Galbreath Special Status Species Assessment – Fish, Amphibians, & Reptiles.

Before I worked on this project, I had no idea how to apply GIS to basic ecological concepts. – Christoph Schopfer, Geography Major

Project Summary

A team of students and Center staff mapped potential habitat for 110 special status plants and animals on the Galbreath Wildlands Preserve. We identified special status species with potential to occur in the Galbreath Preserve using existing agency databases and publications. These included fungi, bryophytes, plants, invertebrates, amphibians, reptiles, birds and mammals. For each species, we collected biological information, undertook GIS-based habitat suitability analysis, and assessed the likelihood of occurrence within preserve boundaries. The project created professional experience for Biology and Geography undergraduates and graduate students who worked on an interdisciplinary team to develop assessment techniques and methods. See Methods (PDF) and Species List (PDF) for additional information.

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Funding: Robert and Sue Johnson Family

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Fish, Amphibians, & Reptiles

These results are part of a larger assessment of all special status species with potential to occur at the Galbreath Wildlands Preserve. Assessments were conducted as planning exercise and do not constitute evidence of occurrence

Osteichthyes (Bony Fishes)

Oncorhynchus kisutch, Coho Salmon: ONKI Text, ONKI Map

**Oncorhynchus mykiss,* Northern California Steelhead: ONMY Text, ONMY Map

Oncorhynchus tshawytscha, California Coastal Chinook Salmon: ONTS Text, ONTS Map

Caudata (Salamanders)

Rhyacotriton variegatus, Southern Torrent Salamander: RYVA Text, RYVA Map

Anura (Frogs)

Ascaphus truei, Western Tailed Frog: ASTR Text, ASTR Map

**Rana boylii,* Foothill Yellow-Legged Frog: RABO Text, RABO Map

Rana draytonii, California Red-Legged Frog: RADR Text, RADR Map

Reptilia (Reptiles)

**Actinemys marmorata,* Western Pond Turtle: ACMA Text, ACMA Map

Coho Salmon - Central California Coast ESU (Oncorhynchus kisutch)

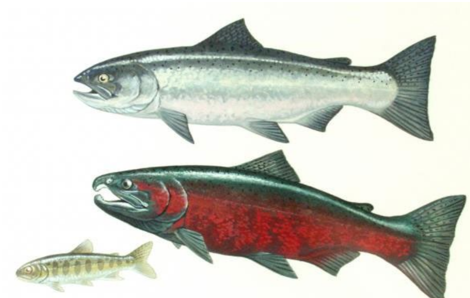
Potential Occurrence: Unlikely to Occur

Status:

Federal: Endangered

State: Endangered

Other: G4 S2



Painting: ©Shari Erickson

Species Description:

The size of an adult coho may measure more than 2 feet (61 cm) in length and can weigh up to 36 pounds (16 kg). However, the average weight of adult coho is 8 pounds (3.6 kg). Coho salmon have dark metallic blue or greenish backs with silver sides and a light belly and there are small black spots on the back and upper lobe of the tail while in the ocean. (From NOAA Species of Concern 2009)

Spawning adults are generally dark and drab. The head and back are dark, dirty bluegreen; the sides are a dull maroon to brown with a bright red lateral streak; and the belly is gray to black (Moyle 1976; Laufle et al. 1986; Sandercock 1991). Females are paler than males, usually lacking the red streak. Characteristics of spawning males also include: hooked jaw, enlarged and more exposed teeth, slightly humped back and a more compressed head and body. The snout is less deformed than in other salmon species. Both sexes have small black spots on the back, dorsal fin, and upper lobe of the caudal fin. Except for the caudal and dorsal, the other fins lack spots. The gums of the lower jaw are grey, except the upper area at the base of the teeth, which is generally whitish. (From Status Review of California Coho Salmon North of San Francisco 2002)

Distribution:

Coho salmon are a widespread species of pacific salmon, occurring in most major river basins around the Pacific Rim from central California to Korea and northern Hokkaido, Japan. In the United States distribution is from Point Hope, Alaska to the San Lorenzo River in Santa Cruz County. (From Endangered Species Petition: Coho Salmon 2000)

The Central California Coho salmon evolutionary significant unit (ESU) distribution ranges from Punta Gorda, California, south to the San Lorenzo River (Recovery Strategy for Coho 2003).

Historically, the Upper Rancheria Creek basin produced, but did not support, year round populations of juvenile coho and juvenile steelhead; however, no coho of any age class have been documented in the upper subbasin since the late 1980s. (From West Coast Watershed 2007)

Life History & Threats:

Coho salmon begin spawning activities after a maturation and growth period, usually two years, but variation does exist (Endangered Species Petition: Coho Salmon 2000). Most individuals return to their natal streams, breeding in the same waters they were hatched (Recovery Strategy for Coho 2003). Minimal straying into other watersheds exists, mainly due to factors such as steam blockage (Recovery Strategy for Coho 2003).

> In California, spawning mainly occurs from November to January although it can extend into February or March if drought conditions are present (Shapovalov and Taft 1954). Shapovalov and Taft (1954) noted that the females choose the spawning sites usually near the head of a riffle, just below a pool, where the water changes from a laminar to a turbulent flow and there is a medium to small gravel substrate. The female digs a nest (redd) by turning partly on her side and using powerful rapid movements of the tail to dislodge the gravels, which are transported a short distance downstream by the current. Approximately 100 or more eggs are deposited in each redd. The fertilized eggs are buried by the female digging another redd just upstream. (From Status Review of California Coho Salmon North of San Francisco 2002)

> Eggs hatch after 8-12 weeks of incubation, the time being inversely related to water temperature. Hatchlings remain in the gravel until their yolk sacs have been absorbed, 4-10 weeks after hatching. Upon emerging, they seek out shallow water along the stream margins. As the fish continue to grow, they move into deeper water and expand their territories until, by July and August, they are in deep pools. (From Endangered Species Petition: Coho Salmon 2000)

> Out-migration in small California streams typically peaks from mid-April to mid-May, if conditions are favorable. Migratory behavior is related to rising or falling water levels, size of fish, day length, water temperature, food densities and dissolved oxygen levels. (From Endangered Species Petition: Coho Salmon 2000)

> Oceanic coho tend to school together. Although it is not known if the schools are mixed, consisting of fish from different streams, fish from different regions are found in the same general areas. Adult coho salmon are primarily piscivores, but shrimp, crabs and other pelagic invertebrates can be important foods in some areas. (From Endangered Species Petition: Coho Salmon 2000)

> Reported distribution of coho salmon has ranged from 15 to 28 streams within the Navarro River watershed (Brown and Moyle 1991; Brown et al. 1994; Adams et al. 1999; NMFS 2001a). CDFG (2001b) estimated approximately 130 miles of coho salmon stream habitat were present in 1963. The present distribution of coho salmon within the Navarro River watershed is substantially less than that recorded historically. Fourteen of the 19 streams listed by Brown and Moyle (1991) as historical coho salmon streams were surveyed in 2001. Coho salmon were observed in only six of these streams. Coho salmon populations are now restricted to the western portion of the watershed. (From Status Review of California Coho Salmon North of San Francisco 2002)

Major threats to coho salmon revolve around human development and its associated impacts. Habitat loss and fragmentation, artificial propagation and genetic lost between population diversity, pollution, habitat modification, over fishing, and climatic variation all have major impacts on coho salmon population abundance and viability (Endangered Species Petition: Coho Salmon 2000, Status Review of California Coho Salmon North of San Francisco 2002).

Central California coho salmon distribution within the Navarro watershed has been particularly impacted by logging, cattle grazing, drought, low flow conditions, and more recently viticulture (Status Review of California Coho Salmon North of San Francisco 2002). Navarro watershed CDFG surveys from the 50's and 60's reported numerous log barriers caused by accumulated debris from historical logging activities and are cited as potential barriers likely limiting distribution and overall production within the watershed (Status Review of California Coho Salmon North of San Francisco 2002).

Habitat & Habitat Associations: Salmonids with potential to occur in the Study Area (Chinook, Coho, and Steelhead) require a variety of habitats and habitat features to successfully reproduce (the following adapted from Smith 2010):

Upstream Migration of Adults: Sufficient streamflow to allow passage over shallow riffles, log jams, falls, etc.

Spawning: Sufficient streamflow over clean gravel, cool water temperature, depth, and cover for escape (usually a deep pool with cover).

> Coho salmon spawn mostly in small streams where the flow is 2.9 - 3.4 cfs and the stream depth ranges between 3.94 and 13.78 inches, depending on the velocity (Gribanov 1948; Briggs 1953; Thompson 1972; Bovee 1978; Li et al. 1979). On the spawning grounds, they seek out sites of groundwater seepage and favor areas where the stream velocity is 0.98 - 1.8 ft/s. They also prefer areas of upwelling. The female generally selects a redd site at the tail-out of a pool or head of a riffle are where there is good circulation of oxygenated water through the gravel. (From Status Review of California Coho Salmon North of San Francisco 2002)
>
> About 85% of redds occur in areas where the substrate is comprised of gravel of 15cm diameter or smaller. In situations where there is mud or fine sand in the nest site, it is removed during the digging process. LWD also diversifies flows, reducing stream energy directed towards redds (Naiman et al. 1992). Pockets of relatively stable gravels help protect redds from the scouring effects of high flows. (From Status Review of California Coho Salmon North of San Francisco 2002)
>
> Optimal temperatures for development of embryos in the gravel are 43-50 degrees F, although eggs and alevins can be found in 40-70 degree F water. Dissolved oxygen levels should be above 8 mg/l for juveniles (Emmett, et al. 1991). (From Endangered Species Petition: Coho Salmon 2000)

Rearing and Overwintering: Cover for escape (undercut banks, logs, pools, surface turbulence, unburied cobbles), suitable water quality (temperature, oxygen, clarity), and enough light for algal and insect production and sight feeding. Deep pools and backwater habitat with good escape cover are particularly important for overwintering areas. Log jams may be valuable refuges during floods. Clear water between major storms to allow for feeding and growth

> Juveniles prefer deep (greater than 3 feet), well shaded pools with plenty of overhead cover; highest densities are typically associated with logs and other woody debris in the pools or runs. Juveniles require water temperatures that do not exceed 71-77 degrees F for extended time and oxygen and food (invertebrates) levels remain high. Preferred temperatures are 50-59 degrees F (Hassler, 1987); preferred water velocities for juveniles are .25 to 1.5 feet per second depending on habitat. High turbidity is detrimental to emergence, feeding and growth of young coho (Emmett, et al, 1991). Young and adult coho salmon are found over a wide range of substrates, from silt to bedrock. (From Endangered Species Petition: Coho Salmon 2000)

Downstream Migration of Juveniles to the Ocean: Sufficient flow for safe passage. Prolonged flow to allow fish to feed and grow quickly in spring before migrating to the ocean. Clear water for rapid growth before and during migration.

Riparian Habitat: Canopy cover is important in maintaining shade for stream temperature control and in providing allochthonous materials in small to moderate sized streams for the aquatic habitats. Shading becomes less important as stream gradient and size increase. About 50% to 75% midday shade appears optimal for most small salmonid streams (USFWS 1986). Healthy, well-vegetated riparian areas helps control watershed erosion, reducing fine sediments and promoting adequate spawning grounds (USFWS 1986). McMahon and Hartman (1998) demonstrated a positive association between Coho Salmon and stream cover and pool complexity.

Conceptual Basis for GIS Model Development:

Without further field surveys to identify water flow (pool, run, riffle) and large woody debris needed by this species, GIS mapping of potential Coho Salmon habitat is limited. To define potential habitat in the Study Area, we mapped all permanent and intermittent watercourses with canopy coverage $\geq$ 40%.

Potential Occurrence in the Study Area:

Habitat: Habitat quality in the upper Navarro Watershed is poor to moderate for salmonids in general (Myers et al. 1998). Habitat assessments for salmonids in the Preserve indicate that Rancheria Creek has high stream temperatures, excessive fine sediments and little instream habitat and shelter (West Coast Watershed 2007).

> Without adequate levels of large woody debris (LWD), instream habitat lacks pool frequency, depth, and complexity. In most surveyed streams in the [Navarro] watershed, there is low pool frequency and an excess of fast water habitat. These conditions are deleterious to both adult and juvenile salmonids. Lack of resting places may lead to adult mortality before spawning and lack of cover may lead to increased adult predation. Likewise, it can be difficult for juveniles to shelter during high flow events and they may be swept away. (From West Coast Watershed 2007)

High temperatures may be due in part to the lack of a well-developed riparian overstory (which is patchy along the mainsteam of the creek) and early seasonal drawdown of surface water. The lower reaches of drainages into Rancheria Creek (e.g., Yale Creek) may, however, provide perennial surface water with cool temperatures needed by resident salmonids populations. These drainages tend to be perennial, and often pooling in the summer, with dense forest and woodland canopy.

Habitat quality for Coho Salmon in the Preserve is poor to moderate (Figure 59). Coho are known to spawn in small coastal rivers and tributaries such as those found on the Preserve. Their fry spend one to two years in freshwater and differ from Steelhead in their preference for slower-moving areas and pools. While pool frequency in the upper watershed is generally low, tributaries to Rancheria Creek may provide year-round, cool, slow-moving habitat needed by fry.

Nearest Occurrence:

Documented Occurrences in Galbreath Wildlands Preserve: Information on Coho occurrence is available for the Rancheria Creek subbasin. Between 1948 and 1952, Coho and Steelhead were rescued during the summer from drying sections of Rancheria Creek by California Department of Fish and Game (KrisWeb 2011). The maximum number of Coho rescued during this period were 51,466 fish in the summer of 1951. Six streams in the Rancheria Watershed subbasin were sampled between 1988 and 2002, but Coho were found only once, in Minnie Creek in 1996 (KrisWeb 2011). Surveys for salmonids in all Rancheria Creek sub-watersheds were conducted in 1998 (West Coast Watershed 2007), and no Coho salmon were found.

Nearest Occurrence to Study Area: CDFG (2002) reports unpublished data from CDFG surveys (2001) that documents six streams in the lower Navarro watershed that currently support Coho spawning activities; mainstem Navarro River, Flynn Creek, South Branch of the North Fork, North Branch of the North Fork, Little North Fork, and John Smith Creek.

Summary: This species is “Unlikely to Occur” in the Preserve because this species has not been documented in the upper Navarro Watershed in the last 10 years, indicating that habitat quality has deteriorated for this species. Aquatic and riparian restoration efforts could increase the likelihood of occurrence for this species.

References

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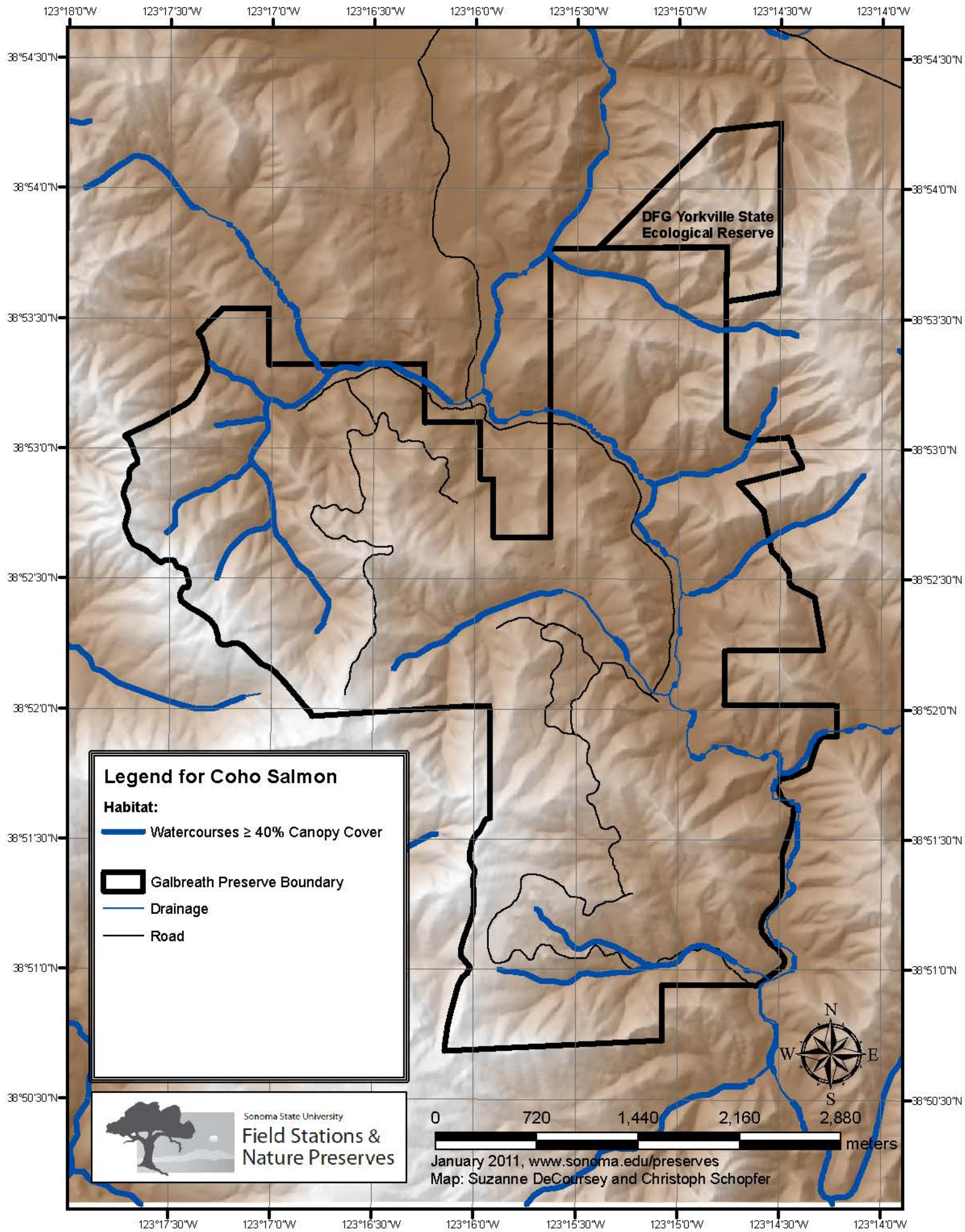
Species Account Description: Neal Ramus & Emily Harvey

Figure 59: Potential habitat for Coho Salmon *(Oncorhynchus kisutch)*

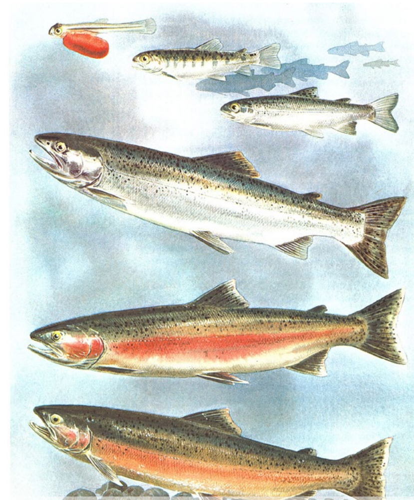


Status:

Federal: Threatened

State: None

Other: Rancheria Creek designated as Critical Habitat



Painting: © NSEA 2010

Species Description:

Steelhead are anadromous rainbow trout which return from the ocean as large silvery trout with numerous black spots on their tail, adipose and dorsal fins. The spots on the tail are typically in radiating lines. Their back can be an iridescent blue to nearly brown or olive. Their sides and belly appear silver, white, or yellow with an iridescent pink to red lateral band. The mouth is large, with the maxillary bone usually extending behind the eyes, which are above pinkish cheeks (opercula). Teeth are well developed on the upper and lower jaws, although basibranchial teeth are absent. The dorsal fin has 10-12 rays; the anal fin, 8-12 rays; the pelvic fin, 9-10 rays; and the pectoral fins 11-17. The scales are small with 110-160 scales along the lateral line, 18-35 scale rows above the lateral line, and 14-29 scale rows below it (Moyle 2002). (From Moyle et al 2008)

The coloration of juveniles is similar to that of adults except they have 5-13 widely spaced, oval parr marks centered on the lateral line with interspaces wider than the parr marks. Juveniles also possess 5-10 dark marks on the back between the head and dorsal fin, which make the fish appear mottled. There are few to no spots on the tail of juveniles and white to orange tips on the dorsal and anal fins. (From Moyle et al 2008)

Steelhead trout can reach up to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though average size is much smaller. They are usually dark-olive in color, shading to silvery-white on the underside with a heavily speckled body and a pink to red stripe running along their sides. (From NOAA Fisheries Service OPR 2010)

Distribution:

In the United States, steelhead trout are found along the entire Pacific Coast. Worldwide, steelhead are naturally found in the Western Pacific south through the Kamchatka peninsula. They have been introduced worldwide. (From NOAA Fisheries Service OPR 2010)

NCC summer steelhead are patchily distributed in a small number of watersheds…. The NCCW steelhead DPS includes all naturally spawning populations of steelhead in California coastal river basins from Redwood Creek (Humboldt Co.) to just south of the Gualala River (Mendocino Co.) (Spence et al. 2007). This distribution includes the Eel River, the third largest watershed in California (From Moyle et al. 2008)

The Northern California Steelhead ESU includes all naturally spawned populations of steelhead in coastal river basins from Redwood Creek to the Gualala River. The major watersheds in this ESU are Mad River, Redwood Creek, Eel River and several smaller coastal watersheds in Mendocino and Sonoma County. Within Mendocino Coast Subbasin there are several smaller streams including the Ten Mile, Noyo, Albion, Navarro, and Garcia Rivers (NOAA Fisheries Protected Resources Division 2005).

Life History & Threats:

> In general, rainbow trout, which include steelhead, exhibit the largest geographic range and most complex suite of traits of any salmonid species…Basically, steelhead are rainbow trout that rear in streams for 1-3 years before turning into smolts and migrating out to sea. They remain in the ocean for varying lengths of time, where they feed on large crustaceans and fish. Spawning adult steelhead typically spend at least one year in the ocean and some may repeat spawning 2-4 times.(From Moyle et al 2008)
>
> The basic life history of summer steelhead is (1) adults migrate upstream in spring to holding pools in headwaters as immature adults, (2) adults hold through the summer in deep pools, (3) adults spawn in fall and survivors migrate back to the ocean, and (4) juveniles rear in headwater streams as well as streams lower in the watershed for 1-3 years, and (5) smolts migrate out to sea during high winter flows. Very few studies have been carried out on NCC summer steelhead, though some research has been completed on these fish in the Middle Fork Eel River population. NCC summer steelhead migrate into the upper Middle Fork Eel River from mid-April through June (Puckett 1975; Jones and Ekman 1980). Migration may extend into July, but fish are increasingly less likely to make it to upstream areas as mainstem flows decrease and stream temperatures increase. Returning adult summer steelhead have an age composition of 1% 2 year olds, 46% 3 year olds, 44% 4 year olds, and 9% five year olds; with 13% of the fish spawning more than once (Puckett 1975). Oversummering summer steelhead have been observed to migrate among pools (Nielsen et al. 1994), though later in the season the pools are often hydrologically disconnected. It is possible that steelhead from large populations also enter smaller rivers (i.e., Mad River and Redwood Creek) following the first fall rain and contribute to other summer populations (T. Weseloh, California Trout, pers. comm.). Spawning timing has not been well documented for NCC summer steelhead and may occur at the same months as winter steelhead. However, it is presumed that temporal and spatial isolation of reproductive fish from sympatric winter steelhead runs serves to maintain the integrity of summer steelhead (Barnhardt 1994). The mountainous high gradient stream reaches inhabited by summer steelhead in the Middle Fork Eel River likely reinforces their spatial isolation from winter steelhead. Spawning habitat is likely similar to that of KMP summer steelhead (see description). Juvenile and ocean life history of NCC summer steelhead is undocumented, but it is presumably similar to KMP summer steelhead. In the Mattole River, a small number of “half pounder” steelhead are observed during annual summer steelhead dive surveys. This phenotype in NCC summer steelhead is not well documented and they may be subadult ‘half-pounders’ similar to those observed further north. Alternatively, these fish may represent large resident trout or small returning adult summer steelhead. Greater monitoring and research is necessary to adequately describe this life history variation of the NCC summer steelhead. (From Moyle et al 2008)
>
> NCCW steelhead enter estuaries and rivers between September and March (Busby et al. 1996). Further migrations upstream occur as late as June, but timing depends upon rainfall and consequent stream discharge being suitable for passage into upper sections of watersheds. Shapovalov and Taft (1954) reported steelhead entering the Eel River estuary as early as August, migrating upstream on increasing stream flows, but not moving during peak flows. Spawning happens primarily in the winter between December and early April (Busby et al. 1996), though favorably wet conditions may lengthen the spawning period into May. These spawning steelhead arrive at spawning areas in reproductive condition. Because steelhead spawning occurs over a protracted period, fry emergence may also take place over a long

period, which influences young-of-the-year redistribution and potentially result in emigration into estuaries (Day 1996). (From Moyle et al 2008)

Unlike salmon, steelhead can spawn more than once. Hopelain (1998) reported that repeat spawning varies considerably among runs and populations, from 18 to 64% of spawners. Females make up the majority of repeat spawners (Busby et al. 1996). In Freshwater Creek, between 10 and 26% of steelhead are repeat spawners, though the proportion of repeat spawners may be mostly indicative of a strong cohort of first time spawners (Ricker 2003). Females lay between 200 and 12,000 eggs (Moyle 2002). Outmigration of spawned adults can occur as late as June, but typically occurs no later than May in most watersheds (Busby et al. 1996). Shapovalov and Taft (1954) noted that hundreds of spawned-out adults often schooled above Benbow Dam on the South Fork Eel River. Additionally, in years with low spring outflows, steelhead may become stranded in their natal streams for the summer (e.g., Noyo, Navarro Rivers; S. Harris, pers. comm. 2007). (From Moyle et al 2008)

Newly emerged steelhead school together and seek shallow waters along riffle margins or pool edges, while older juveniles maintain territories in faster and deeper locations in pool and run habitats. Where steelhead coexist with larger coho salmon juveniles, they prefer pool habitats for faster growth, although young-of-year steelhead can be competitively displaced to riffle habitats (Smith and Li 1983). Yearling steelhead occasionally emigrate from their natal rivers and recent studies have shown that some one year old smolts return as adults (Mike Sparkman, CDFG, pers. comm.). However, successful juveniles typically rear in streams for two years. Juvenile steelhead favor areas with cool, clear, fast-flowing riffles, ample riparian cover and undercut banks, and diverse and abundant invertebrate life (Moyle 2002). Growth rates vary with environmental conditions. NCCW steelhead grow from 0.24 to 0.37 mm/day in the Navarro and Mattole Rivers, respectively (Zedonis 1990; Cannata 1998). In Redwood Creek, growth rates were greater, ranging from 0.26 to 0.73 mm/day (M. Sparkman, CDFG, pers. comm. 2007). NCCW steelhead juveniles of all sizes can show some movement in their streams and typically individuals leave during higher spring flows with movement peaking during late April or May depending on flows. Young-of-year steelhead will emigrate to estuaries as late as June or July (M. Sparkman, pers. comm. 2007). In Freshwater Creek, out-migrating steelhead averaged 156 mm FL, while the back-calculated ocean entry check for migrating spawners was at 194 mm FL, suggesting that additional rearing takes place in the estuary (Ricker 2003). In the Navarro River, a greater proportion of older (2+) juveniles reside in the estuary than in the river. Minimum growth in the estuary appears to occur when the river mouth is closing and a shift from estuarine to lagoon conditions occurs, typically between mid-August and mid-September (Cannata 1998). In the Mattole lagoon, juveniles display benthic feeding strategies. Within the lower lagoon, they primarily eat amphipods (*Corophium* spp.), while in the upper lagoon they eat primarily caddisfly larvae (Zedonis 1990). (From Moyle et al 2008)

Smoltification (the physiological process of adapting to survive in ocean conditions) occurs in early spring and smolts typically emigrate from the river to the estuary or ocean between March and June. However, conditions may prevent exit from the estuary until late fall. A common process in small estuaries supporting NCCW steelhead is the formation of a summer lagoon when beach sands form a bar across the mouth of the river. Strong salinity stratification in lagoons without sufficient inflow or very strong winds can lead to poor water quality (see discussion in Habitat). Steelhead then seek refuge near the surface, in near-shore waters where more mixing occurs, or upstream beyond the seasonally stratified zone. In the Navarro River, some NCCW steelhead enter the ocean as they begin their third year of life after spending at least one year in the estuary (Cannata 1998). Prior to bar formation across the mouth of the Navarro River, larger juvenile steelhead were observed in the estuary close to the ocean where water temperatures were cooler and salinities were higher. Following creation of the bar, these fish moved back into the upper lagoon. (From Moyle et al 2008)

California steelhead can spend up to four years in the ocean, though many steelhead returning to the small coastal tributary, Freshwater Creek, spend just two years in the sea (e.g., Ricker 2003). In coastal California basins, the most common life history patterns for first time spawners are 2/1 (years in fresh water/ocean), 2/2, and 1/2 (Busby et al. 1996). The majority of returning steelhead in the Mad River were three years old (Zuspan and Sparkman 2002; Sparkman 2003). (From Moyle et al 2008)

NCCW steelhead were captured in August during trawl surveys north and south of Cape Blanco (Brodeur et al. 2004), suggesting much of their time in the ocean is spent fairly close to their natal streams. Steelhead grow rapidly at sea, feeding on fish, squid, and crustaceans taken in surface waters (Barnhart 1986). It is believed that steelhead use their strong homing sense to return to the same area in which they lived as fry to spawn (Moyle 2002). (From Moyle et al 2008)

In Redwood Creek and the Mad, Eel, and Mattole Rivers, a small number of “half pounder” steelhead are observed annually. These half pounders are likely distinct from the half pounder steelhead in the Klamath Mountain Province, which are reported to enter and leave the river as immature, subadult fish (Kesner and Barnhart 1972). The NCCW steelhead half pounders are generally larger (25-35 cm FL or larger) than Klamath fish but they are not well documented. The high phenotypic plasticity in juvenile and adult life histories demonstrated by NCCW steelhead suggest the ‘half pounders’ may represent small reproductive fish, large resident fish, or a mixture of different life history variations. (From Moyle et al 2008)

Steelhead populations are affected by both natural and human factors, but when increasingly severe anthropogenic pressures are added to naturally stressful conditions (floods, droughts, fires, poor ocean conditions…)...culverts and bridges are barriers to steelhead passage in numerous smaller watersheds across the NCCW steelhead region….A significant proportion of the NCCW steelhead landscape is industrial timberlands, both private and public, which have already undergone one or more cycles of tree removal, include intense no-holds-barred logging in the 19th century. The cumulative, synergistic effects of these operations is difficult to grasp, though direct impacts to steelhead from logging include increased sedimentation and stream temperatures, reduced canopy cover, destruction of instream habitat, and altered flow timing and volume… These changes in the aquatic ecosystem have reduced the ability of adults to reproduce, juveniles to forage, and migrants to safely pass to the ocean, as well as having indirect effects, such as reducing the productivity of aquatic invertebrates that are the principal food for the fish. Areas subjected to logging in many steelhead watersheds also suffer from increased effects of fire, a natural phenomenon in most coastal landscapes, especially outside the coastal fog belt… An additional problem has been “salvage logging” where large dead trees are removed after a fire, enhancing the erosion following a fire by increased road building and reducing availability of trees to fall into streams and create steelhead habitat….Agricultural and ranching land use practices can negatively impact adjacent streams containing steelhead and other anadromous fish. The trampling and removal of riparian vegetation by grazing livestock destabilizes and denudes stream banks, increasing sediment and temperature in the streams (Spence et al. 1996) These activities can lead to a reduction in canopy over stream channels and siltation of pools necessary for juvenile rearing (Moyle 2002). Other impacts of agriculture include stream channelization, large woody debris removal, and armoring of banks to prevent flooding of fields (Spence et al. 1996)…. All of these activities, in combination with diversions for irrigation, degrade aquatic habitat quality, reducing its suitability for steelhead or other native fishes while enhancing its suitability for non-native fishes (Harvey et al. 2002)….. These land uses have also altered floodplain hydrology, increased bank instability, increased sediment delivery and transport of pollutants. Within the river channel, these activities disrupt substrate composition, divert flows, reduce water quality, and inhibit natural processes of temperature regulation. In addition, lagoon and estuary habitats often store excess sediments, have reduced habitat complexity, and are impaired by temperature increases. All of these factors can affect the suitability of impacted reaches for steelhead and numerous populations inhabit impaired watersheds…While sport fishing regulations require a zero take for naturally produced NC steelhead, fishing for steelhead and "trout" continues in large portions of the two largest systems, the Mad and Eel Rivers.... No studies have been carried out to evaluate the impact of hatchery releases on wild steelhead and other salmonids in the northern California coastal region, but studies elsewhere have shown that releases of large numbers of fish result in negative competitive interactions between wild steelhead and hatchery fish for food, habitat, and mates (Nickelson et al. 1986). Also, carrying capacity of rivers is often exceeded during the outmigration of hatchery smolts decreasing food availability (Spence et al. 1996). Hatchery steelhead have been documented to displace a large percentage of wild steelhead in some streams (McMichael et al. 1999) and they may directly prey upon smaller young-of-year wild steelhead. Other risks from hatcheries include disease transmission, alterations of migration behavior in wild fish, and genetic changes that affect subsequent fitness in wild populations (Waples 1991)… Non-native species are present in many of the watersheds used by NC steelhead, but the biggest problem has been created by the invasion of the Eel River system by Sacramento pikeminnow (Brown and Moyle 1997). Pikeminnow not only prey directly on juvenile steelhead but they displace them from pool habitat into less desirable riffle habitat, presumably resulting in reduced growth and survival. (From Moyle et al 2008)

NCC summer steelhead have declined from a combination of factors including habitat loss, water management, disturbance, hatcheries, and poaching. Recent changes in sportfishing regulations and hatchery operations have reduced some of these threats…The scattered distribution of NCC summer steelhead suggests that stochastic events can have drastic consequences to local populations. Natural disturbance can be synergistic with the decades of poor watershed management, mainly in association with logging, which has occurred in many of the summer steelhead watersheds…. It is likely that effects of the 1952 and 1964 floods were exacerbated by land use practices in almost all drainages containing NCC summer steelhead. These floods deposited enormous amounts of gravel into pools that originated from landslides and mass wasting, especially from areas with steep slopes that had been logged. The floods not only filled in pools, but widened stream beds and eliminated riparian vegetation that served as cover and kept streams cooler. The gravel accumulated from the 1964 flood is gradually being scoured out of the pools, but much of it still remains… In numerous watersheds including the Mattole, Mad, Van Duzen rivers and Redwood Creek, rural landowner water use for residential and agricultural purposes significantly curtail flows in the mainstem river. This reduces habitat availability and truncates migration patterns…. Even where habitats are apparently suitable, summer steelhead may be absent because of continuous disturbance by humans. Heavy use of streams by gravel mining, swimmers, and rafters may stress the fish. This may make them less able to survive natural periods of stress (e.g., high temperatures), less able to spawn or to survive spawning, and more likely to move to less favorable habitats. Because disturbance makes the fish move around more, they are also more likely to be observed and captured by illegal poachers. Hatchery-reared salmonids have adverse effects on wild populations. Summer steelhead were brought into the Mad River Hatchery from the Washougel River, Washington in 1971 (Roelofs 1982) and likely impacted wild summer steelhead. The specific consequences of these hatchery fish on wild stocks of summer steelhead are not known….Illegal harvest of summer steelhead remains a persistent threat to these fish due to lack of adequate game warden or other law enforcement staffing in many of the rural locations occupied by these fish…(From Moyle et al 2008)

In the early 1960s, most of the water quality in the Navarro basin and its tributaries had experienced intense degradation from recent timber harvest activities. By the time CDFG conducted surveys in 1996, many of the streams had at least partially recovered; however, historic impacts and current land use practices continue to impair water quality in the Rancheria watershed. Water quality in the Navarro River watershed is impacted by sediment and temperature. The river is on the 303(d) list of impaired waterbodies in California; potential sources of the impairment include: agriculture, agricultural return flows, resource extraction, flow regulation/modification, water diversions, habitat modification, removal of riparian vegetation, streambank modification or destabilization, and drainage or filling of wetlands

(NCRWQCB 2006)….(From West Coast Watershed 2007)

Throughout the watershed, riparian forest is not well established, presumably due to a variety of historic land use practices. The lack of riparian forest in the watershed coupled with the instream large woody debris (LWD) removal program encouraged by CDFG in the 1950s through the 1970s has resulted in a dearth of LWD, which negatively impacts salmonid habitat. Without adequate levels of LWD, instream habitat lacks pool frequency, depth, and complexity. In most surveyed streams in the watershed, there is low pool frequency and an excess of fast water habitat. These conditions are deleterious to both adult and juvenile salmonids. Lack of resting places may lead to adult mortality before spawning and lack of cover may lead to increased adult predation. Likewise, it can be difficult for juveniles to shelter during high flow events and they may be swept away. (From West Coast Watershed 2007)

Habitat & Habitat Associations: Salmonids with potential to occur in the Study Area (Chinook, Coho, and Steelhead) require a variety of habitats and habitat features to successfully reproduce. The following breakdown of general salmonid habitat types and descriptions are adapted from Smith 2010.

Upstream Migration of Adults: Sufficient streamflow to allow passage over shallow riffles, log jams, falls, etc.

Adult steelhead require high flows with water at least 18 cm deep for passage (Bjornn and Reiser 1991). Reiser and Peacock (1985 in Spence et al. 1996) reported the maximum leaping ability of adult steelhead to be 3.4 m. Temperatures of 23-24°C can be lethal for the adults (Moyle 2002), although migrating winter steelhead usually do not encounter these conditions (Table 1). (From Moyle et al 2008)

Due to their long migration through mountainous terrain into the Middle Fork Eel River, NCC summer steelhead require adequate flows to reach optimal over-summering habitats. Water depth does not seem to be critical to migrating fish because they usually migrate when stream flows are high, but a minimum depth of 13 cm is required (NOAA 2005). Water velocities greater than 3-4 m sec-1, however, may impede their upstream progress. (From Moyle et al 2008)

Adult steelhead swimming ability is hindered at water velocities above 3 to 3.9 m/sec (Reiser and Bjornn 1979 in Spence et al. 1996). Preferred holding velocities are much slower, and range from 0.19m/sec for juveniles and 0.28m/sec for adults (Moyle and Baltz 1985)… (From Moyle et al 2008)

Spawning: Sufficient streamflow over clean gravel, cool water temperature, depth, and cover for escape (usually a deep pool with cover).

For spawning, steelhead require loose gravels at pool tails for optimal conditions for redd construction. Redds are usually built in water depths of 0.1 to 1.5 m where velocities are between 0.2 and 1.6 m/sec. Steelhead use a smaller substrate size than most other coastal California salmonids (0.6 to 12.7 cm diameter)… (From Moyle et al 2008)

Steelhead embryos incubate…in the range of 5 to 13° C….High levels of sedimentation (>5% sand and silt) can reduce redd survival and emergence due to decreased permeability of the substrate and dissolved oxygen concentrations available for the incubating eggs (McEwan and Jackson 1996). When fine sediments (<2.0mm) compose >26% of the total volume of substrate, poor embryo survival is observed (Barnhart 1986). Out of the gravel, emerging fry can survive at a greater range of temperatures than embryos, but they have difficulty obtaining oxygen from the water at temperatures above 21.1°C (McEwan and Jackson 1996). (From Moyle et al 2008)

Rearing and Overwintering: Cover for escape (undercut banks, logs, pools, surface turbulence, unburied cobbles), suitable water quality (temperature, oxygen, clarity), and enough light for algal and insect production and sight feeding. Deep pools and backwater habitat with good escape cover are particularly important for overwintering areas. Log jams may be valuable refuges during floods. Clear water between major storms to allow for feeding and growth

> During the first couple years of freshwater residence, steelhead fry and parr require cool, clear, fast-flowing water (Moyle 2002). … As temperatures become stressful, juvenile steelhead will move into faster riffles to feed due to increased prey abundance (see bioenergetic box in SONCC coho account) and seek out cool-water refuges associated with cold-water tributary confluences and gravel seeps….However, juvenile steelhead can live in streams that regularly exceed 24°C for a few hours each day with high food availability and temperatures that drop to more favorable levels at night (Moyle 2002 and bioenergetics box in SONCC coho account). (From Moyle et al 2008)

> For most adult steelhead temperatures of 23-24°C can be lethal (see NCC winter steelhead account) but summer NCC steelhead likely regularly encounter temperatures in this range….Cold tributary confluences are critical oversummering location for NCC summer steelhead. Steep, well-shaded, narrow tributaries contributed as much as 95% of the stream flow during the late summer in the river and are often 3- 4ºC cooler than the mainstem (Jones 1980)… In watersheds inhabited by NCC summer steelhead, complex and well-shaded habitats with appropriate depths and temperatures are important for oversummering of adult fish (Nakamoto 1994). These features and alluvial recharge (Nielsen et al. 1994) via springs and seeps provide cool areas for fish. (From Moyle et al 2008)

> Physical structures such as boulders, large woody debris, and undercut banks create hydraulic heterogeneity that increases habitat available for steelhead in the form of cover from predators, visual separation of juvenile territories, and refuge during high flows… (From Moyle et al 2008)

Downstream Migration of Juveniles to the Ocean: Sufficient flow for safe passage. Prolonged flow to allow fish to feed and grow quickly in spring before migrating to the ocean. Clear water for rapid growth before and during migration.

Riparian Habitat: Canopy cover is important in maintaining shade for stream temperature control and in providing allochthonous materials in small to moderate sized streams for the aquatic habitats. Shading becomes less important as stream gradient and size increase. About 50% to 75% midday shade appears optimal for most small salmonid streams (USFWS 1986). Healthy, well-vegetated riparian areas helps control watershed erosion, reducing fine sediments and promoting adequate spawning grounds (USFWS 1986).

Conceptual Basis for GIS Model Development: Potential Habitat in the Study Area was mapped as perennial streams and rivers.

Potential Occurrence in the Galbreath Wildlands Preserve:

Habitat: Habitat quality in the upper Navarro Watershed is poor to moderate for salmonids in general (Myers et al. 1998). Habitat assessments for salmonids in the Preserve indicate that Rancheria Creek has high stream temperatures, excessive fine sediments and little instream habitat and shelter (West Coast Watershed 2007):

> Without adequate levels of large woody debris (LWD), instream habitat lacks pool frequency, depth, and complexity. In most surveyed streams in the [Navarro] watershed, there is low pool frequency and an excess of fast water habitat. These conditions are deleterious to both adult and juvenile salmonids. Lack of resting places may lead to adult mortality before spawning and lack of cover may lead to increased adult predation. Likewise, it can be difficult for juveniles to shelter during high flow events and they may be swept away. (From West Coast Watershed 2007)

High temperatures may be due in part to the lack of a well-developed riparian overstory (which is patchy along the mainsteam of the creek) and early seasonal drawdown of surface water. The lower reaches of drainages into Rancheria Creek (e.g., Yale Creek) may, however, provide perennial surface water with cool temperatures needed by resident salmonids populations. These drainages tend to be perennial, and often pooling in the summer, with dense forest and woodland canopy.

Habitat quality for Steelhead in the Preserve is poor to moderate (Figure 60). Steelhead are known to spawn in small coastal rivers and tributaries such as those found on the Preserve. Their fry spend one to two years in freshwater and prefer faster-moving water which is widespread in the upper watershed (West Coast Watershed 2007). Tributaries to Rancheria Creek may provide year-round, cool, slow-moving habitat needed by fry.

Nearest Occurrence:

> Documented Occurrences in the Galbreath Wildlands Preserve: Information on Steelhead occurrence is available for the Rancheria Creek subbasin.There have been numerous studies of Steelhead in the Navarro Watershed and more specifically, Rancheria Creek. Between 1948 and 1952, Coho and Steelhead were rescued from drying areas of Rancheria Creek during the summer by California Department of Fish and Game (KrisWeb 2011). The maximum number of Steelhead rescued were 118,659 in 1952. CDFG found steelhead during electrofishing surveys in the Creek in 1994, 2000 (spring, summer, and fall), and 2001 (spring, summer, and fall). Paskernack et al. (2002) collected specimens from Rancheria Creek. The NOAA National Marine Fisheries Service (2005) considers Rancheria Creek a “critical habitat” for the Northern California Steelhead ESU.

Summary: This species is “Known to Occur” in the Galbreath Wildlands Preserve. Most recently, it has been observed during surveys in 2002 and 2005.

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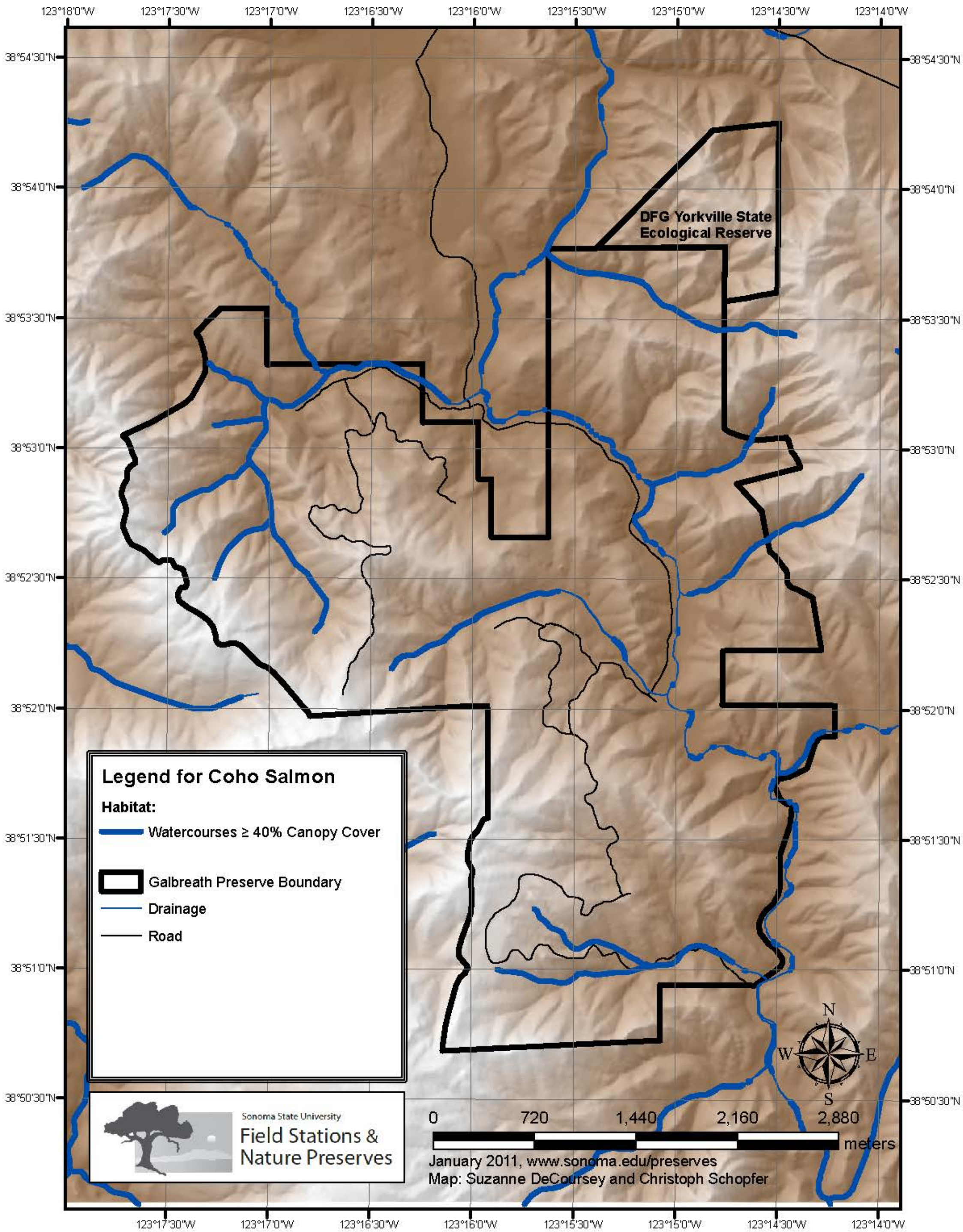
Species Account Description: Katie Terwilliger, Linden Schneider & Emily Harvey

Figure 59: Potential habitat for Coho Salmon *(Oncorhynchus kisutch)*



Status:

Painting: ©Shari Erickson

Federal: Threatened

State: Species of Special Concern

Other: G5 S1S2, USFS:S

Species Description:

The Chinook is distinguished from other *Oncorhynchus* species by its large size (adults may reach a weight of 45kg), and by having small black spots on both lobes of the caudal fin, black pigment along the base of the teeth, and a large number of pyloric caeca (>100) (McPhail and Lindsey 1970). Chinook also differ from other species by their variable flesh color, from white through various shades of pink to red. (From Healey 2003)

Distribution:

Spawning stocks of Chinook are known to be distributed from northern Hokkaido to the Anadyr River on the Asian coast and from central California to Kotzebue Sound, Alaska, on the North American Coast (McPhail and Lindsey 1970; Major et al. 1978). The largest rivers support the largest aggregate runs of Chinook and also tend to have the largest individual spawning populations. (From Healey 2003)

The Central California Chinook salmon ESU constitutes the southernmost portion of the coastal North American range of Chinook salmon. The ESU includes all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River (exclusive) to the Russian River. (From NMFS 2007)

Although Chinook populations have been found from drainages in this region of the North Coast, Chinook has not been documented from the Navarro watershed (Good et al. 2005).

Life History & Threats:

Chinook salmon display a range of complicated and variable life histories (Healy 2003). A deficiency exists in research and historical records regarding distribution, abundance and life history in the Central California Chinook ESU. A review from Bjorkstedt et. al. (2005) suggested dramatic population declines, and possible extirpation in southern watersheds before the 20th century.

A large part of the variation in Chinook life history apparently derives from the fact that the species occurs in two behavioral forms. One form, which has been designated "stream-type" (Gilbert 1913), is typical of Asian populations and of northern populations and headwater tributaries of southern populations in North America. Stream-type Chinook spend one or more years as fry or parr in fresh water before migrating to sea, perform extensive offshore oceanic migrations, and return to their natal river in the spring or summer, several months prior to spawning. The second form, which has been designated "ocean-type" ("sea-type" in Gilbert 1913), is typical of populations on the North American coast of 56*N. Ocean-type Chinook migrate to sea during their first year of life, normally within three months after emergence from the spawning gravel, spend most of their ocean life in coastal waters, and return to their natal river in the fall, a few days or weeks before spawning. (From Healey 2003)

Chinook salmon are also characterized by the timing of adult returns to freshwater for spawning, with the most common types referred to as fall-run and spring-run fish. Typically, spring-run fish have a protracted adult freshwater residency, sometimes spawning several months after entering freshwater, and produce stream-type progeny. Fall-run fish spawn shortly after entering freshwater and generally produce ocean-type progeny. Historically, both spring-run and fall-run fish existed in the [Central California] Chinook salmon ESU. At present only fall-run fish appear to be extant in the DPS [Distinct Population Segment]. (From NMFS 2007)

Throughout their range, fall-run Chinook salmon generally return to freshwater from September to October or early November and spawn shortly thereafter; however, along the central coast of California, fall-run Chinook may only gain access to rivers following the arrival of large winter storms in November through January, and might time their return migrations accordingly. The most common ages-at-maturity for Chinook salmon in the CC-Chinook ESU are three and four years, with five-year-olds constituting a small proportion of some populations (Myers et al., 1998). (From Bjorkstedt et al. 2005)

Adult female Chinook will prepare a redd (or nest) in a stream area with suitable gravel type composition, water depth and velocity. The adult female Chinook may deposit eggs in 4 to 5 "nesting packets" within a single redd. Spawning sites have larger gravel and more water flow up through the gravel than the sites used by other Pacific salmon. (From NOAA NMFS 2009)

After laying eggs in a redd, adult Chinook will guard the redd from 4 to 25 days before dying. Chinook salmon eggs will hatch, depending upon water temperatures, 90 to 150 days after deposition. (From NOAA NMFS 2009)

Fry subsequently emerge from the gravel in late winter or spring. Ocean-type juveniles may begin migrating toward sea within a few weeks to a few months of emergence, but some individuals may reside in rivers through the summer months, before moving to estuaries during the fall or winter (Reimers, 1973; Healy, 1991; Moyle, 2002). (From Bjorkstedt et al. 2005)

Recent information on the distribution and status of fall-run Chinook salmon in the NCCCRD is quite limited, and what information is available is concentrated in watersheds that enter the Pacific Ocean north of Punta Gorda (i.e., north of the Mattole River, inclusive) and the Russian River (Agrawal et al., 2005). Historical accounts are also sparse and do little to reduce our uncertainty regarding whether populations of fall-run Chinook salmon persisted in coastal watersheds between Cape Mendocino and the Russian River. Moreover, populations of salmon in the Russian River were known to be in dramatic decline in the 1880s (Steiner Environmental Consulting, 1996), and it is quite possible that Chinook salmon had been effectively extirpated from the Russian River before the turn of the 20th century (Myers et al., 1998), all of which limits our ability to evaluate the historical structure of Chinook salmon in the southern range of the CC-Chinook ESU. Most historical accounts correspond to watersheds for which we have evidence of Chinook salmon from relatively recent spawner surveys; however, sparse historical evidence and recent angler reports suggest that Chinook salmon at least occasionally enter the Ten Mile, Noyo, Big, Albion, Navarro, Garcia, and Gualala rivers. (From Bjorkstedt et al. 2005)

Loss of historic spawning grounds due to dams and other impediments to fish movement has affected this species like it has many other salmonids. Degradation of remaining spawning habitat from water diversions, introduced species, and altered sediment dynamics has

> occurred. Competition and predation from hatchery reared Chinook salmon leads to a number of problems including genetic introgression, competition, etc. Degraded water quality from a variety of pollution sources including agriculture and urbanization and other development has probably contributed to species decline. Loss of riparian and estuary habitats from the above-listed development sources is also a problem. (From NOAA NMFS 2009)

Habitat & Habitat Associations: Salmonids with potential to occur in the Study Area (Chinook, Coho, and Steelhead) require a variety of habitats and habitat features to successfully reproduce (the following adapted from Smith 2010):

Upstream Migration of Adults: Sufficient streamflow to allow passage over shallow riffles, log jams, falls, etc.

Spawning: Sufficient streamflow over clean gravel, cool water temperature, depth, and cover for escape (usually a deep pool with cover).

> Stream flow, gravel quality, and silt load all significantly influence the survival of developing Chinook salmon eggs. Therefore, behavioral traits such as spawning site selection would need to be correlated with physical fecundity traits. Healey (1991) showed that Suboptimum habitat conditions delay or discourage spawning at a specific site. (From Myers et al. 1998)

Rearing and Overwintering: Cover for escape (undercut banks, logs, pools, surface turbulence, unburied cobbles), suitable water quality (temperature, oxygen, clarity), and enough light for algal and insect production and sight feeding. Deep pools and backwater habitat with good escape cover are particularly important for overwintering areas. Log jams may be valuable refuges during floods. Clear water between major storms to allow for feeding and growth

> The process by which Chinook take up residence in a stream is not well studied. Juvenile Chinook were most abundant where substrate particle size was small, velocity was low, and depth was shallow, but were found in small numbers in virtually every habitat investigated. Fish size was positively correlated with water velocity and depth for both species, but the species differed in size owing to differences in emergence timing and fry size between the species. Chinook were mainly in riverine habitat and seldom in beaver ponds or off-channel sloughs. (From Healey 2003)

> Velocity and turbidity were the principal factors associated with Chinook distributions. Chinook were rare in still water or where velocity was greater than 30 cm/s. Habitat segregation appears to provide a mechanism for reducing competition between cohabiting Chinook and other stream salmonids (same for stream and ocean). Chinook prefer finer substrates than steelhead of comparable size, but both species showed a strong preference for the rubble type of habitat. Limited day-to-day movement of fry suggests strong fidelity to a particular site. (From Healey 2003)

Downstream Migration of Juveniles to the Ocean: Sufficient flow for safe passage. Prolonged flow to allow fish to feed and grow quickly in spring before migrating to the ocean. Clear water for rapid growth before and during migration.

Riparian Habitat: Canopy cover is important in maintaining shade for stream temperature control and in providing allochthonous materials in small to moderate sized streams for the aquatic habitats. Shading becomes less important as stream gradient and size increase. About 50% to 75% midday shade appears optimal for most small salmonid streams (USFWS

1986). Healthy, well-vegetated riparian areas helps control watershed erosion, reducing fine sediments and promoting adequate spawning grounds (USFWS 1986).

Conceptual Basis for GIS Model Development: Without further field surveys to identify water flow (pool, run, riffle), and large woody debris needed by this species, GIS mapping of potential Chinook Salmon habitat is limited. To define potential habitat in the Study Area, we mapped all permanent and intermittent watercourses with canopy coverage greater $\geq$ 40%.

Potential Occurrence in the Galbreath Wildlands Preserve:

Habitat: Habitat quality in the upper Navarro Watershed is poor to moderate for salmonids in general (Myers et al. 1998). Habitat assessments for salmonids in the Preserve indicate that Rancheria Creek has high stream temperatures, excessive fine sediments and little instream habitat and shelter (West Coast Watershed 2007).

> Without adequate levels of large woody debris (LWD), instream habitat lacks pool frequency, depth, and complexity. In most surveyed streams in the [Navarro] watershed, there is low pool frequency and an excess of fast water habitat. These conditions are deleterious to both adult and juvenile salmonids. Lack of resting places may lead to adult mortality before spawning and lack of cover may lead to increased adult predation. Likewise, it can be difficult for juveniles to shelter during high flow events and they may be swept away. (From West Coast Watershed 2007)

High temperatures may be due in part to the lack of a well-developed riparian overstory (which is patchy along the mainsteam of the creek) and early seasonal drawdown of surface water.

Chinook are mostly known to spawn in large rivers, but can use small streams when there is sufficient water flow. Drainages in the Preserve rarely reaches the flow levels preferred by this species and we rank habitat quality for this salmonids as poor (Figure 61).

Nearest Occurrence:

> Documented Occurrences in the Galbreath Wildlands Preserve: This species has not been documented as historically occurring in the Navarro Watershed. No Chinook salmon were found during surveys for salmonids in the upper Navarro watershed in 1998 (Myers et al. 1998).
>
> Nearest Occurrence to the Galbreath Wildlands Preserve: Chinook do occur in watersheds that drain to the ocean to the north and south of the Navarro Watershed: Good et al. (2005) identifies the Noyo River and the Russian River as historical watersheds which supported Chinook salmon populations.

Summary: This species is “Unlikely to Occur” in the Preserve because it has never been documented in the Navarro Watershed and potential habitat quality is poor.

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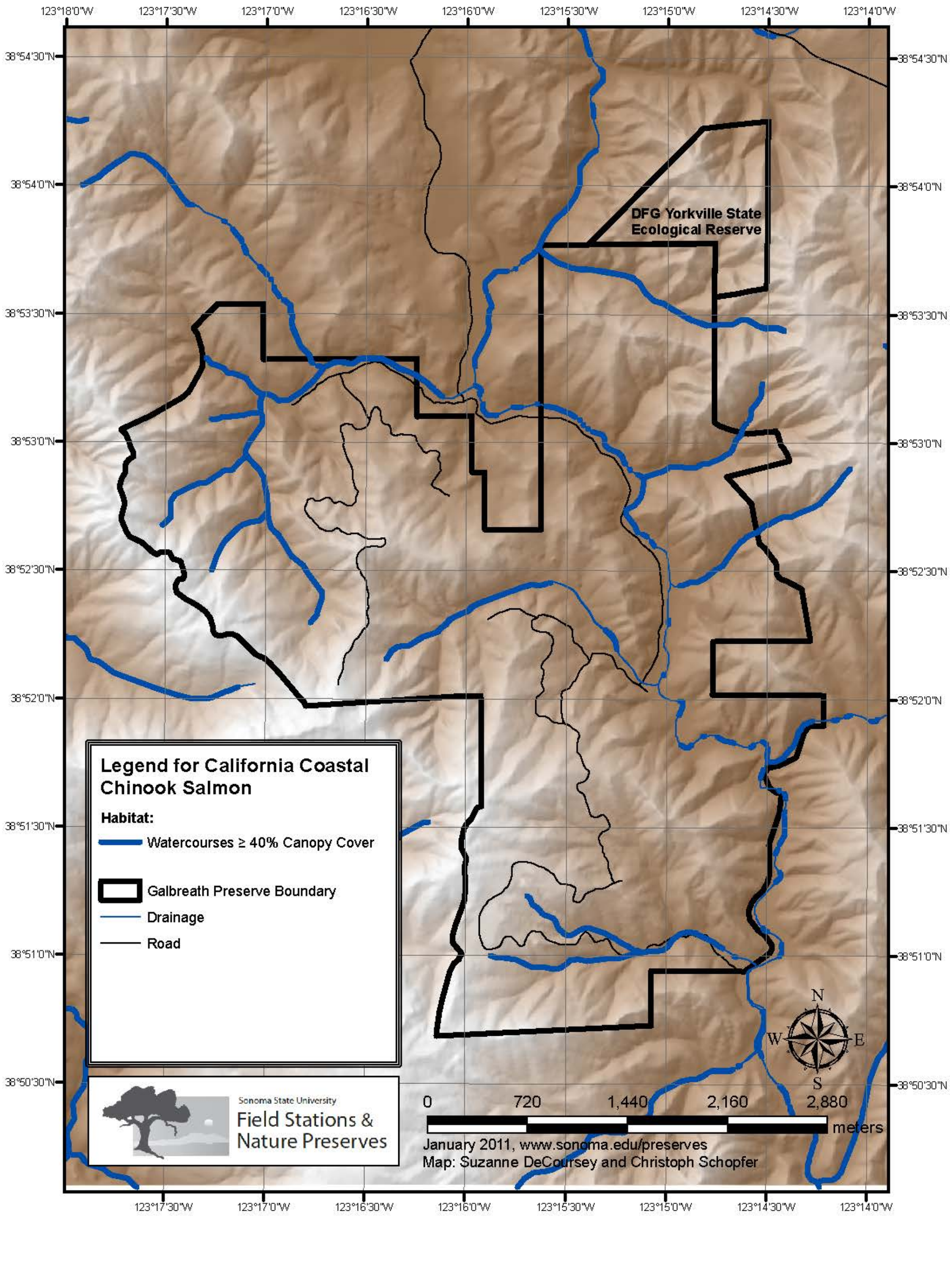
Species Account Description: Neal Ramus & Emily Harvey

Figure 61: Potential habitat for California Coastal Chinook Salmon *(Oncorhynchus tshawytscha)*



Status:

Photo: Gary Nafis 2010

Federal: None

State: Species of Special Concern

Other: G3G4 S2S3

Species Description:

The southern seep salamander is a moderate-sized (ca. 40.0-51.4 mm SVL) olive or pale olive salamander with strongly black to brown spots, and some fine white guanophores dorsally (Stebbins and Lowe 1951, Good and Wake 1992). Undersurfaces range from greenish yellow to yellow, usually heavily flecked and spotted with dark melanic blotches of variable size (Fitch 1936; Stebbins and Lowe 1951; Good and Wake 1992; pers. observ.). The iris is blackish-brown with metallic, light-colored markings (Stebbins and Lowe 1951). (From Jennings and Hayes 1994)

Distribution:

This species occurs in coastal forests of northwestern California south to Point Arena in Mendocino Co. (Jennings and Hayes 1994) and is common in prime habitat. Its elevational range extends from near sea level to about 1200 m (3940 ft) (Jennings and Hayes 1994). (From Marangio 2005)

Life History & Threats:

Primarily aquatic, but also capable of terrestrial activity. Adults are active even at very low temperatures, as cold as 41 - 50 degrees F (5 -10 degrees C), and are extremely moisture dependent. With highly reduced lungs, this species relies on its skin surfaces to take in oxygen, making it very intolerant of desiccation. When temperatures rise and stream flows decrease significantly, and when stream flows increase to levels too high for them to tolerate, salamanders burrow into stream bed substrates. (From Nafis 2010)

Reproduction is aquatic. Little is known about the seasonal reproductive habits of Torrent salamanders (*Rhyacotriton*). Single, loosely laid, pigmentless eggs are laid in water and abandoned. Clutches of 8 and 11 eggs have been found beneath rocks in streams with gravel substrates. Egg development is slow - eggs of Columbia Torrent Salamanders, *R. kezeri*, have reported hatching after about 210 days in the laboratory. Larvae develop in the water, with short stubby gills and a tail fin that does not extend onto the back. Larvae may take 3-5 years to metamorphose, at which time they are about 1 - 1.5 inches long (3.1-4.0 cm). (From Nafis 2010)

The relatively narrow hydric and thermal requirements of *R. variegatus* make it particularly vulnerable, and are probably the reason this species is closely associated with seep habitats in coastal old-growth. Moreover, the apparently relatively long interval to reproductive maturity probably makes replacement of disturbed *R. variegatus* populations relatively slow. Until the variation in hydric and thermal requirements that appears to restrict this species to seep and small stream habitats are better understood, one must take the conservative approach that coastal old-growth seeps and small streams are the only habitats that can support viable populations of this species. Recent estimates place the amount of coastal old-growth redwood forests in California, which comprise a significant portion of coastal old-growth forests in California, at 12% of their historic extent (Fox 1988), over half of which is found on private or unreserved public lands, and therefore susceptible to significant timber harvest. Moreover, how *R. variegatus* is distributed through the remaining suitable habitat is poorly understood. (From Jennings and Hayes 1994)

Habitat & Habitat Associations: Permanent cold creeks, steams and seepages with low water flow. This species has been associated with mossy rocks and the splash zone of waterfalls (Welsh 2006). Old-growth coniferous forests (>21" DBH) with closed canopy (Welsh 2006). <50% cobble in creeks, remainder mixture of pebble, gravel and sand (Welsh 2006). Mossy rocks, seeps, slash zones (Marangio 2005).

Aquatic larvae live in clear shallow water and still, mucky water in creeks, often with accumulated leaves. (From Nafis 2010)

Cold, permanent seeps and small streams with a rocky substrate appear to be the preferred habitats (Fitch 1936, Stebbins and Lowe 1951, Stebbins 1955). Relatively recent work has linked this species to seeps, small streams, and waterfalls in wet or mesic, coastal old-growth habitats (Bury 1983; Welsh and Lind 1988; Corn and Bury 1989; Good and Wake 1992; Welsh 1993; see also Raphael 1988), an association that is likely influenced by the fact that old-growth provides the hydric and thermal environment more favorable (cooler and wetter) to the survival of *R. variegatus* for longer intervals than similar habitats in non old-growth situations (Welsh 1990). *Rhyacotriton variegatus* larvae may be found in somewhat larger streams (especially in the splash zone of waterfalls: D. Good, pers. comm.), but their abundance in seeps has led to the suggestion that predators, like the larvae of Pacific giant salamanders *(Dicamptodon ensatus* and *D. tenebrosus),* may largely exclude them from the former habitats (Stebbins 1955; see also Nussbaum 1969). The greater frequency of *R. variegatus* in seeps may also reflect the greater facility; and thus bias, with which seeps versus streams are sampled as well as the lack of systematic sampling for *R. variegatus* in streams, so the reasons for the apparent restriction of *R. variegatus* to seeps needs study in order to refine current understanding of the habitat requirements for this species. Adults and metamorphosed individuals have been found in concealed locations within a few meters of the seep habitat that displays surface flow; such locations typically have shallow free water or a saturated substrate (Stebbins and Lowe 1951). (From Jennings and Hayes 1994)

It is found primarily in cold, well-shaded permanent streams and spring seepages (Behler and King 1979) in redwood, Douglas fir, mixed conifer, montane riparian and montane hardwood-conifer habitats (Stebbins 1951, Anderson 1968). (From Marangio 2005)

Conceptual Basis for GIS Model Development: The Southern Torrent Salamander requires permanent cold creeks, steams and seepages with low water flow that occur in old-growth coniferous forests. This species has been associated with mossy rocks and the splash zone of waterfalls (Welsh 2006). To identify potential habitat for this species we mapped:

- Perennial streams in closed canopy (≥ 70% canopy cover) coniferous forests (i.e., Redwood-Douglas fir mix (*Sequoia sempervirens-Pseudotsuga menziesii)* and Pacific Douglas fir (*Pseudotsuga menziesii var.menziesii*)
- Sections of perennial streams running through coniferous forest with ≥ 28 cm DBH

(Note that *Rhyacotriton* occurs in coniferous forest > 21” DBH (Welsh 2006). The two largest DBH classes in the Study Area are 27.94 cm – 60.96 cm (11 -24 in) and > 60.96 cm (> 24 in). To map potential habitat, we included both classes.)

Potential Occurrence in the Galbreath Wildlands Preserve:

Habitat: Habitat preferred by this species includes old growth coniferous forest and permanent cold creeks, streams and seepages with low water flow. Habitat in the Preserve is moderate in quality but widespread (Figure 62). Tributaries to Rancheria Creek retain surface water throughout the year and are heavily shaded, providing cool water temperatures.

Nearest Occurrence:

Documented Occurrences in Galbreath Wildlands Preserve: Repeated class surveys since 2005 have not found Southern Torrent Salamanders in the Preserve. Class survey crews were composed of 15 to 20 students who visited the Preserve as part of Sonoma State Herpetology (2 classes since 2005, visiting twice monthly from January to May) and Vertebrate Biology (5 classes since 2005, visiting once during March). Both classes search watercourses adjacent to access roads.

Nearest Occurrence to Galbreath Wildlands Preserve: The nearest documented occurrence to the Preserve of Southern Torrent Salamander is in Manchester, California (AmphibiaWeb 2010), approximately 26 miles to the west.

Summary: We anticipate that this species is “Unlikely to Occur” in the Galbreath Wildlands Preserve because although habitat is moderate in quality, the Preserve is located at the southern edge of Southern Torrent Salamanders’ range and is further inland than other documented occurrences in Mendocino County.

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Species Account Descriptions: Emily Harvey

Figure 62: Potential habitat for Southern Torrent Salamander *(Rhyacotriton variegatus)*

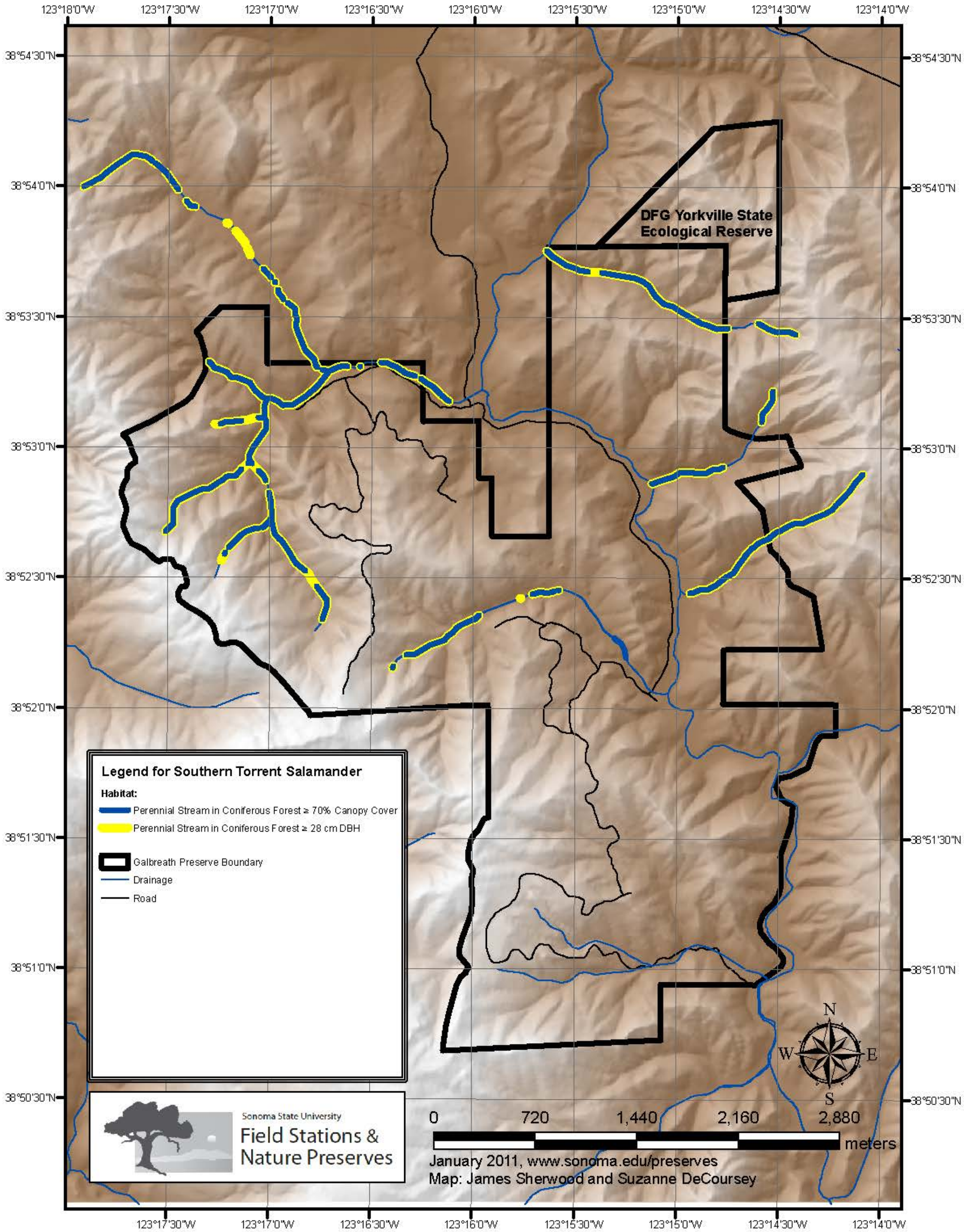


Photo: Brad Moon 2006

Status:

Federal: None

State: Species of Special Concern

Other: G4 S2S3

Species Description:

A small (35.0-45.0 mm SUL) olive, brown, gray, or reddish frog, often with a pale yellow or greenish triangle extending between the eyes and snout, and a dark eyestripe (Mittleman and Myers 1949, Metter 1964a). The undersurfaces are white to yellowish white. The eyes are brown with gold iridophores on both the upper and lower portions of the iris, but a greater density of iridophores is present on the upper iris (Metter 1964a). (From Jennings and Hayes 1994)

Distribution:

The western tailed frog is often considered uncommon, but has been shown by experienced observers to be quite common in suitable habitats. Presently this species is known only from Del Norte, Siskiyou, Humboldt, Trinity, Shasta, Tehama, and Mendocino cos. (Bury 1968, Jennings and Hayes 1994), but Salt (1952) suggested a southern limit to the range as far south as central Sonoma Co. In California, western tailed frogs occur in permanent streams of low temperatures in conifer-dominated habitats including redwood, Douglas fir, Klamath mixed-conifer, and ponderosa pine habitats. It also occurs in montane hardwood-conifer habitats. Western tailed frogs occur more frequently in mature or late-successional stands than in younger stands (Bury 1983, Bury and Corn 1988, Welsh 1990, Jennings and Hayes 1994). Elevational range extends from near sea level to 1980 m (6500 ft) (Jennings and Hayes 1994). (From Morey 2000)

Life History & Threats:

Most data in this summary of the life history of *A. truei* comes from outside of California. *Ascaphus truei* has one of the most distinctive life histories of any North American frog. Adults are nocturnal and have been observed to be active between April and October, and may reproduce during most months over that interval (Gaige 1920, Stebbins 1985). Amplexus is pelvic, males use their small tail as a penis in sperm transfer (Slater 1931, Wemz 1969), females can store sperm (Metter 1964b), and fertilization is internal (Metter 1964a). The unpigmented, heavily yolked eggs are among the largest of any North American frog (ca. 4.0 mm average diameter; Wright and Wright 1949) and are deposited in rosary-like strings of 33-98 eggs on the undersurfaces of submerged rocks (Nussbaum et al. 1983, Adams 1993). Embryos have the narrowest range of thermal tolerance (5°-18°C) and the lowest critical thermal maximum of any North American frog (Brown 1975a). The rate of oxygen consumption during development is also very low (Brown 1977). This suite of features gives *A. truei* the slowest rate of embryonic development among North American frogs. Tadpoles, which have the lower lip expanded into a distinctive sucker-like disk (Gaige 1920, Gradwell 1973), normally attach themselves to rocks in turbulent water (Altig and Brodie 1972), where they feed on diatoms, filamentous green algae, desmids, and conifer pollen for up to 9 months of the year (Metter 1964a, Brown 1990). Tadpoles exhibit a diel cycle that involves movement to high positions on rocks at night, presumably for feeding purposes (Altig and Brodie 1972). They also actively avoid water temperatures above 22°C and die at water temperatures during winter months are probably two reasons why larval development is slow (Brown 1989), and the time required to reach metamorphosis requires at least 2-3 years (Ricker and Logier 1935; Metter 1964b, 1967), and has been recently postulated to take as long as 4 years (Brown 1990). Adults also appear sensitive to elevated temperatures (Metter 1966, Landreth and Ferguson 1967, Welsh 1990) with lethal thermal maxima at 23-24°C (Claussen 1973a). In western Montana, the minimum age at which *A. truei* first reproduce has been estimated at 7 years, males and females are estimated to first reproduce in their 8^{th} and 9th years, respectively, and adults may have an average lifespan of 15-20 years ,(Daugherty and Sheldon 1982a). Following metamorphosis, pre-reproductive *A. truei* from Montana exhibited limited movement, and adults, who were highly philopatric, moved even less (Daugherty and Sheldon 1982b), probably spending the majority of their time immersed in water (e.g., Claussen 1973b). Nevertheless, occasional observations of *A. truei* some distance from streams (Slater 1934; Bury and Corn 1988a, 1988b) indicate that it is able to resist desiccation like other terrestrial anurans (Claussen 1973b) and that some variation in its movement ecology may exist across its geographic range. Pacific giant salamanders (*Dicamptodon ensatus* and *D. tenebrosus*), foothill yellow-legged frogs (*Rana boylii*), and Oregon garter snakes (*Thamnophis hydrophilus)* coexist with *A. truei* in streams in California (Myers 1931, Bury 1968), and may prey on tailed frog larvae (Metter 1963; Bury 1968; Welsh and Lind, pers. comm.). Adults and juveniles of *A. truei* eat mostly amphipods, springtails, and the larvae of insects found in moist habitats (Bury 1970). (From Jennings and Hayes 1994)

Threatened in upper Sacramento River system; Special Concern elsewhere in the state; the highly specialized features of tailed frog biology (e.g., the low temperature requirements of various life stages coupled to densely forested streams) that result in long periods of development and long intervals to replace adults make this species vulnerable (Bury and Corn 1988b). Noble and Putnam (1931) and Metter (1964a) noted that *A. truei* disappeared with the removal of timber through harvesting or fire, presumably because of the increased temperatures that result when the stream is exposed (Gray and Edington 1969, Brown and Krygier 1970). Further support for the latter emerged recently when significantly different densities of tailed frogs were encountered in small streams with different temperatures because of differential removal of forest cover during the 1980 Mount Saint Helens eruption (Hawkins et al. 1988). Deforestation appears to be somewhat less detrimental along the immediate coast (Corn and Bury 1989), presumably because the maritime climate maintains a more favorable (cooler) temperature regime (Bury 1968), but the demography of *A. truei* in coastal situations needs study. For the aforementioned reason, populations of *A. truei* occupying interior locations in the upper Sacramento River system are considered at greater risk than those occupying coastal drainage systems in California. Flooding also appears to have the ability to significantly modify the structure of *A. truei* populations (Metter 1968b), so modification of the historical flooding regime may influence whether this species survives locally. (From Jennings and Hayes 1994)

Habitat & Habitat Associations: Perennial cold creeks and streams. Water temperature appears to be a very important factor, with frog only occurring in water between 5° and 24° C (Morey 2000). Old-growth coniferous forests (Jennings and Hayes 1994).

The habitat of *A. truei* is best characterized as permanent streams of low temperature to which many aspects of its life history can be correlated (Bury 1968). Intermittent streams with all the other proper environmental factors are unsuitable habitats (Brown 1990). Tailed frogs have been recorded in forested assemblages dominated by Douglas fir *(Pseudotsuga menziesii),* redwood, Sitka spruce *(Picea sitchensis),* Ponderosa pine, and western hemlock *(Tsuga hererophylla).* Although not correlated with any specific forest assemblage, recent work has established that tailed frogs are either recorded more frequently or solely in mature and old-growth stands (Bury 1983; Bury and Corn 1988a,1988b; Raphael 1988; Welsh and Lind 1988;

> Corn and Bury 1989; Welsh 1990; Welsh 1993), which possess the habitat structure most likely to create the low temperature and clear water conditions that the life stages of *A. truei* require (Welsh 1990; Welsh 1993). In California, tailed frogs are largely restricted to coastal forests with > 100 cm annual precipitation (Bury 1968). (From Jennings and 1994)

Conceptual Basis for GIS Model Development: Potential habitat for the Western Tailed Frog in the Study Area was mapped as drainages with permanent water and coniferous forest (i.e., Redwood-Douglas fir mix, *Sequoia sempervirens-Pseudotsuga menziesii)* and Pacific Douglas fir (*Pseudotsuga menziesii var.menziesii))*. Possible best habitat was mapped as mature coniferous forest > 61 cm in DBH.

Potential Occurrence in the Galbreath Wildlands Preserve:

Habitat: The quality of habitat for this species is poor to moderate in the Preserve (Figure 63). Perennial streams are available but only portions occur in coniferous forest. In addition, the species is suspected of being reliant on old growth and most large trees have been logged during the past few decades. Stream temperature has not been documented. The best habitat occurs as short sections of stream less than 200 m in length.

Nearest Occurrence:

> Documented Occurrences in the Galbreath Wildlands Preserve: This species has not been documented on the Preserve. Extensive field surveys visiting perennial creeks and ponds have been conducted by Sonoma State Biology Field Herpetology and Vertebrate Biology Classes since 2005. Both classes of about 15-20 students searched the preserve for herpetological species of interest including the western tailed frog. Vertebrate Biology visited the preserve once every March. Field Herpetology visited the preserve twice monthly from January to May.
>
> Nearest Occurrence to the Galbreath Wildlands Preserve: Albion, California (AmphibiaWeb 2010), over 40 miles from the Preserve.

Summary: We anticipate that this species is “Unlikely to Occur” in the Preserve. Habitat quality is poor to moderate, disjunct and occurs along relatively short reaches, and previous searches have not found this species. However, previous searches for this species have not be conducted in best habitat areas, which are remote from access roads. Further searches and assessments, especially with regards to stream temperatures, are warranted.

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Species Account Description: Emily Harvey

Figure 63. Potential habitat for Western Tailed Frog, *Ascaphus truei*

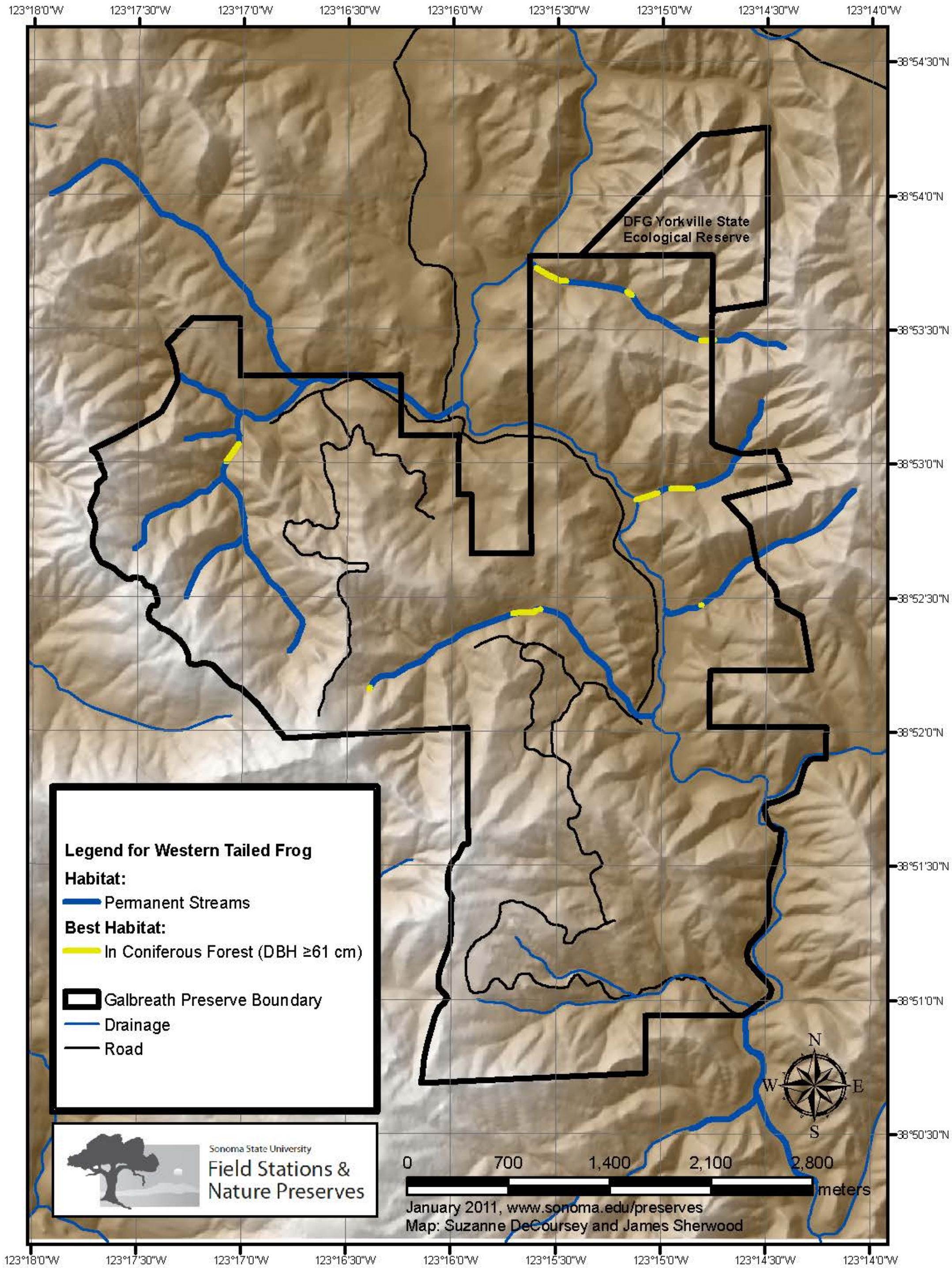

Photo: UC Berkelev 2009

Status:

Federal: None

State: Species of Special Concern

Other: G3 S2S3 BLM:S USFS:S

Species Description:

A moderate-sized (37.2-82.0 mm SUL) highly variably colored frog, but usually dark to light gray, brown, green, or yellow with a somewhat mottled appearance often with considerable amounts of brick or reddish pigment, and rough, tubercled skin (Zweifel 1955; unpubl. data). A light band is present between the eyelids that often appears as a pale triangle between the eyelids and the nose. Undersurfaces of the legs and lower belly are yellow or orangish-yellow, the latter color usually present on the largest individuals (pers. observ.). The iris is silvery gray with a horizontal, black countershading stripe (pers. observ.). (From Jennings and Hayes 1994)

Distribution:

The foothill yellow-legged frog occurs in the Coast Ranges from the Oregon border south to the Transverse Mountains in Los Angeles Co., in most of northern California west of the Cascade crest, and along the western flank of the Sierra south to Kern Co. Livezey (1963) reported an isolated population in San Joaquin Co. on the floor of the Central Valley. Isolated populations are also known from the mountains of Los Angeles County. Its elevation range extends from near sea level to 1940 m (6370 ft) in the Sierra (Jennings and Hayes 1994). (From Morey 2000)

Life History & Threats:

Terrestrial individuals are primarily diurnal. Frogs may be active all year in the warmest localities, but may become inactive or hibernate in colder areas. Like most ranid frogs, males of this species probably defend areas around themselves during the breeding season (Martof 1953, Emlen 1968). In California, breeding and egg laying usually await the end of spring flooding and may commence any time from mid-March to May, depending on local water conditions. The breeding season at any locality is usually about two weeks for most populations. Females deposit eggs in clusters of 200 to 300 (range 100 to 1000). They hatch in about five days. Tadpoles reach maximum sizes of 50 to 55 mm (2.2 in) and transform in three to four months. Adults eat both aquatic and terrestrial invertebrates. Adult insects appear to be favored, but snails, and pieces of molted skin have also been found in stomach samples (Fitch 1936). Tadpoles probably graze on algae and diatoms along rocky stream bottoms. (From Morey 2000)

Habitat loss and degradation, introduction of exotic predators, and toxic chemicals (including pesticides) pose continued and increasing threats to the long-term viability amphibians throughout California (Jennings and Hayes 1994). In addition, poorly timed water releases from upstream reservoirs can scour egg masses of this species from their oviposition substrates (Jennings and Hayes 1994), and decreased flows can force adult frogs to move into permanent pools, where they may be more susceptible to predation (Hayes and Jennings 1988). (From East Contra Costa County HCP/NCCP 2006)

Habitat & Habitat Associations:

Foothill yellow-legged frog requires shallow, flowing water, apparently preferentially in small to moderate-sized streams situations with at least some cobble-sized substrate (Hayes and Jennings 1988, Jennings 1988b). This type of habitat is probably best suited to oviposition (see Storer 1925, Fitch 1936, Zweifel 1955) and likely provides significant refuge habitat for larvae and postmetamorphs (Hayes and Jennings 1988, Jennings 1988b). Foothill yellow-legged frogs have been found in stream situations lacking a cobble or larger-sized substrate gram (Fitch 1938, Zweifel 1955), but it is not clear whether such habitats are regularly utilized (Hayes and Jennings 1988). Foothill yellow-legged frogs are infrequent or absent in habitats where introduced aquatic predators (i.e., various fishes and bullfrogs) are present (Hayes and Jennings 1986, 1988; Kupferberg 1994), probably because their aquatic developmental stages are susceptible to such predators (Grinnell and Storer 1924). (From Jennings and Hayes 1994)

The foothill yellow-legged frog is found in or near rocky streams in a variety of habitats, including valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow types. (From Morey 2000)

Unlike most other ranid frogs in California, this species is rarely encountered (even on rainy nights) far from permanent water. Tadpoles require water for at least three or four months while completing their aquatic development. (From Morey 2000)

Conceptual Basis for GIS Model Development: Foothill Yellow-Legged Frogs require perennial or seasonal rocky creeks that retain water for at least three months (Morey 2000). Potential habitat for Foothill Yellow-Legged Frog was mapped as perennial watercourses and the mainstem of Rancheria Creek which retains water for up to 3 months during the winter.

Potential Occurrence in the Galbreath Wildlands Preserve:

Habitat: Yellow-Legged Frogs live in small to moderate sized rocky streams with shallow flowing permanent water. Habitat quality for the Foothill Yellow-Legged Frog is good in the Galbreath Wildlands Preserve (Figure 64). Documented areas with a cobble substrate and shallow, slow moving water include the mainstem of the Rancheria Creek (not during winter storms) and the lower portion of Levingston Creek. The main stem quickly draws down before the summer and frogs along the mainstem must seek more permanent water in tributaries.

Nearest Occurrence: Adults and tadpoles of Yellow Legged Frogs have been observed in the Preserve on multiple occasions by staff, researchers, and students in Vertebrate Biology and Herpetology classes during multiple years. Frogs are commonly found during the Spring on most tributaries to Rancheria Creek searched, and along some sections of Rancheria Creek (near Preserve Road crossing of Levingston Creek). They can be reliably found throughout the year in a small stream channel at Levingston Falls.

Summary: Yellow-Legged Frog is "Known to Occur" in the Preserve in most drainages searched in the Preserve to date.

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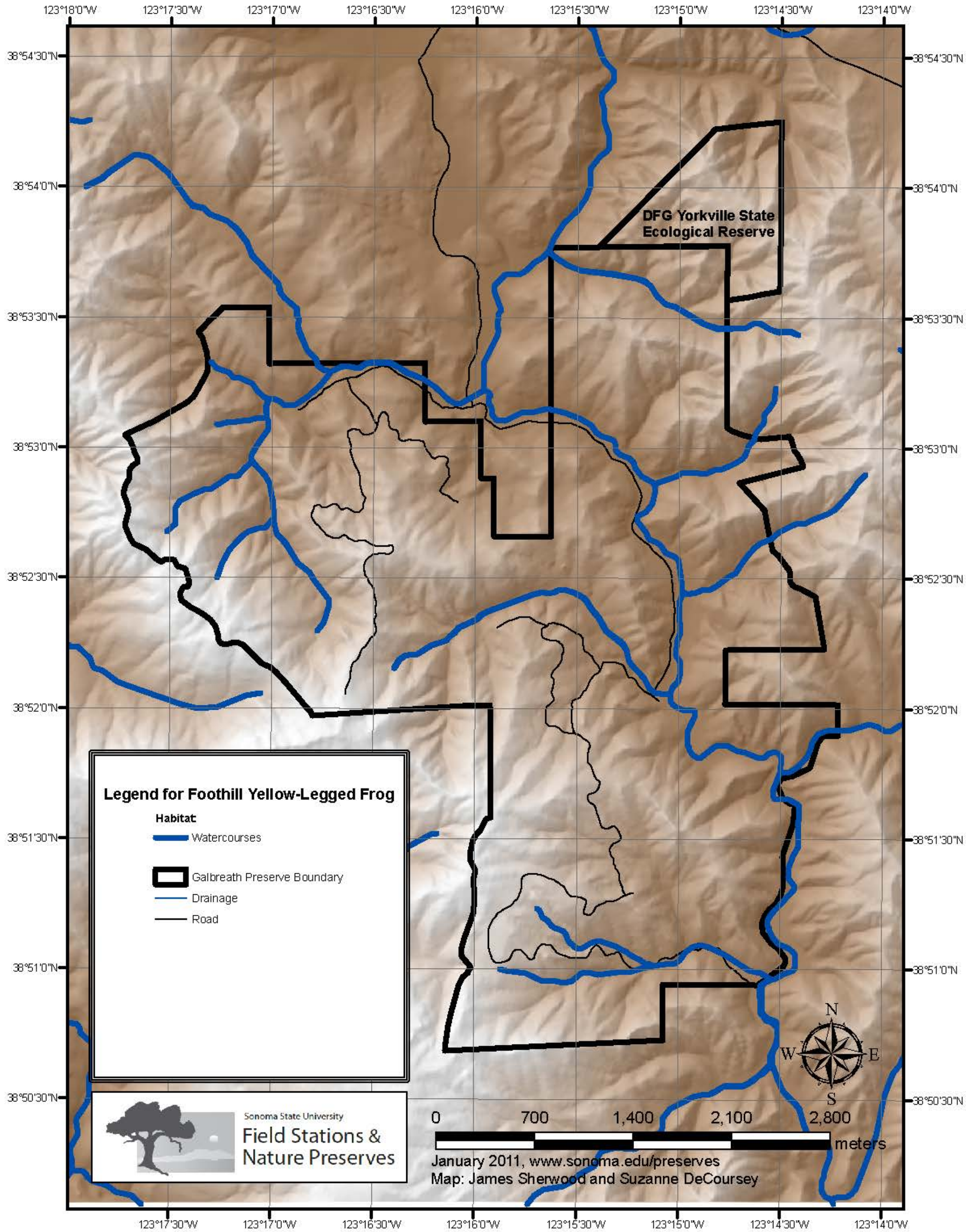
System. <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=1500> 2010 June 15.

UC Berkeley. 2009 December. Foothill Yellow Legged Frog Photo. Endangered Wildlife. Coarsegolf Resource Conservation District. <http://www.crcd.org/endangeredwildlife.html> 2010 June 17.

Species Account Description: Emily Harvey

Figure 64: Potential habitat for Foothill Yellow-Legged Frog *(Rana boylii)*



Status:

Photo: S. Price 2008

Federal: Threatened

State: Species of Special Concern

Other: None

Species Description:

A large (85.0-138.0 mm SUL) brown to reddish brown frog with prominent dorsolateral folds and diffuse moderate-sized dark brown to black spots that sometimes have light centers (Storer 1925; pers. observ.). Distribution of red or red orange pigment is highly variable, but usually restricted to the belly and the undersurfaces of the thighs, legs, and feet. Some individuals have red pigment extending over all undersurfaces and upper surfaces of the body; other individuals lack red pigment entirely or have it restricted to the feet (pers. observ.). The groin has a distinct black region with a complex arrangement of light blotches that range from white to pale yellow in color. The posterior thigh is a nearly uniform brown color with 3-12 distinct white to lemon-yellow spots. The iris is dark brown with iridophores on the upper and lower portions of the iris (pers. observ.). (From Jennings and Hayes 1994)

Distribution:

The California red-legged frog (*Rana aurora draytonii*) is endemic to California and Baja California, Mexico, and its known elevational range extends from near sea level to elevations of about 1,500 meters (5,200 feet). Nearly all sightings have occurred below 1,050 meters (3,500 feet) (Natural Diversity Database 2001). The species has been extirpated from 70 percent of its former range and now is found primarily in coastal drainages of central California, from Marin County, California, south to northern Baja California, Mexico, and in isolated drainages in the Sierra Nevada, northern Coast, and northern Transverse Ranges (U.S. Fish and Wildlife Service 1996a). Populations remain in approximately 256 streams or drainages in 28 counties. (From US Fish and Wildlife Service 2002)

Red-Legged Frogs were originally divided into two subspecies: California Red-Legged Frog (*Rana aurora draytonii*) and the Northern Red-Legged Frog (*Rana aurora aurora*). In 2004, Shaffer et al. found that genetic differentiation warranted listing the subspecies as two distinct species: the California Red-Legged Frog (*Rana draytonii*) and the Northern Red-Legged Frog (*Rana aurora*) (Shaffer et al. 2004). In the same study, they found that the intergrade zone between the two species was further north than previously thought, occurring in southern Mendocino County between the towns of Manchester and Elk, California (Shaffer et al. 2004).

Life History & Threats:

A highly aquatic species with little movement away from streamside habitats. Individuals are occasionally found on roads at night during winter and spring rains. The nature of these movements is unknown. Active all year coastally, but with periods of inactivity (late summer to early winter) elsewhere. (From Morey and Basey 2008)

Adults take aquatic and terrestrial insects and crustaceans and snails (Stebbins 1951), as well as worms, fish, tadpoles, smaller frogs, and small mammals. (Dickerson 1906, Baldwin and Stanford 1987). Aquatic larvae are mostly herbivorous. (From Morey and Basey 2008)

Breeds January to July (peak in February) in the south, and March to July in the north. Females lay 750 to 4000 eggs in clusters up to 10 in across, attached to vegetation 7 to 15 cm (2 to 6 in) below the surface (Stebbins 1954). Tadpoles require 11 to 20 weeks to reach metamorphosis (Stebbins 1951, Calef 1973). (From Morey and Basey 2008)

Eggs are deposited in permanent pools attached to emergent vegetation (Stebbins 1954). Northern red-legged frog (R. aurora) eggs are typically submerged whereas California red-legged frog (R. draytonii) eggs are in contact with waters surface (Hayes and Kremples 1986). (From Morey and Basey 2008)

The California red-legged frog is threatened within its remaining range, by a wide variety of human impacts to its habitat, including urban encroachment, construction of reservoirs and water diversions, contaminants, agriculture, and livestock grazing. These activities can destroy, degrade, and fragment habitat. The introduction of non-native predators and competitors also continues to threaten the viability of many California red-legged frog populations. (From US Fish and Wildlife Service 2002)

Habitat & Habitat Associations:

Breeding Sites:

Breeding sites of the California red-legged frog are in a variety of aquatic habitats; larvae, tadpoles, and metamorphs have been collected from streams, deep pools, backwaters within streams and creeks, ponds, marshes, sag ponds, dune ponds, and lagoons. Breeding adults are often associated with deep (greater than 0.7 meter [2 feet]) still or slow moving water and dense, shrubby riparian or emergent vegetation (Hayes and Jennings 1988), but frogs have been observed in shallow sections of streams that are not cloaked in riparian vegetation. Reis (1999) found the greatest number of tadpoles occurring in study plots with water depths of 0.26 to 0.5 meters (10 to 20 inches). While frogs successfully breed in streams, high flows and cold temperatures in streams during the spring often make these sites risky environments for eggs and tadpoles. California red-legged frogs also frequently breed in artificial impoundments such as stock ponds. It is assumed, however, that these ponds must have proper management of hydroperiod, pond structure, vegetative cover, and control of non-native predators, although some stock ponds support frogs despite a lack of emergent vegetation cover and the presence of non-native predators (N. Scott and G. Rathbun in litt. 1998). (From US Fish and Wildlife Service 2002)

Requires permanent or nearly permanent pools for larval development, which takes 11 to 20 weeks (Storer 1925, Calef 1973). Intermittent streams must retain surface water in pools year-round for frog survival (Jennings et al. 1993). May require rains for dispersal. Individuals have been found considerable distances from breeding sites on rainy nights. Water salinity may have an important influence on embryo survival (Jennings and Hayes 1989). (From Morey and Basey 2008)

Upland Sites:

The manner in which California red-legged frogs use upland habitats is not well understood; studies are currently examining the amount of time California red-legged frogs spend in upland habitats, patterns of use, and whether there is differential use of uplands by juveniles, subadults, and adults. Dispersal distances are considered to be dependent on habitat availability and environmental conditions (N. Scott and G. Rathbun in litt. 1998). Frogs spend considerable time resting and feeding in riparian vegetation when it is present. It is believed that the moisture and cover of the riparian plant community provide good foraging habitat and may facilitate dispersal in addition to providing pools and backwater aquatic areas for breeding. California red-legged frogs can be encountered living within streams at distances exceeding 3 kilometers (2 miles) from the breeding site, and have been found up to 30 meters (100 feet) from water in adjacent dense riparian vegetation, for up to 77 days (Rathbun et al. 1993). (From US Fish and Wildlife Service 2002)

California red legged frogs often disperse from their breeding habitat to forage and seek summer habitat if water is not available. This summer habitat could include spaces under boulders or rocks and organic debris, such as downed trees or logs; industrial debris; and agricultural features, such as drains, watering troughs, abandoned sheds, or hay-ricks. California red-legged frogs use small mammal burrows and moist leaf litter (Jennings and Hayes 1994); incised stream channels with portions narrower and deeper than 46 centimeters (18 inches) may also provide habitat (U.S. Fish and Wildlife Service 1996a). This depth may no longer be an accurate estimate of preferred depth for this species as individuals have been found using channels and pools of various depths. (From US Fish and Wildlife Service 2002)

Conceptual Basis for GIS Model Development: To identify suitable breeding and upland habitat for the California Red-Legged Frog in the Study Area, we mapped:

Aquatic Breeding Habitat: perennial ponds and water courses

Non-Breeding and Upland Habitat:

- vegetation within 30 m of suitable breeding habitat
- streams within 3 km of suitable breeding habitat that are wet in the non-breeding season

Potential Occurrence in the Galbreath Wildlands Preserve:

Habitat: Red-legged frogs breed in perennial ponds and stream pools. They can be found within vegetation up to 30 m from breeding sites, and will occupy ephemeral sections of streams in the wet season up to 3 km from breeding areas. Habitat quality for Red-Legged Frogs is poor to moderate in the Galbreath Wildlands Preserve (Figure 65). Perennial ponds and stream sections do occur on the Preserve, although much of this habitat is shaded by high canopy and lacks the dense, shrubby riparian or emergent vegetation preferred by this species. While frogs can also successfully breed in streams, these habitats are not preferred since they often have high flows and cold temperatures which can be detrimental for eggs and tadpoles. Some sections of Rancheria Creek may have appropriate backwaters and riparian scrub, but these areas usually draw down quickly in the summer and may not retain water long enough to allow breeding between March and July.

Nearest Occurrence:

Documented Occurrences in the Galbreath Wildlands Preserve: Red-Legged Frogs have not been observed on the Preserve. In 2010, James Bettaso (US Fish and Wildlife, Arcata) conducted spring surveys for Red-legged Frogs at the most likely habitats in the Preserve: perennial pond and at the waterfall pool on Levingston Creek.

James and assistant Kendra Gietzen surveyed the pond for frogs and egg masses from 11:15 am to 1:00 pm on March 19, 2010. In addition, they deployed a frog logger (remote recording device) that recorded 5 minute audio recordings on the hour from 8 pm to 2 am every night from March 19 to April 7, 2010. No evidence of red-legged frogs was detected during the surveys.

Field surveys visiting perennial creeks and ponds have been conducted by Sonoma State Biology Field Herpetology (twice monthly between January and May each year) and Vertebrate Biology Classes (once in March each year) since 2005. Both classes of about 15-20 students each searched the Preserve for herpetological species of interest including the Red-Legged Frog. No red-legged frogs have been found.

Nearest Occurrence to the Galbreath Wildlands Preserve: The closest documented populations of California Red-Legged Frog occur in Manchester, Mendocino County, about 25 miles northwest of Galbreath Wildlands Preserve (Shaffer et al. 2004).

Summary: We anticipate that the California Red-Legged Frog is “Unlikely to Occur” in the Preserve because of poor to moderate habitat quality, lack of observed occurrence during field surveys, and the long distance to the nearest documented occurrence.

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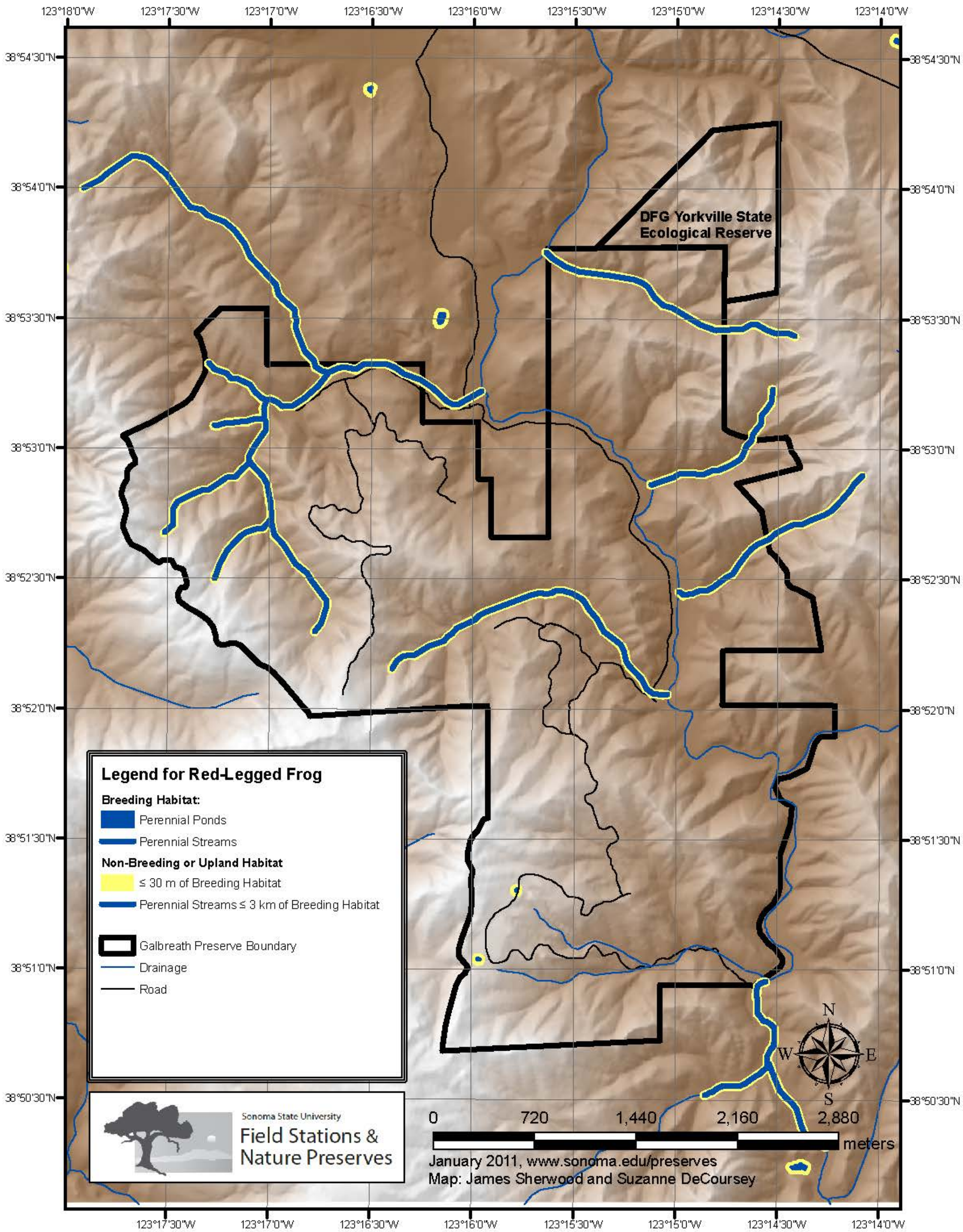
Species Account Description: Emily Harvey

Figure 65: Potential habitat for Red-Legged Frog *(Rana draytonii)*



Status:

Federal: None

State: Species of Special Concern

Other: G3G4 S3, IUCN:VU

Photo: Jeff Neuman 1998

Species Description:

A moderate-sized (120-210 mm CL), drab brown or khaki-colored turtle lacking prominent markings on its carapace (Holland 1991a). At close range, the carapace can frequently be observed to have a fine, vermiform reticulum of light and dark markings (pers. observ.). Males frequently develop a light, unmottled throat and lower facial area as they become sexually mature, markings that become even more prominent (contrasting) with increasing age; females typically retain the mottled or darker-colored throat and facial area juveniles possess into adulthood (Holland 1991a). The belly or plastron is variously marked with varying degrees of dark and light markings; turtles sometimes have an entirely dark or an entirely light plastron (pers. observ.). The iris is straw-colored with a brown eyestripe extending through the eye (D. Holland, pers. comm.). (From Jennings et al. 1994)

Distribution:

The western pond turtle is uncommon to common in suitable aquatic habitat throughout California, west of the Sierra-Cascade crest and absent from desert regions, except in the Mojave Desert along the Mojave River and its tributaries. Elevation range extends from near sea level to 1430 m (4690 ft) (Jennings and Hayes 1994). Associated with permanent or nearly permanent water in a wide variety of habitat types. (From Morey 2000)

Life History & Threats:

The Western Pond Turtle is an aquatic turtle that utilizes multiple habitat types throughout the year. In some northern populations turtles will aestivate in the summer and overwinter during the winter months. Adults spend most of their time thermoregulating by basking on the shoreline or emergent logs. Adults breed in their primary aquatic habitat in early spring (April and May). Females leave their aquatic habitat to nest in an upland location and lay 1-13 eggs in early summer. Young hatch in the late summer and generally over winter in the nest until early spring. Juveniles feed on Nekton and spend most of their time in shallow water with high amounts of vegetative cover. Growth rates vary with elevation and latitudes but generally juveniles grow rapidly for the first 4-5 years. Reproductive maturity is though to occur between 7-11 years of age in California populations. Adults feed primarily on slow moving aquatic invertebrates but are opportunistic feeders and will eat almost anything they can overpower (Jennings et al. 1994).

The greatest threats to Western Pond Turtle populations are habitat loss and fragmentation. Elimination of habitat due to agricultural and urban development, flood control and water diversion threaten the survival of Western Pond Turtles. Competition with invasive turtle species, such as Red-Eared Slider's and hatching predation by Bullfrogs threaten recruitment in Western Pond Turtle populations as well (Jennings et al. 1994).

Habitat & Habitat Associations:

Aquatic: Western pond turtles require permanent or relatively permanent ponds, lakes, creeks and pools along intermittent streams (Morey 2000).

Western pond turtles inhabit some of the larger rivers within their range (e.g., the Sacramento, Klamath,and Willamette), but are usually restricted to areas near the banks or in adjacent backwater habitats where the current is relatively slow and abundant emergent basking sitesand refugia exist. They may be found in slower moving streams where emergent basking sites are available,but generally avoid heavily shaded areas. In some areas of California, intermittent streamshold sizeable populations. Turtles are also known to use ephemeral pools. (From Hays 1999)

Habitats used by western pond turtles may have a variety of substrates including solid rock, boulders, cobbles, gravel, sand, mud, decaying vegetation, and combinations of these. In many areas turtles are found in rocky streams with little or no emergent vegetation. In other areas they occur in slow-moving streams or backwaters with abundant emergent vegetation such as cattails or bulrush (*Scirpus* spp.)(Holland 1991c). In certain coastal streams of California they occur in areas with no emergent vegetation but abundant submerged vegetation, most typically ditch grass (*Ruppia maritima*). In the northern parts of the range, pond lilies (*Nuphar* spp.) or arrow weed (*Sagittaria* spp.) are often the dominant aquatic macrophytes. In disturbed habitats large mats of filamentous algae may be the only aquatic vegetation present. Dense growths of woody vegetation along the edges of a watercourse may shade potential emergent basking sites, and make habitats unsuitable for pond turtles. (From Hays 1999)

In the northern parts of the range, pond lilies (*Nuphar* spp.) or arrow weed (*Sagittaria* spp.) are often the dominant aquatic macrophytes. (From Hays 1999)

Western pond turtles use partially submerged logs, rocks and mats of floating vegetation as basking sites (Morey. 2000). Juveniles require shallow water with submergent and emergent vegetation for foraging and predator avoidance (Jennings et al. 1994).

Overwintering/Aestivating:

Western pond turtles use upland areas for dispersal, to nest, to overwinter, and to aestivate. Many turtles overwinter on land at sites up to 500 m (0.3 mi) from the water. Overwintering sites tend to have a deep layer of duff or leaf litter under trees or shrubs, and some turtles return to the same site each year (Holland 1994, Holland and Bury 1998, K. Slavens, pers. comm.). Reese and Welsh (1997) reported that 10 turtles overwintered at upland sites a mean distance of 203 m (666 ft) from the water. Turtles burrowed into deep leaf or needle litter at sites beyond the riparian zone in woodlands with 15-90% canopy cover. Most of the overwintering sites were on relatively cool north or east facing slopes. (From Hays 1999)

Nesting:

Females utilize south facing slopes ranging from 25-60 degrees for nesting (Jennings et al. 1994). Females will generally migrate about 100 m to reach a nesting site, but can travel as far as 400 m. (From Hays 1999)

Turtles usually nest in open areas with good sun exposure that are dominated by grasses and herbaceous vegetation, with few shrubs or trees close by. Exposure varies, but typically is south or southwest (Holland 1991b). The distance from water for 275 nests in California averaged 45.6 (149ft) m (range 1.5-402 m)(5-1,326 ft) (Holland and Bury 1998).

(From Hays 1999)

Females use high clay or silt fraction substrate and unshaded south facing slopes for nesting site (Jennings et al 1994).

Conceptual Basis for GIS Model Development:

Aquatic: To define potential habitat in the Study Area, we mapped all permanent and intermittent watercourses and ponds. Since dense growth of woody vegetation along the edges of watercourse minimizes potential for occurrence, we removed sections of watercourses with ≥ 40% canopy cover.

Nesting: We identified areas:

- ≤ 400 m of the suitable aquatic habitat
- 25-60 degrees in slope. (Note that the maximum slope in the Study Area is 54 degrees. Due to slope category cutoffs in the GIS database, the lowest slope chosen was 23 degrees.)
- on S, SE, or SW facing slopes
- with clay loam or loam soils.

Overwintering/Aestivating: Areas ≤ 500 m from suitable aquatic habitat:

- in woodland or shrubland habitat types with 15-90% canopy cover. (Note that due to canopy cover category cutoffs in the GIS database, we mapped woodland types with 10-89% canopy cover. Also, all shrubland habitats in the GIS base are recorded as having < 10% canopy cover, and were not included in the map. No shrublands occur within the boundaries of the Preserve.)

Although "most" overwintering sites may be on north or east facing slopes, we did not map this habitat attribute.

Potential Occurrence in the Galbreath Wildlands Preserve:

Habitat: Rancheria Creek and surrounding upland areas provide abundant potential aquatic, nesting, and overwintering/aestivating habitats on the Preserve (Figure 66). Because surface water in Rancheria Creek is seasonal, aquatic habitat is not available for Western Pond Turtles during the summer.

Nearest Occurrence: Western Pond Turtles are regularly observed by researchers and classes in Rancheria Creek at the Elkhorn Road crossing and in sections of the creek near the Preserve Road crossing. Observations include individuals of different life stages.

Professional Consultations: Nick Geist (SSU Professor) works with Western Pond Turtles on the Preserve.

Summary: This species is observed regularly on the Preserve. Good quality habitat is abundant and sufficient to support many individuals of this widespread species.

References:

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Species Account Description: Emily Harvey

Figure 66: Potential habitat for Western Pond Turtle *(Actinemys marmorata)*