). 2005. Personal communication: conversation with B. Spence (NMFS Santa Cruz Laboratory) in March 2005 regarding observations of coho salmon in Coyote Creek made in the late 1950s by L. J. Hendricks.

285. Snider, W. M. 1985. Instream flow requirements of anadromous salmonids, Brush Creek, Mendocino County, California. California Department of Fish and Game, Environmental Services Branch, Stream Evaluation Report Number 85-1: 33 p.

286. Snyder, J. O. 1914. Fishes of the streams tributary to Monterey Bay, California. Bulletin of the United States Bureau of Fisheries 32: 49–72.

287. Snyder, R. U. (California Department of Fish and Game). 2003. Letter dated 19 November 2003 to M. Kilgour (NMFS Santa Cruz Laboratory) regarding coho presence in Tramway Gulch, Johnson Creek, and Dunn Creek. Yountville, California. 1 p. + attachments.

288. Stanley, J. T., J. J. Smith, D. W. Alley, D. Matias, and B. Elsey. 1982. Fish habitat assessments for Santa Cruz County streams. Prepared by Harvey and Stanley Associate, Inc., Alviso, CA for John Gichrist and Associates and the Santa Cruz County Planning Department, Santa Cruz, CA. Preliminary Draft, File #139-01. 74 p.

289. State Division of Water Resources 1952. Estimated minimum flow during July in coastal streams possessing no records of flow and draining the west slope of the coast range between San Luis Obispo and Crescent City. State Division of Water Resources, Available from California Department of Fish and Game, Yountville, CA. 3 p.

290. State Water Resources Control Board. 1982. Draft staff report for fact-finding hearing, Zayante Creek/Lower San Lorenzo River and the upper San Lorenzo River instream beneficial use protection program. Prepared by staff of State Water Resources Control Board, 59 p. + appendices.

291. Steffens, J. and R. Rhodes (Mendocino Fisheries Program). 1982. Fish Passage Inventory: North Fork Ten Mile River (Ten Mile River tributary), 25 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 6 p.

292. Steffens, J. and R. Rhodes (Mendocino Fisheries Program). 1982. Stream habitat survey: Middle Fork Ten Mile River (Ten Mile River tributary), 30 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

293. Steiner, T. and J. B. Knox. 1999. Fish rescue and relocation in the tributaries of San Geronimo Creek (Lagunitas watershed) in 1999. Salmon Protection and Watershed Network, Forest Knolls, CA. 7 p.

294. Stout, B. (California Department of Fish and Game). 1965. Stream survey: Coleman Valley Creek (Salmon Creek tributary), 3 August 1965. California Department of Fish and Game , Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/southsonoma_cdfg_stout_1965_colemanss.pdf). 4 p.

295. Stout, B. (California Department of Fish and Game). 1965. Stream survey: Russian Gulch Creek (Pacific Ocean tributary), 29 July 1965. California Department of Fish and Game, Yountville, CA. 3 p.

296. Stout, B. (California Department of Fish and Game). 1965. Stream survey: Tanner [sic] Creek (Salmon Creek tributary), 5 August 1965. California Department of Fish and Game, Yountville, CA. 3 p.

297. Stout, B. (California Department of Fish and Game). 1965. Stream survey: West Branch Russian Gulch Creek (Russian Gulch Creek tributary), 22 July 1965. California Department of Fish and Game, Yountville, CA. 3 p.

298. U.S. Fish and Wildlife Service. 1962. A detailed report on fish and wildlife resources affected by Dry Creek project, Russian River, basin, California. U. S. Department of Interior, Portland, OR.

299. Ubry, R. (Mendocino Fisheries Program). 1982? Stream habitat survey: Middle Fork Ten Mile River (Ten Mile River tributary), summer 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

300. Ubry, R. and G. Sibbald (Mendocino Fisheries Program). 1982. Stream habitat survey: Middle Fork Ten Mile River (Ten Mile River tributary), 29 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

301. Ubry, R. and G. Sibbald (Mendocino Fisheries Program). 1982. Stream habitat survey: unnamed tributary (aka Section 14 Creek; North Fork Ten Mile River tributary), 25 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

302. Ubry, R. and G. Sibbald (Mendocino Fisheries Program). 1982. Stream habitat survey: unnamed tributary (aka Section 24 Creek; North Fork Ten Mile River tributary), 25 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 2 p.

303. Ubry, R. and J. Steffens (Mendocino Fisheries Program). 1982. Stream habitat survey: Little North Fork Ten Mile River (Ten Mile River tributary), 22 June 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

304. Ulmer, L. (California Department of Fish and Game). 1988. Letter dated 21 October 1988 to Lt. J. Peabody regarding dewatering of East Branch of Soquel Creek, Santa Cruz County, fishery impact assessment. 3 p.

305. USFWS (U.S. Fish and Wildlife Service). 1968. Memorandum from a Fish and Wildlife Biologist to Files: Analysis of fish habitat of Napa River and tributaries, Napa County, California, with emphasis given to steelhead trout production. U.S. Fish and Wildlife Service,

306. Van Zandt, M. and W. Jones (California Department of Fish and Game). 1975. Stream survey: Mallo Pass Creek (Pacific Ocean tributary), 21 August–19 September 1975. California Department of Fish and Game, Yountville, CA. 3 p.

307. Vestal, E. (California Department of Fish and Game). 1966. Memorandum: Russian Gulch, tributary to Bodega Bay, Marin County—note on occurrence of silver salmon by retired fish and game warden, Lee Shea. California Department of Fish and Game, Yountville, CA. 1 p.

308. Walder, R. (Salmon Protection and Watershed Network). 2003. Personal communication: phone conversion with B. Spence (NMFS Santa Cruz Laboratory) in December 2003 regarding observations of coho salmon in the unnamed stream known as Candellero Creek (San Geronimo Creek tributary).

309. Walder, R. and T. Steiner. 2002. Coho spawning in 2001–02 in the San Geronimo sub-watershed, with opportunistic notes on steelhead. Salmon Protection and Watershed Network, Forest Knolls, CA. 7 p.

310. Walder, R. K. and T. Steiner. 2001. Relocation of stranded native fishes from isolated pools in the San Geronimo Creek system, 2001. Salmon Protection and Watershed Network, Forest Knolls, CA. 13 p.

311. Walder, R. K., T. Steiner, and G. Kang. 2003. Relocation of stranded native fishes from isolated pools in the San Geronimo Creek system, 2002. Salmon Protection and Watershed Network, Forest Knolls, CA. 11 p.

312. Williams, T. H. (National Marine Fisheries Service). 2001. Summary of fish collected by electrofishing in Oat, Big, and Kinsey Creeks, Humboldt County, May 24-25, 1999. National Marine Fisheries Service, Fisheries Ecology Division, Southwest Fisheries Science Center, Santa Cruz, CA. 2 p.

313. Wilson, M. and J. Steffens (Mendocino Fisheries Program). 1982. Stream habitat survey: Churchman Creek (South Fork Ten Mile River tributary), 7–14 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

314. Wilson, M. and J. Steffens (Mendocino Fisheries Program). 1982. Stream habitat survey: South Fork Ten Mile River (Ten Mile River tributary), 8 July 1982. Center for Education and Manpower Resources, Ukiah, CA. Available from California Department of Fish and Game, Arcata, CA. 1 p.

315. Wood, R. and W. H. Thomson. 1967. A report to the California State Water Rights Board on the effect of Application No. 22111, for unappropriated water from Love Creek, Santa Cruz County, California, on fish and wildlife resources. California Department of Fish and Game, San Francisco, CA. 9 p.

316. Wooster, T. (California Department of Fish and Game). 1988. Memorandum: electrofishing in Hatch Gulch Creek (Big River tributary), 25 October 1988. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_wooster_1988_hatgulcrk.pdf). 2 p.

317. Wooster, T. (California Department of Fish and Game). 1988. Memorandum to files: electrofishing in Daugherty Creek (South Fork Big River tributary), 10 October 1988. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/big_cdfg_wooster_1988_daugcrk.pdf). 2 p.

318. Worsely, P. F. 1972. The commercial and sport fishery. Page 135–141 *in* Tomales Bay Study Compendium of Reports.Reprint: .

319. Young, K. and J. Jahn (WSP/Americorps). 1995. Stream inventory report: unnamed Parlin Creek tributary aka Waldo Gulch (South Fork Noyo River tributary), 3–4 October 1995. California Department of Fish and Game, Yountville, CA. Electronic copy of survey available from Klamath Resource Information System web page (www.krisweb.com/biblio/noyo_cdfg_xxxx_1995_parlinwaldosir.pdf). 3 p.

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