APPENDIX D

BIOLOGICAL SURVEYS

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APPENDIX D

Biological Surveys

Fish Surveys

CDFG initiated fish studies in 1997. Fish studies were conducted in the tributaries that flow through each of the four proposed project areas. Past studies also were reviewed and evaluated as part of this effort. Results and discussions of findings in past fishery studies and recently conducted surveys of fishery resources in the four proposed reservoir areas are summarized in this section.

Sites and Colusa Cell Reservoirs

Fish studies for the Sites and Colusa Reservoirs include three basic areas: fish resource studies in streams within the proposed reservoirs and within the Colusa Basin Drain, and habitat typing of the dominant streams in the proposed reservoir areas.

Studies of fish in streams that flow through the proposed Sites and Colusa Reservoir areas were conducted in 1998 and 1999. Within the footprint of the potential areas, 36 sample stations were seined to determine fish species composition. The stations were spread out among Hunter, Minton, Logan, Antelope, and particularly Stone Corral and Funks Creeks. Seven farm impoundment ponds in the area also were seined for fish.

In the Sites and Colusa Reservoir areas, 12 species of fishes were caught in 1998 and 1999. Five species were game fishes, and seven species were non-game fishes (Table D-1).

Table D-1

Fish Caught in the Sites Reservoir Area in 1998 and 1999

Common Name	Scientific Name
Bluegill	*Lepomis macrochirus*
California roach	*Hesperoleucus symmetricus*
Chinook salmon	*Oncorhynchus tschawtscha*
Green sunfish	*Lepomis cyanellus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Red-eared sunfish	*Lepomis microlophus*
Sacramento blackfish	*Porthodon microlepidotus*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*atostomus occidentalis*
Sculpin sp.	*Cottus sp.*

Hitch were found in all of the creeks in the Sites and Colusa Reservoir areas. Hitch also were present in the greatest numbers. Stone Corral Creek had the greatest diversity of fishes throughout the year, with

eight species, including two species of introduced game fish, bluegill, and green sunfish. However, fish densities were lower, particularly for hitch in Stone Corral, than in other creeks. The next most diverse creek, Funks Creek, had only five species of fish, including one introduced game fish, the largemouth bass.

Most fish captured during seining were minnows, members of the Cyprinid family. California roach are the only fish present that are adapted to spending summers in the remaining pools of intermittent streams (Moyle, 1976). Very few fish found while seining, including game fish, were above 5.9 inches long, suggesting that only juvenile fish rear in these areas. Adult fish typically ascend seasonal creeks in the study area in winter and spawn there in early spring. Most of the adults migrate downstream after they spawn.

Three game fish species were found in the seven ponds that were seined: red-eared sunfish, bluegill, and largemouth bass. Red-eared sunfish were found in one pond, bluegill were found in abundance in two ponds, and largemouth bass were found in three ponds out of the seven seined.

No species of concern or threatened or endangered species were found in this study. The species caught during the study are common in California.

Sites Reservoir

Stone Corral Creek. Eleven stations were sampled on Stone Corral Creek between July 15, 1998, and January 6, 1999. Eight species of fish were found in Stone Corral Creek, including two species of game fish, green sunfish, and bluegill.

The fish that occurred at the most stations was the Sacramento pike minnow, followed by the hitch (Table D-2). The density of fish on Stone Corral was relatively low for all species at all stations. Hitch were the dominant species in terms of density (0.8 fish/square yard [yd^2]).

Table D-2

Species Caught at Each Station and Relative Abundance in Stone Corral Creek

Species	Station Sampled											Fish/Yd^2
	1	2	3	4	5	6	7	8	9	10	11	
Bluegill				X								0.002
California roach		X		X								0.020
Green sunfish			X					X	X	X	X	0.030
Hitch		X	X					X	X	X	X	0.800
Mosquitofish				X								0.002
Sacramento blackfish											X	0.200
Sacramento pike minnow			X	X	X	X		X	X		X	0.200
Sacramento sucker			X	X		X					X	0.020

Antelope Creek. Five stations were sampled on Antelope Creek between July 14, 1998, and November 25, 1998. Three species of fish were captured on Antelope Creek: green sunfish, hitch, and Sacramento pike minnow (Table D-3). Hitch were the most abundant fish, with an average density of 3.8 fish/yd^2. The

Sacramento pike minnow and the green sunfish both had a relative abundance of 0.20 fish/yd^2. A single spring-run chinook salmon swam up Antelope Creek in the spring and died in a pool in early summer. Habitat in Antelope Creek does not support salmon because the creek almost dries up each summer. The remaining water is too hot to allow salmon to survive there.

Table D-3

Species Caught at Each Station and Relative Abundance in Antelope Creek

Species	Station Sampled					Fish/Yd^2
	1	2	3	4	5	
Green sunfish		X		X	X	0.2
Hitch	X	X	X	X	X	3.8
Sacramento pike minnow				X	X	0.2

Funks Creek. A total of 15 stations were sampled on Funks Creek between July 22, 1998, and January 8, 1999. Funks Creek had five species of fish, including one introduced game fish, largemouth bass. The most common fish in Funks Creek was the hitch, with an average density of 3.1 fish/yd^2 (Table D-4). Hitch were caught in 11 out of 15 stations seined.

Table D-4

Species Caught at Each Sample Station and Relative Abundance in Funks Creek

Species	Station Sampled															Fish/Yd^2
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hitch			X	X	X	X	X	X	X	X	X	X	X			3.100
Largemouth bass									X			X				0.001
Sacramento pike minnow				X	X				X				X			0.060
Sacramento sucker					X	X			X	X			X			0.020
Sculpin														X		—

The most diverse sections of Funks Creek sampled were in the lower reaches, stations 5, 6, 9, 10, 12, and 13. In the upper reaches of Funks Creek that were sampled, either fish were lacking or only one species was found. Hitch densities varied widely throughout the creek, and no one area seemed to maintain a higher population.

Colusa Cell Reservoir

Hunters Creek. Three stations were seined on Hunters Creek between July 22, 1998, and August 3, 1998. Only two species of fish were found on Hunters Creek, the mosquitofish and the green sunfish. Both species were found in two of the three stations (Table D-5). Mosquitofish were found in relative abundance, at 3.8 fish/yd^2, but they only occurred in abundance at one station. Green sunfish were found to have an average density of 2.3 fish/yd^2.

Table D-5

Relative Abundance of Fish Caught in Hunters Creek

Species	Fish/Yd^2
Green sunfish	2.3
Mosquitofish	3.8

Minton Creek. Minton Creek was sampled in two locations in August 1998. Hitch were found in one of those stations at a density of 0.5 fish/yd^2.

Logan Creek. Four stations were sampled on Logan Creek in August 1998. Hitch were caught in stations 1 and 2. The average density of hitch in Logan Creek was 0.4 fish/yd^2.

Colusa Basin Drain

The Colusa Basin Drain (CBD) is a natural channel; historically, it has transported water from west side tributaries, such as Willow, Funks, Stone Corral, and Freshwater Creeks, to the Sacramento River. It also has carried overflowing floodwater from the Sacramento River. With the advent of agriculture in the Sacramento Valley, the CBD was channelized and dredged to carry agricultural runoff in addition to natural flows.

The CBD provides little bank cover for fish; however, some instream cover is provided by large and small woody debris. Its banks are scoured by periodic high flows, and roads often run along the dikes that contain the waters of the CBD. The bottom of the CBD is largely mud. Water in the CBD is turbid and warm in the summer, and turbid and cool during the winter. The proposed diversion from the CBD for the Sites and Colusa Reservoirs would be east of the town of Maxwell, along the CBD.

Two fyke nets were placed in the CBD, one upstream from the diversion point and one downstream, to sample fish. Periodic seining, seine and hook, and line sampling also were used to sample fish in the CBD at the upper net location.

A total of 9 game fish and 17 nongame fish were caught (Table D-6). The warmouth (*Lepomis gulosus*) and the largemouth bass *(Micropterus salmoides*), which were caught by United States Geological Survey (USGS) in 1996, were not observed in the recent surveys.

Table D-6

Resident Fish of the Colusa Basin Drain

Common Name	Scientific Name
Game Fish	
Black bullhead	*Ictalurus melas*
Black crappie	*Pomoxis nigromaculatus*
Bluegill	*Lepomis macrochirus*
Brown bullhead	*Ictalurus nebulosus*
Channel catfish	*Ictalurus punctatus*
Chinook salmon	*Oncorhynchus tschawtscha*

Table D-6
(Continued)

Common Name	Scientific Name
Game Fish (continued)	
Green sunfish	*Lepomis cyanellus*
White catfish	*Ictalurus catus*
White crappie	*Pomoxis annularis*
Nongame Fish	
Big scale logperch	*Percina macrolepida*
California roach	*Hesperoleucus symmetricus*
Carp	*Cyprinus carpio*
Fathead minnow	*Pimephales promelas*
Goldfish	*Carassius auratus*
Hitch	*Lavinia exilicauda*
Inland silversides	*Menidia beryllina*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tridentata*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptycholcheilus grandis*
Sacramento splittail	*Pogonichthys macrolepidotus*
Sacramento sucker	*Catostomus occidentalis*
Sculpin sp.	*Cottus sp.*
Threadfin shad	*Dorosoma pretenense*
Tui chub	*Gila bicolor*
Tule perch	*Hysterocarpus traski*

Thomes-Newville Reservoir

CDFG initiated studies of the impacts on fish and wildlife in the Thomes-Newville Reservoir area in 1979 as part of DWR's Thomes-Newville Reservoir planning studies. However, the planning studies were halted in 1982. CDFG completed a report of its abbreviated studies in 1983 (Brown et al., 1983). In 1998, CDFG initiated studies of fish and wildlife resources in the Thomes-Newville Reservoir area as part of the North-of-Delta Offstream Storage Program. A brief survey of springrun chinook salmon was conducted during the recent investigations. This section discusses recent findings and recapitulates the effort and results of the 1982 study (Brown et al., 1983).

Seining for juvenile chinook salmon in Stony and Thomes Creeks was done over three years, from 1980 to 1982. Carcasses of chinook salmon were counted to estimate the number of adult salmon in Stony and Thomes Creeks. On June 13, 1979, August 18, 1980, and August 12, 1998, Thomes Creek was surveyed to enumerate spring-run chinook salmon and summer-steelhead. A fyke net was placed in the creek near the mouth of Thomes Creek to capture juvenile and larval Sacramento sucker and Sacramento pike

minnows migrating to the Sacramento River. Streams in the footprint of the proposed Thomes-Newville Reservoir were sampled by electrofishing 1981 and 1982.

Thomes Creek

Juvenile Chinook Salmon and Steelhead

Thirteen juvenile chinook salmon were captured by seining during the 1980 sampling period (Table D-7). These fish were caught in lower Thomes Creek from March 20 to May 24, 1980. Six juvenile chinook salmon were captured by seining during the 1981 sampling period. One of these fish was from Coleman National Fish Hatchery.

Table D-7

Juvenile Chinook Salmon Seined from Thomes Creek in 1980 and 1981 (Brown et al., 1983)

Sample Period	Number of Weekly Seining Events	Number of Fish	Average Length of Fish (in)
March 1980	4	5	2.8
April 1980	5	8	2.8
Total 1980	9	13	
March 1981	2	5	4.1
April 1981	1	1	2.3
Total 1981	3	6	

Seven juvenile steelhead were captured by seining in Thomes Creek in 1981. Four of these fish were probably from Coleman National Fish Hatchery. They had rounded fins and deformed dorsal fins, which are a characteristic of hatchery-grown fish.

In 1981, 206 juvenile chinook salmon were captured by fyke netting in Thomes Creek; 20 were from the main stem, and 186 were from the Tehama-Colusa Canal discharge canal (Tables D-8 and D-9).

Table D-8

Fyke Net Catches of Juvenile Chinook Salmon from Main Stem of Thomes Creek in 1981 (Brown et al., 1983)

Sample Period	Hours Fished	Number of Salmon	Average Length of Fish (inches)
February	672	0	0
March	744	9	2.7
April	648	10	3.1
May	336	1	2.7
Total	2,400	20	

Table D-9

Fyke Net Catches of Juvenile Chinook Salmon from the Tehama-Colusa Canal Discharge Channel in Thomes Creek in 1981 and 1982 (Brown et al., 1983)

Sample Period	Number of Fish	Average Length of Fish (inches)
January 1981	1	1.4
February 1981	126	1.3
March 1981	59	1.3
Total 1981	186	
January 1982	2	1.4
February 1982	45	1.4
March 1982	337	1.5
Total 1982	384	

No juvenile chinook salmon or steelhead were captured by seining or fyke netting in the main stem of Thomes Creek during the 1982 sampling period. However, 384 juvenile chinook salmon were captured by fyke netting in the Tehama-Colusa Canal discharge channel. The first fish was captured during the first week of January, but the bulk of the emigration did not occur until the third week of February.

Adult Chinook Salmon

1980-1981 Fall-Run Estimate. Fifty-nine chinook salmon carcasses were tagged during 12 surveys of Thomes Creek. Of these carcasses, 23 were recovered. From these data, an estimated 155 salmon spawned in Thomes Creek during the sampling period. Live fish were first observed in the creek November 11, 1980, but the first carcass was tagged 9 days later. The last carcass was tagged on January 12, 1981.

Of the fish tagged, 57 (97%) were located in the Tehama-Colusa Canal outlet channel. Only two fish (3 percent) were tagged in the mainstem. Observation of six redds and four live fish indicate there was some spawning activity in areas below Henleyville.

1981-1982 Fall-Run Estimates. Thirty-eight chinook salmon carcasses were tagged during 10 surveys of Thomes Creek. Of these carcasses, 20 were recovered. From the data, an estimated 167 salmon spawned in Thomes Creek during the sampling period. All of the fish recovered were located in the Tehama-Colusa Canal outlet channel. No live fish or redd were seen in the mainstem.

1979-1980 Spring-Run Estimates. No adult anadromous salmonid was seen during the June 1979 or August 1980 spring-run chinook salmon surveys in Thomes Creek. Numerous juvenile steelhead and brown trout were seen in the area of the survey, which may indicate that habitat for spring-run chinook salmon or summer steelhead may exist.

1999 Spring-Run Estimates. One adult spring-run chinook salmon was seen during August 1999 diving surveys in Thomes Creek. As in 1980, numerous juvenile steelhead and brown trout were seen in the area of the survey.

1979 Late Fall-Run. The late spawning characteristics of a few chinook salmon indicate that they were of the late fall-run. Those that spawned in late December and January were salmon of this race.

Resident Fish and Migratory Nongame Fish

Twenty-two species of fish were observed in Thomes Creek (Table D-10). CDFG staff developed population and biomass estimates for 13 of these species (Table D-11). Three species were gamefishes ,and 10 were nongame fishes. While steelhead were the most abundant fish above the gorge, Sacramento pike minnow, Sacramento suckers, hardhead, California roach, and speckled dace were the more common fish below the gorge.

Table D-10

Fish Species Found in Thomes Creek in 1982 (Brown et al., 1983)

Common Name	Scientific Name
Bluegill	*Lepomis machrochirus*
Brown bullhead	*Ictalurus nebulosus*
California roach	*Lavinia symmetricus*
Carp	*Cyprinus carpio*
Channel catfish	*Ictalurus punctatus*
Golden shiner	*Notemigomus crysoleucus*
Goldfish	*Carassius auratus*
Green sunfish	*Lepomis cyanellus*
Hardhead	*Mylopharodon conocephalus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tredentata*
Prickly sculpin	*Cottus asper*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentatlis*
Smallmouth bass	*Micropterus dolomeiu*
Speckled dace	*Rhinicthys osculus*
Steelhead	*Onchorynchus mykiss*
Threespine stickleback	*Gasterosteus aculeatus*
Tule perch	*Hysterocarpus traski*
White catfish	*Ictalurus catus*

Most of the nongame fish that were caught in the reach below the gorge were juveniles, indicating that this reach serves primarily as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead migrate annually from the Sacramento River into Thomes Creek

and its tributaries to spawn. Juveniles that do not emigrate immediately after hatching remain to rear until the following rainy season, when water flows to the mouth.

Table D-11

Average Population Estimates and Biomass Estimates for Fish Caught in Sections of Thomes Creek in 1982 (Brown et al., 1983)

Species	Average Population Estimate	Average Biomass (lb/acre)
Bluegill	3	4.5
California roach	41	10.7
Carp	90	64.2
Goldfish	1	19.2
Green sunfish	14	15.2
Hardhead	47	47.3
Hitch	1	0.4
Largemouth bass	5	8.0
Prickly sculpin	1	1.8
Sacramento pike minnow	337	89.2
Sacramento sucker	143	16.1
Speckled dace	229	16.1
Tule perch	1	0.2

Thomes Creek below Paskenta usually dries up except for a few residual pools scattered along the streambed during the late summer. This makes it impossible for resident adult fish to live throughout the summer months. Some adult game fish, such as largemouth bass, smallmouth bass, bluegill, and green sunfish, ascend the creek from the Sacramento River during the late spring and early summer to use these pools as spawning areas.

Stony Creek

Juvenile Chinook Salmon and Steelhead

During the 1980 sampling period, 181 juvenile chinook salmon were caught by seining (Table D-12). Salmon were first caught during the second week of February, while the last salmon was caught during the first week of May. During the 1981 sampling period, 73 juvenile chinook salmon were captured by seining. Fish were first captured during the third week of February, while the last fish were captured during the second week of April. During the 1982 sampling period, only four juvenile chinook salmon were captured by seining. Two fish were captured during January, and two were captured during the first week of March.

Adult Chinook Salmon

1981-1982 Fall-Run Estimates. Thirty-six chinook salmon carcasses were tagged during five surveys. Of these, 2 were recovered. From these data, CDFG estimates that 393 salmon spawned in Stony Creek

during the sampling period. Twenty-five fish (69%) were females, while 11 fish (31%) were males. This represents a male-female ratio of 1:2.3.

Table D-12

Juvenile Chinook Salmon Seined from Stony Creek in 1980, 1981, and 1982 (Brown et al., 1983)

Sample Period	Number of Fish	Average Length of Fish (inches)
February 1980	64	1.7
March 1980	51	1.8
April 1980	60	2.0
May 1980	6	3.0
Total 1980	181	
February 1981	5	1.5
March 1981	64	2.1
April 1981	4	3.0
Total 1981	73	
January 1982	2	3.3
March 1982	2	1.7
Total 1982	4	

Most of the spawning activity was located in lower Stony Creek in the reach between Interstate 5 bridge and the North Diversion Dam. At least 35 redds and 29 carcasses were counted in this area.

Resident Fish Surveys

Six species of fish, two game species and four nongame species, were captured in streams potentially inundated by the Thomes-Newville Reservoir. These streams include North Fork Stony Creek, Salt Creek, and Heifer Camp Creek. Rainbow trout were captured in sections of streams above the inundation line where the water is cool and cover is abundant. California roach, Sacramento pike minnow, Sacramento sucker, carp, and green sunfish were captured in sections of streams below the inundation line. California roach, Sacramento pike minnows, and Sacramento suckers were more abundant species, while carp and green sunfish are relatively uncommon (Tables D-13 and D-14).

Table D-13

Population Estimates for Fish Caught in Selected Sections of Streams Within the Thomes-Newville Reservoir Site in 1983 (Brown et al., 1983)

Species	North Fork Stony Creek	Salt Creek	Heifer Camp Creek
California roach	4	546	120
Carp	1		
Green sunfish	-	13	
Rainbow trout	-	24	8
Sacramento pike minnow	12	24	85
Sacramento sucker	> 2	45	6

Table D-14

Average Biomass Estimates (lb/acre) for Fish Caught in Selected Sections of Streams Within the Thomes-Newville Reservoir Site in 1983 (Brown et al., 1983)

Species	North Fork Stony Creek	Salt Creek	Heifer Camp Creek
California roach	0.9	427.3	72.3
Carp	145.4	-	
Green sunfish	-	33.9	
Rainbow trout	-	74.9	18.7
Sacramento pike minnow	8	339.9	775.1
Sacramento sucker	0.09	88.3	

Upper Salt Creek supports a population of rainbow trout. Nongame fishes were not found in this area and, because of a waterfall, migratory Cyprinids cannot ascend the creek.

Twenty-eight species of fishes were observed in Stony Creek (Table D-15). CDFG staff developed population and biomass estimates for 22 of these species (Table D-16). Nine species were game fish, and 13 were nongame fish. Largemouth bass and bluegill were the most abundant gamefish below Black Butte Reservoir, and channel catfish and white catish were the most abundant game fish above the Sacramento River. Sacramento pike minnows and suckers were found in all stations throughout Stony Creek, were the most abundant, and had the highest biomass for all species of fish. Prickly sculpin were found in all sections but made up a very small portion of the total biomass. Most of the nongame fish that were caught in the reach below Black Butte Reservoir were juveniles, indicating that this reach serves primarily as a spawning and rearing area.

Table D-15

Fish of the Stony Creek Drainage (Excludes Fish Within Newville Reservoir Site) (Brown et al., 1983)

Common Name	Scientific Name
Black bullhead	*Ictalurus melas*
Black crappie	*Pomoxis melas*
Bluegill	*Lepomis machrochirus*
Brown bullhead	*Ictalurus nebulosus*
California roach	*Lavinia symmetricus*
Carp	*Cyprinus carpio*
Channel catfish	*Ictalurus punctatus*
Golden shiner	*Notemigomus crysoleucus*
Goldfish	*Carassius auratus*
Green sunfish	*Lepomis cyanellus*
Hardhead	*Mylopharodon conocephalus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tridentata*
Prickly sculpin	*Cottus asper*
Rainbow trout	*Onchorynchus mykiss*
Redear sunfish	*Lepomis microlophus*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentatlis*
Smallmouth bass	*Micropterus dolomeiu*
Speckled dace	*Rhinicthys osculus*
Threadfin shad	*Dorosoma petenense*
Threespine stickleback	*Gasterosteus aculeatus*
Tule perch	*Hysterocarpus traski*
White catfish	*Ictalurus catus*
White crappie	*Pomoxis annularis*

Table D-16

Average Population Estimates and Biomass Estimates for Fish Caught in Selected Sections of Stony Creek in 1982 (Brown et al., 1983)

Species	Average Population Estimate	Average Biomass (lb/acre)
Black crappie	8	87.4
Bluegill	19	8.0
Carp	5	64.2
Channel catfish	57	47.3
Goldfish	8	33.9
Green sunfish	7	2.7
Hardhead	9	24.1
Hitch	32	20.5
Largemouth bass	13	11.6
Mosquitofish	3	0.09
Prickly sculpin	57	11.6
Roach	200	54.4
Sacramento pike minnow	146	91.0
Sacramento sucker	96	256.9
Smallmouth bass	5	16.1
Speckled dace	318	41.9
Threadfin shad	2	0.9
Threespine stickleback	3	0.05
Tule perch	6	5.4
White catfish	30	34.8
White crappie	5	17.8

Red Bank

This section describes the results of current and past fish studies conducted on Red Bank and Cottonwood Creeks, the major tributaries of the Red Bank Reservoir area. Past studies date back to 1969. Other studies reviewed include reports prepared by CDFG and DWR in 1972, 1975, 1985, and 1987.

Red Bank Creek

In 1998, CDFG biologists sampled fish at 28 stations within the footprint of Schoenfield Reservoir. Sixteen stations were seined on Red Bank Creek and its tributaries, Dry and Grizzly Creeks. Twelve stations were sampled on Red Bank Creek by electrofishing.

Four species of nongame fish were observed (Table D-17). The most common species of nongame fish found was the California roach (0.588 fish/yd^2) followed by the Sacramento pike minnow (0.158 fish/yd^2)

(Table D-18). Four species of resident game fish also were observed. The most common resident game fish were largemouth bass (0.009 fish/d_2). Juvenile steelhead were found in 2 of the 28 stations sampled.

Table D-17

Nongame Fish Observed in Red Bank and Cottonwood Creeks

Common Name	Scientific Name	Cottonwood Creek (1976)	Red Bank Creek (1998)
California roach	*Hesperoleucus symmetricus*	X	X
Carp	*Cyprinus carpio*	X	
Golden shiner	*Notemigonus crysoleucas*	X	
Hardhead	*Mylopharodon conocephalus*	X	
Hitch	*Lavinia exilicauda*	X	
Mosquitofish	*Gambusia affinis*	X	
Pacific lamprey	*Lampetra tridentata*	X	X
Prickly sculpin	*Cottus asper*	X	
Sacramento pike minnow	*Ptychocheilus grandis*	X	X
Sacramento sucker	*Catostomus occidentalis*	X	X
Speckled dace	*Rhinichthys osculus*	X	
Threespine stickleback	*Gasterosteus aculeatus*	X	
Tule perch	*Hysterocarpus traski*	X	

Table D-18

Relative Abundance of Non-Game Fish Caught in Lower Cottonwood Creek, 1976, and in Red Bank Creek, 1998 (Fish/Yd^2)

Common Name	Cottonwood Creek (1976)	Red Bank Creek (1998)
California roach	0.003	0.588
Carp	0.003	
Hardhead	0.022	
Sacramento pike minnow	0.015	0.158
Sacramento sucker	0.006	0.091

Cottonwood Creek

Biologists conducted fisheries surveys of Cottonwood Creek from the confluence of the north fork to the mouth of Cottonwood Creek in 1976 to provide environmental documentation for reservoir planning. Observations were made by diving, seining, fyke netting, and electrofishing. Abundance estimates were made for fish caught by electrofishing. No estimates of abundance were done for fish caught in fyke nets; therefore, these fish were not included in the relative abundance tables.

Thirteen species of nongame fish were observed in Cottonwood Creek (Table D-17). The most common species of resident nongame fish found were hardhead (0.022 fish/yd^2) and Sacramento pike minnow (0.015 fish/yd^2) (Table D-18). Some Sacramento pike minnows and Sacramento suckers migrate to the Sacramento-San Joaquin estuary to rear and return to Cottonwood Creek as adults to spawn.

Biologists observed 10 species of resident game fish in the Cottonwood Creek system in 1976 (Table D-19). The most common resident game fish were bluegill (0.022 fish/yd^2) and green sunfish (0.015 fish/yd^2) (Table D-20). Steelhead were common in the higher reaches of the Cottonwood system, but not common in the lower reaches, while green sunfish and bluegill were more common in the lower reaches surveyed. No estimates of abundance were done for fish caught in fyke nets; therefore, these fish were not included in the relative abundance tables.

Table D-19

Game Fish Observed in Cottonwood Creek, 1976, and in Red Bank Creek, 1998

Common Name	Scientific Name	Cottonwood Creek	Red Bank Creek
Black bullhead	*Ictalurus melas*	X	
Bluegill	*Lepomis macrochirus*	X	
Brown bullhead	*Ictalurus nebulosus*	X	X
Brown trout	*Salmo trutta*	X	
Chinook salmon	*Onchorhynchus tshawytscha*	X	
Green sunfish	*Lepomis cyanellus*	X	X
Largemouth bass	*Micropterus salmoides*	X	X
Smallmouth bass	*Micropterus dolomieui*	X	
Steelhead	*Onchorhynchys mykiss*	X	X
White catfish	*Ictalurus catus*	X	

Table D-20

Relative Abundance of Resident Game Fish Caught in Lower Cottonwood Creek and in Red Bank Creek (Fish/Yd^2)

Common Name	Scientific Name	Cottonwood Creek (1976)	Red Bank Creek (1998)
Bluegill	*Lepomis macrochirus*	0.022	0.001
Brown bullhead	*Ictalurus nebulosus*	0.006	
Green sunfish	*Lepomis cyanellus*	0.015	0.001
Largemouth bass	*Micropterus salmoides*	0.003	0.009
Smallmouth bass	*Micropterus dolomieui*	0.003	

Biologists found populations of juvenile steelhead in South Fork Cottonwood Creek in the Yolla Bolly Wilderness in the summer of 1976. No estimates of populations of juvenile steelhead were made. The

Yolla Bolly Wilderness is well above the proposed Dippingvat Dam site. Adult steelhead were seined from the mouth of Cottonwood Creek in November 1976.

CDFG estimates that Cottonwood Creek supports an average of 1,000 steelhead, based on the best estimates of biologists who were most familiar with Cottonwood Creek. Biologists found juvenile steelhead in the footprint of the proposed Schoenfield Reservoir in Red Bank Creek in 1998. They were found at a density of 0.002 fish/yd^2. Steelhead were found in 2 of 28 stations sampled.

Fall-run chinook salmon ascend Cottonwood Creek and spawn in late October through November. They spawn in Cottonwood Creek from the mouth to the confluence of North Fork Cottonwood Creek. About 53% of fall-run chinook salmon spawn from the mouth of Cottonwood Creek to the Interstate 5 highway bridge; 23% spawn from the Interstate 5 highway bridge to the confluence of Cottonwood Creek and the South Fork Cottonwood Creek; and 24% spawn in Cottonwood Creek between the confluence of the south and north forks. Their young begin migrating after they incubate in January. They migrate downstream from January through May. CDFG estimates that an average of 3,600 fall-run chinook salmon spawn in Cottonwood Creek.

Late fall-run chinook salmon migrate up Cottonwood Creek and spawn in January. Biologists observed them spawning at the mouth of North Fork Cottonwood Creek in January 1976. Late fall-run chinook salmon young that migrate downstream in May and June are much smaller than the fall-run young at that time of year. Young late fall-run chinook salmon were caught in fyke nets near the mouth of Cottonwood Creek in May and June 1976. CDFG estimates that an average of 300 late fall-run chinook salmon migrate up Cottonwood Creek.

Spring-run chinook salmon migrate up Cottonwood Creek in April and spend the summer in deep pools in South Fork Cottonwood Creek, Beegum Gulch, and North Fork Cottonwood Creek. Most are found in Beegum Gulch. Young spring-run chinook salmon migrate downstream from January through May. CDFG estimates that an average of 500 spring-run chinook salmon run up Cottonwood Creek. Some young chinook salmon from the Sacramento River use the lower reach of Cottonwood Creek from Interstate 5 to the mouth for rearing during the summer and fall.

The most significant findings of these studies are the presence of fall-run chinook salmon, late fall-run chinook salmon, spring-run chinook salmon, and steelhead in Cottonwood Creek. The presence of steelhead in Red Bank Creek is also a significant finding.

Amphibian Surveys

Amphibian studies were initiated in 1997 for Sites, Colusa, and Red Bank projects. DFG collected data on occurrence, distribution, and relative abundance of amphibians at the proposed reservoir inundation areas for these projects. All aquatic habitats were categorized as to type of water body (e.g., pond, farm impoundment, vernal pool, or creeks). All ponds were measured for length, width, and depth during the initial assessment. DFG also reviewed past amphibian studies for Red Bank and Thomes-Newville Projects. A summary of the 1997 survey findings and findings of past studies are presented below.

Sites and Colusa Cell Reservoirs

California Red-Legged Frog. Surveys were conducted August 1997 to January 1998, and between the months of May through October 1998. All ponds and creeks in the area were surveyed a minimum of four times during each of these periods. Both night and day surveys were conducted during this time, at least two of each for each habitat site. Day surveys were performed on clear, sunny days with minimal wind.

Night surveys were conducted on warm, still nights from an hour past sunset until midnight. No California redlegged frogs were found during any of these surveys.

California Tiger Salamander. The historic range of California tiger salamanders was established using distribution records. Grasslands, vernal pools, and farm pond impoundments that contained water for only part of the year were examined as potential California tiger salamander habitat sites. All ponds and vernal pools and the surrounding territory were examined for burrows, log debris, type of terrestrial vegetation, use of land and its current condition, embankments, and surrounding topography. Each pond was then seined.

Transect and visual pond inspections were conducted at night, during storms that continued from the day into the night, and when the air temperature was between 7 to 10 degrees Celsius (°C) (45 to 50°F) or warmer during the months of November and March for the 1997-98 and 1998-99 seasons.

Dip netting and seining surveys were done twice a year for each vernal pool and intermittent pond, at least 15 days apart. The first survey was done between March 15 and April 15, and the second between April 15 and May 15. Only ponds that would hold water for at least 10 weeks during the survey time interval were inspected.

No California tiger salamanders were found during any of these surveys.

Surveys of Common Amphibians. General herpetology surveys were done by ground searching near ponds and other habitats, transects, and night driving studies.

A total of five species were found during this survey (Table D-21). The most prevalent species found was the bullfrog, *Rana catesbieana*, with a catch per hour effort ratio of 4.8 (ground searching method only) for adults.

Table D-21

Amphibian Species of the Sites Project Area

Common Name	Scientific Name
Bullfrog	*Rana catesbieana*
California newt	*Taricha torosa*
California slender salamander	*Batrachoseps attenuatus*
Pacific tree frog	*Hylla regilla*
Western toad	*Bufo boreas*

Oak woodland and farm ponds were habitat where the greatest diversity of species was found. All five species of amphibians were found in this type of habitat (Table D-22). Pacific tree frogs were found in all five habitat types.

Table D-22

Amphibian Species Found in Each Habitat Type in the Sites Reservoir Area

Common Name	Scientific Name	Riparian	Oak Woodland	Grassland	Farm Pond	Vernal Pool
Bullfrog	*Rana catesbieana*	X	X	X	X	
California newt	*Taricha torosa*		X		X	
California slender salamander	*Batrachoseps attenuatus*		X		X	
Pacific tree frog	*Hylla regilla*	X	X	X	X	X
Western toad	*Bufo boreas*	X	X	X	X	

Ground searches were the most productive method of locating a variety of amphibians. Representatives of all species found during the study were located via ground searches. Dip netting and seining were particularly effective in capturing semi-aquatic amphibians, especially larval amphibians. Bullfrog larvae were found in riparian habitat, oak woodland, and farm ponds. Both pacific tree frog larvae and western toad larvae were found in farm ponds and vernal pools. Western toad larvae also were found in riparian habitat.

No threatened or endangered amphibians were found in this study. All species caught or observed are regarded as common.

Thomes-Newville Reservoir

Surveys for amphibians at the Thomes-Newville Reservoir area were conducted by CDFG from April 1981 through May 1982 at the request of DWR to provide environmental information for water project planning. No new surveys of amphibians at the Thomes-Newville Reservoir area were undertaken during the recent investigations of offstream storage.

The amphibian surveys were done by ground searching ponds and transects, seining, or night driving studies. Ground searches were done both day and night, but driving surveys were done only at night. Pitfall trapping was also done in the Thomes-Newville Reservoir area surveys. A camera was used to photograph specimens for species verification and to maintain a general record of the find.

This 1981-1982 survey produced observations of seven amphibian species that occur within the habitats in the project area and surrounding areas (Table D-23). No estimate of population sizes was possible because of the small number of recaptures that occurred during the pitfall trapping.

Table D-23

Amphibians Observed in the Thomes-Newville Reservoir Area in 1982

Common Name	Scientific Name
Black salamander	*Aneides flavipunctatus*
Bullfrog	*Rana catesbeiana*
California slender salamander	*Batrachoseps attenuatus*
Foothill yellow-legged frog	*Rana boylei*
Pacific tree frog	*Hyla regilla*
Western spadefoot toad	*Bufo boreas*
Western toad	*Spea hammondi*

Western toads and Pacific tree frogs were found in all habitat types. Some species, such as black salamanders, were much more limited in their distribution (Table D-24).

Table D-24

Amphibian Species Found in the Thomes-Newville Project Area in 1982

Common Name	Scientific Name	Grass-land	Chaparral	Oak Savannah	Pine-Oak Woodland	Riparian	Stream	Standing Water
Black salamander	*Aneides flavipunctatus*				X			
Bullfrog	*Rana catesbeiana*					X	X	X
California slender salamander	*Batrachoseps attenuatus*	X	X	X	X			
Foothill yellowlegged frog	*Rana boylei*					X	X	X
Pacific tree frog	*Hyla regilla*	X	X	X	X	X	X	X
Western spadefoot toad	*Bufo boreas*	X		X				
Western toad	*Spea hammondi*	X	X	X	X	X	X	X

Pitfall traps tended to be selective for amphibians. This trapping method failed to provide any amphibian species not found by at least one other collection method.

Although no amphibian species listed as rare or endangered was found in the project area, two species were found that are considered Species of Special Concern by the State of California because of habitat losses. These species complete their reproductive cycle in both temporary and permanent ponds found throughout the inundation area. Spadefoot toads and foothill yellow-legged frogs occur in the streams coursing through the reservoir site. The presence of these species constitutes a significant finding.

Red Bank Reservoir

CDFG conducted studies of the Red Bank Reservoir area in 1986 and in 1997-1999. The major objectives of these surveys was to search for California redlegged frogs, which are listed as federally threatened, and to conduct general herpetology surveys. Two species listed as federal and California Species of Special Concern that could occur in the area, the foothill yellow-legged frog and western spadefoot toad, were searched for during these surveys.

Historic ranges of the species searched for were established. Physical observations of the present habitat, historic records, and CDFG's Natural Diversity Database also were used to establish the list of potential species that could occur in the Red Bank Reservoir areas. The results of past surveys conducted in the Red Bank Reservoir area also were reviewed.

Surveys were conducted during the fall of 1997 and during the months of May through October 1998 for California red-legged frogs. Surveys were not conducted during the breeding or rearing period of the frogs, to avoid disturbing breeding frogs, eggs, or larvae. All ponds and creeks in the study area were surveyed a minimum of four times during this 5-month period in 1998. Both night and day surveys were conducted during this time, at least two of each for each habitat site. No site was sampled twice within a 24- hour period. Day surveys were performed on clear, sunny days with minimal wind. Night surveys were conducted on warm still nights from an hour past sunset until midnight. Photographs also were taken of the environment in which animals were found, to confirm field notes and to document the state of the habitat at the time it was surveyed.

General amphibian surveys were done by ground searching ponds and transects, seining, or night driving studies. Ground searches were done both day and night. Driving surveys were done only at night. Seining was done during the day. General amphibian surveys were conducted year round throughout the Red Bank Reservoir areas, when the weather was appropriate for amphibian activity.

During these studies, five species of amphibians were found (Table D-25). The most common species of amphibians observed were foothill yellow-legged frogs (14.80/hour) and western toads (13.10/hour). The foothill yellow-legged frogs are a Species of Special Concern.

Table D-25

Relative Abundance of Amphibians Observed in the Red Bank Reservoir Area

Common Name	Scientific Name	Catch per Hour	
		Cottonwood Creek	Red Bank Creek
Bullfrog	*Rana catesbeiana*	0.02	1.06
California red-legged frog	*Rana draytonii*		<0.01
Foothill yellow-legged frog	*Rana boylei*	14.80	3.91
Pacific tree frog	*Hyla regilla*	0.01	1.58
Western toad	*Spea hammondi*	13.10	5.65

The most significant find in the current investigation was the discovery of a California red-legged frog in Sunflower Gulch, a tributary to Red Bank Creek. Another individual was observed in the same location in 1986. Extensive searches failed to find other red-legged frogs in the study area. It is probable that the population of red-legged frogs is very small at the site of the proposed Red Bank Reservoir.

One amphibian species of Special Concern, the foothill yellow-legged frog, was plentiful throughout the Red Bank Reservoir area. They were found in both Red Bank Creek and South Fork Cottonwood Creek.

Reptile Surveys

DWR requested the CDFG to conduct studies of the reptiles in the proposed Sites, Colusa, and Red Bank Reservoir areas. CDFG biologists conducted the sampling in spring and summer of 1998 and 1999. Past reptile studies for the Red Bank and Thomes-Newville Reservoirs also were reviewed.

Sites and Colusa Cell Reservoirs

CDFG biologists looked for western pond turtles, a federal and state Species of Special Concern, when seining or during daytime visual surveys in the project areas. Carapaces (shells) of dead turtles also were noted and measured. During periods of warm weather, biologists watched the creek when possible while traveling to and from work stations, which yielded positive results in locating western pond turtles.

General herpetology surveys were done by ground searching near ponds, transects, and night driving studies. Ground searches were done both day and night, while driving surveys were done only at night. Searching ponds was done during the day. General herpetology surveys were conducted year round throughout the area when the weather was appropriate for reptile activity. A total of 14 reptile species were found during this survey (Table D-26). One Species of Special Concern was found, the western pond turtle. Western pond turtles were found in the project area, as well as outside the reservoir footprint both upstream and downstream. Western fence lizards were the most common reptiles found (Table D-27).

Table D-26

Status of Reptile Species in the Sites and Colusa Reservoir Area

Common Name	Scientific Name	Status	
		State	Federal
Aquatic garter snake	*Thamnophis couchii*		
Common garter snake	*Thamnophis sirtalis*		
Common king snake	*Lampropeltus getula*		
Gopher snake	*Pituohpis catenifer*		
Ring neck snake	*Diadophis punctatus*		
Sharp-tailed snake	*Contia tenuis*		
Southern alligator lizard	*Elgaria muliticoranata*		
Western fence lizard	*Sceloporus occidentalis*		
Western pond turtle	*Clemmys marmorata*	CDFG: SC CDFG: Protected	FSC
Western racer	*Coluber mormon*		
Western rattle snake	*Crotalus viridus*		
Western sagebrush lizard	*Sceloporus graciosus gracilis*		
Western skink	*Eumeces skiltonianus*		
Western terrestrial garter snake	*Thamnophis elegans*		

CDFG = California Department of Fish and Game SC = Species of Special Concern
FSC = Federal Species of Special Concern

Table D-27

Catch Per Hour Effort for Each Survey Method

Common Name	Scientific Name	Searching	Dipnetting	Seining	Night Driving
Aquatic garter snake	*Thamnophis couchii*	0.0005	0.009	0	0
Common garter snake	*Thamnophis sirtalis*	0.02	0.04	0.02	0
Common king snake	*Lampropeltus getula*	0.003	0	0	0
Gopher snake	*Pituohpis catenifer*	0.007	0.009	0	0
Ring neck snake	*Diadophis punctatus*	0.0005	0	0	0
Sharp-tailed snake	*Contia tenuis*	0.0005	0	0	0
Southern alligator lizard	*Elgaria muliticoranata*	0.005	0	0	0
Western fence lizard	*Sceloporus occidentalis*	0.17	0	0	0
Western pond turtle	*Clemmys marmorata*	0.0009	0	0	0
Western racer	*Coluber mormon*	0.0002	0	0	0
Western rattlesnake	*Crotalus viridus*	0.02	0.009	0.06	0.2
Western sagebrush lizard	*Sceloporus graciosus gracilis*	0.0005	0	0	0
Western skink	*Eumeces skiltonianus*	0.006	0	0	0
Western terrestrial garter snake	*Thamnophis elegans*	0.05	0	0.02	0

Riparian habitat had the greatest diversity of reptiles found (Table D-28). Eleven of the 14 species of reptiles were found in this type of habitat. The common garter snake, gopher snake, and western fence lizard were found in all five habitat types.

Table D-28

Reptile Species Found in Each Habitat Type

Common Name	Scientific Name	Riparian	Oak Woodland	Grass-land	Farm Pond	Vernal Pool	Roads
Aquatic garter snake	*Thamnophis couchii*	X				X	
Common garter snake	*Thamnophis sirtalis*	X	X	X	X	X	
Common king snake	*Lampropeltus getula*	X		X	X		
Gopher snake	*Pituohpis catenifer*	X	X	X	X	X	
Ring neck snake	*Diadophis punctatus*					X	
Sharp-tailed snake	*Contia tenuis*	X					
Southern alligator lizard	*Elgaria muliticoranata*	X	X	X	X		
Western fence lizard	*Sceloporus occidentalis*	X	X	X	X	X	
Western pond turtle	*Clemmys marmorata*	X					
Western racer	*Coluber mormon*	X	X				

Table D-28
(Continued)

Common Name	Scientific Name	Riparian	Oak Woodland	Grass-land	Farm Pond	Vernal Pool	Roads
Western rattlesnake	*Crotalus viridus*	X	X	X	X		X
Western sagebrush lizard	*Sceloporus graciosus gracilis*		X				
Western skink	*Eumeces skiltonianus*		X				
Western terrestrial garter snake	*Thamnophis elegans*	X	X		X		

Thomes-Newville Reservoir

Surveys for reptiles at the Thomes-Newville Reservoir were conducted from April 1981 through May 1982 at DWR's request to provide environmental information for water project planning. Reptile surveys were done by ground searching ponds and transects, seining, or night driving studies. Ground searches were done both day and night. Driving surveys were only done at night. Animals were identified using published identification keys. Pitfall trapping also was done in the Thomes-Newville Reservoir area. A camera was used to photograph specimens for species verification and to maintain a general record of the find.

This survey produced observations of 15 reptile species that occur within the habitats in the project area and surrounding areas (Table D-29). No estimate of population sizes was possible because of the small number of recaptures that occurred during the pitfall trapping.

Table D-29

Observed Reptiles in the Thomes-Newville Reservoir Area in 1982

Common Name	Scientific Name
Common garter snake	*Thamnophis sirtalis*
Common king snake	*Lampropeltis getulus*
Gopher snake	*Pituophis malanoleucus*
Sagebrush lizard	*Sceloperus graciosus*
Sharp-tailed snake	*Contia tenuis*
Southern alligator lizard	*Elgaria multicarinata*
Striped racer	*Masticophis lateralis*
Western aquatic garter snake	*Thamnophis couchi*
Western fence lizard	*Sceloperus occidentalis*
Western pond turtle	*Clemmys marmorata*
Western racer	*Coluber constrictor*
Western rattlesnake	*Crotalus viridis*
Western skink	*Eumeces skiltonianus*
Western terrestrial garter snake	*Thamnophis elegans*
Western whiptail	*Cnemidophorus tigris*

Pitfall traps tended to be selective for lizards and smaller snakes, such as the sharp-tailed snake. Larger snakes, because of their length, could easily avoid falling into the traps. This trapping method failed to provide any reptile species not found by at least one other collection method.

Western fence lizards were found in all habitat types (Table D-30). Gopher snakes and western rattlesnakes also were found in most habitat types. The sagebrush lizards were much more limited in their distribution.

Table D-30

Reptile Species Found in the Thomes-Newville Project Area in 1982

Common Name	Scientific Name	Grass-land	Chaparral	Oak Savannah	Pine-Oak Woodland	Riparian	Stream	Standing Water
Common garter snake	*Thamnophis sirtalis*	X				X	X	X
Common king snake	*Lampropeltis getulus*	X	X	X	X			
Gopher snake	*Pituophis malanoleucus*	X	X	X	X	X		
Sagebrush lizard	*Sceloperus graciosus*		X					
Sharp-tailed snake	*Contia tenuis*	X	X					
Southern alligator lizard	*Elgaria multicarinata*	X	X	X	X	X		
Striped racer	*Masticophis lateralis*	X	X					
Western aquatic garter snake	*Thamnophis couchi*					X	X	
Western fence lizard	*Sceloperus occidentalis*	X	X	X	X	X	X	X
Western pond turtle	*Clemmys marmorata*					X	X	X
Western racer	*Coluber constrictor*	X	X	X		X		
Western rattlesnake	*Crotalus viridis*	X	X	X	X	X		
Western skink	*Eumeces skiltonianus*	X	X	X				
Western terrestrial garter snake	*Thamnophis elegans*	X		X		X	X	X
Western whiptail	*Cnemidophorus tigris*		X	X	X			
Total number of species observed		**15**	**14**	**13**	**10**	**13**	**8**	**8**

Although no reptile species listed as rare or endangered was found in the Thomes-Newville Reservoir area, one Species of Special Concern to the State of California is found throughout the inundation area. The western pond turtle occurs in streams coursing through the reservoir site. The presence of this species constitutes a significant finding.

Red Bank Reservoir

Reptile surveys were conducted in the Red Bank Reservoir area 1998. Surveys were done by ground searching near ponds, transects, seining, or night driving studies. Ground searches were done both day and night. Driving surveys were done only at night. Seining was done during the day. General reptile surveys were conducted year-round throughout the Red Bank Reservoir areas, when the weather was appropriate for reptile activity. A 1986 survey of the Red Bank Reservoir area also was reviewed.

The objectives of the reptile surveys within the Red Bank Reservoir area were to search for one species, the western pond turtle, listed as a federal and sate Species of Special Concern. The western pond turtle, was found throughout the study area.

During the 1998 studies, 11 species of reptiles were found (Table D-31). The most significant finding of these studies was the discovery of western pond turtles, a California Species of Special Concern. They were found in Red Bank Creek and South Fork Cottonwood Creek. The most common species of reptiles observed were western terrestrial garter snakes.

Table D-31

Names and Abundance of Reptiles in the Red Bank Project Area

Common Name	Scientific Name	Catch per Hour	
		Cottonwood Creek	Red Bank Creek
Common garter snake	*Thamnophis sirtalis*	0.39	0.03
Common king snake	*Lampropeltis getulus*	0.01	0.01
Gopher snake	*Pituophis malanoleucus*	0.05	0.01
Southern alligator lizard	*Elgaria multicarinata*	0.02	0.01
Western fence lizard	*Sceloperus occidentalis*	0.14	0.08
Western pond turtle	*Clemmys marmorata*	0.17	0.09
Western racer	*Coluber mormon*	--	0.01
Western rattlesnake	*Crotalus viridis*	0.12	0.01
Western sagebrush lizard	*Sceloperus graciosus gracilis*	0.02	0.01
Western skink	*Eumeces skiltonianus*	0.01	0.03
Western terrestrial garter snake	*Thamnophis elegans*	0.15	0.13

Avian Surveys

The purpose of the avian survey effort was to identify the occurrence, density, and distribution of state and federally listed species of birds that may occur within the proposed project areas. These data provide information to help evaluate and compare the potential project effects on state and federally listed avian species and their habitats at the four proposed reservoir locations.

A compilation of state and federal listed species, California Species of Special Concern, and federal Species of Management Concern that could occur within the proposed reservoirs was developed from several sources, including: the Natural Diversity Database, California Wildlife Habitat Relationships

Program, literature review, landowner interviews, United States Fish and Wildlife Service (USFWS) lists, and consultation with species experts.

Three methodologies were used to determine presence, density, and distribution of State and federally listed bird species at the proposed reservoir locations, including monthly avian line-transects, annual bank swallow surveys, and annual owl surveys using pre-recorded calls. The avian studies were confined primarily to the area of the reservoir footprint. However, line transects extended up to 2.5 miles from the reservoir footprints along key drainages. Surveys were initiated at the existing Funks Reservoir to document which state or federally listed avian species would use a reservoir within low elevation grassland habitats.

Line transects were established in representative habitat within proposed reservoir locations as access allowed, using standard avian line transect methodology (Emlen 1971). Transect length and initiation dates are identified in Table D-32. Initial access for the transect surveys was obtained at different points in time, resulting in different numbers of transect repetitions for each season at the four proposed reservoir locations. Sites Reservoir data are most comprehensive; the 12.5-mile transect has been surveyed monthly since March 1997. CDFG conducted avian surveys between 1980 and 1983 within the Stony and Thomes Creek watersheds as part of the fish and wildlife studies for the proposed Thomes-Newville Reservoir.

Table D-32

Avian Transect Lengths and Initiation Date

Reservoir Location	Transect Length	Date Initiated
Sites Reservoir	12.5 miles	March 1997
Colusa Cell Reservoir	11.0 miles	October 1997
Newville Reservoir	19.5 miles	December 1998
Red Bank Reservoir	16.0 miles	April 1998
Funks Reservoir (existing)	2.5 miles	October 1997

Line transects were surveyed either by foot or from a vehicle at a rate of 2 to 3 miles per hour. All state and federally listed avian species, California Species of Special Concern, and federal Migratory Nongame Birds of Management Concern detected were recorded. The distance from the transect line at the point of detection was recorded using a Tasco Lasersite Rangefinder. Detections were recorded onto field data sheets in 100-yard increments. The maximum range of the rangefinder was 800 yards (either side of the transect line); this was used as the outer limit of the transect. State and federally listed species detected outside of the 800-yard limit were noted (presence), but not included in density estimates. Both a 10X40 binoculars and a 15X60 spotting scope were used for field identification.

Information recorded included species, number of individuals, and lateral distance from the transect line at the point of first sighting. Data analyses followed the methods of Balph et al. (1977). This method of line transect data analyses allows the field data to be used to determine differences in detectability between species and within the same species at different points in their life cycle, resulting in greater precision in density estimates.

Monthly transect results were consolidated into seasonal groups for density analyses. Seasons were defined based on the dates used by the California Wildlife Habitat Relationships Program for seasonal

bird reports (Zeiner et. al. 1990). These seasonal breakdowns are based on documented migration and residency patterns of California species. Avian surveys were not conducted during periods of precipitation, high wind, or reduced visibility (fog or smoke).

Bank swallow surveys involved walking all permanent and ephemeral stream reaches with downcut channels during the bank swallow breeding season (May through July). All vertical banks were inspected for the presence of bank swallow burrows. All foraging swallow species were identified. All detections of burrows or foraging bank swallows were recorded.

Owl surveys were conducted at night along the previously identified line transect routes during May or June. Sampling was initiated at dusk. The methodology involved broadcasting pre-recorded calls using a tape recorder with an external speaker at half-mile intervals. Each species call (burrowing owl, shorteared owl, and long-eared owl) was broadcast for 30 seconds followed by 30 seconds of silence to detect return calls. Three repetitions of each call/listen cycle were conducted for each species at each one-half mile interval along the line transects. All owl detections were logged. Owl surveys were not conducted during periods of high wind or precipitation.

Review of existing databases indicated that nine state or federally listed avian species may occur within Tehama, Glenn, or Colusa Counties. Three of these species were identified during avian transect sampling at or near the proposed reservoir locations: the southern bald eagle, the bank swallow, and the greater sandhill crane (Table D-33).

Table D-33

State and Federal Listed and Special Concern Avian Species That May Occur at North-of-Delta Offstream Storage Reservoirs

Common Name	Status	Sites	Colusa	Thomes-Newville	Red Bank	Funks
Aleutian Canada Goose	FT					
American bittern	MNBMC					X
American white pelican	CSSC					X
Bank swallow	ST		X			
Barrow's goldeneye	CSSC					
Bell's sage sparrow	MNBMC					
Burrowing owl	CSSC, MNBMC	X	X	X		
California gull	CSSC	X				X
California horned lark	CSSC, MNBMC	X	X	X	X	
Common loon	CSSC, MNBMC					X
Cooper's hawk	CSSC	X	X	X	X	
Double-crested cormorant	CSSC		X			X
Ferruginous hawk	CSSC, MNBMC	X				X
Golden eagle	CSSC	X	X	X	X	X
Grasshopper sparrow	MNBMC		X			X
Greater sandhill crane	ST		X			

Table D-33
(Continued)

Common Name	Status	Sites	Colusa	Thomes-Newville	Red Bank	Funks
Hermit warbler	MNBMC					
Lark sparrow	MNBMC	X	X	X	X	
Lawrence's goldfinch	MNBMC		X		X	X
Least bittern	MNBMC					
Loggerhead shrike	CSSC, MNBMC	X	X	X	X	X
Long-billed curlew	CSSC, MNBMC	X	X	X		X
Long-eared owl	CSSC	X	X	X	X	
Merlin	CSSC	X		X	X	
Mountain plover	CSSC, MNBMC					
Northern goshawk	CSSC, MNBMC					
Northern harrier	CSSC	X	X	X	X	X
Northern spotted owl	FE, SE					
Osprey	CSSC				X	
Peregrine falcon	SE					
Prairie falcon	CSSC	X	X	X	X	X
Purple martin	CSSC					
Sharp-shinned hawk	CSSC	X	X		X	X
Short-eared owl	CSSC, MNBMC					X
Southern bald eagle	SE, FT	X	X	X	X	X
Swainson's hawk	ST					
Tri-colored blackbird	CSSC, MNBMC	X	X	X		
Vaux's swift	CSSC, MNBMC					
Western snowy plover	CSSC, MNBMC					
Western yellow-billed cuckoo	SE, MNBMC					
White-faced ibis	CSSC, MNBMC					
White-tailed kite	MNBMC	X				X
Willow flycatcher	SE					
Yellow warbler	CSSC	X				
Yellow-breasted chat	CSSC					

CSSC = California Species of Special Concern
FE = Federal Endangered
FT = Federal Threatened
MNBMC = Migratory Nongame Birds of Management Concern (USFWS)
SE = State Endangered
ST = State Threatened

Sporadic wintering use by both adult and immature bald eagles has been documented at each of the four proposed reservoir locations. Wintering use was nearly an order of magnitude greater at Funks Reservoir than at any of the proposed reservoir locations. Fish and a large concentration of waterfowl are available as prey for bald eagles wintering at Funks Reservoir. Up to five bald eagles have been observed perched around the reservoir on one date. Extensive winter bald eagle surveys were conducted along Thomes Creek as part of the Thomes-Newville Reservoir studies in the 1980s. These studies confirmed extensive use of Thomes Creek by wintering bald eagles. No suitable nesting habitat is present in the vicinity of the Sites, Colusa, or Thomes-Newville Reservoirs. An adult and an immature bald eagle were observed together within the Red Bank Reservoir area during late April 1998. No indication of nesting, other than these two sightings during the breeding season, has been observed.

A single sighting of a bank swallow was made near the proposed Colusa Reservoir Cell during avian transect sampling. This sighting was made during late September 1998 approximately 2.5 miles east of the proposed Colusa Reservoir Cell. This sighting represents a transient or migrating bank swallow rather than a breeding season use. CDFG surveys conducted at the proposed Thomes-Newville Reservoir in the early 1980s identified two small bank swallow colonies along Thomes Creek, downstream from the project area. Both of these historic colony locations appear to be outside of the footprint of the proposed reservoir.

Five sandhill cranes were observed flying over the Colusa Reservoir site during November 1997. No actual habitat use was observed. This observation occurred on a date when the Sacramento Valley was fogged in, while the adjacent foothill areas were fog free. Under these conditions, sandhill cranes may set down and use foothill annual grasslands. No other sandhill crane observation at any of the other three reservoir locations was made during the sampling effort. No sandhill crane use was recorded during the three years of intensive study conducted at Thomes-Newville Reservoir during the early 1980s.

Nesting habitat for peregrine falcon, northern spotted owl, yellow-billed cuckoo, greater sandhill crane, and willow flycatcher is absent from the proposed reservoir sites. Marginal Swainson's hawk nesting/foraging habitat is present at Sites, Colusa, and Newville Reservoir locations and absent at the Red Bank Reservoir area. Habitats within the proposed reservoirs offer very limited opportunity for wintering or migration use by Aleutian Canada goose, mountain plover, peregrine falcon, greater sandhill crane, and willow flycatcher.

Thirty-six avian species classified as either California Species of Special Concern or federal Migratory Nongame Birds of Management Concern may occur within Tehama, Glenn, or Colusa Counties. Twenty-five of these species have been observed at or near one or more of the proposed reservoir locations, including: American bittern, American white pelican, burrowing owl, California gull, California horned lark, common loon, Cooper's hawk, double-crested cormorant, ferruginous hawk, golden eagle, grasshopper sparrow, lark sparrow, Lawrence's goldfinch, loggerhead shrike, long-billed curlew, long-eared owl, merlin, northern harrier, osprey, prairie falcon, sharp-shinned hawk, short-eared owl, tri-colored blackbird, white-tailed kite, and yellow warbler (Table D-33).

Seasonal avian density estimates developed from line transect data for each of the four proposed reservoir locations are presented in Tables D-34 through D-37. Seasonal avian density estimates for the existing Funks Reservoir are shown in Table D-38.

Table D-34

Sites Reservoir Avian Transect Results
(Density in Birds/Square mile)

Species	Summer	Fall	Winter	Spring
Burrowing owl	0.24	0.05		
California horned lark	4.83	1.58	2.90	6.57
Cooper's hawk		0.03		0.06
Ferruginous hawk			0.12	
Golden eagle	0.23	0.20	0.26	0.32
Lark sparrow	NS	NS	0.47	1.46
Loggerhead shrike	0.93	1.60	1.17	0.47
Long-billed curlew			14.59	1.26
Northern harrier	0.05	0.50	1.53	0.58
Sharp-shinned hawk		0.40		0.03
Southern bald eagle			0.07	
Tri-colored blackbird				5.38
White-tailed kite	0.12			0.12
Miles of transect per season	37.50	88.0	75.0	150.50

NS = not sampled

Table D-35

Colusa Cell Reservoir Avian Transect Results
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
Bank swallow		0.14		
Burrowing owl		0.14		0.03
California horned lark	85.00	7.38	22.63	36.66
Cooper's hawk		0.14	0.27	
Double-crested cormorant				0.10
Golden eagle	0.22	0.32	0.24	0.30
Lark sparrow	NS	NS		0.80
Loggerhead shrike	0.89	2.15	1.84	2.82
Long-billed curlew				4.53
Northern harrier	1.00	0.67	0.87	0.50
Prairie falcon		0.14		
Sandhill crane		0.67		
Sharp-shinned hawk		0.14		

Table D-35
(Continued)

Species	Summer	Fall	Winter	Spring
Southern bald eagle		0.04	0.03	0.10
Tri-colored blackbird	41.50			20.32
Miles of transect per season	20.0	74.5	38.0	87.5

NS = not sampled

Table D-36

Thomes-Newville Reservoir Avian Transect Results
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
California horned lark	NS	NS	0.52	0.75
Cooper's hawk	NS	NS	0.17	
Golden eagle	NS	NS	0.10	0.13
Lark sparrow	NS	NS	7.64	1.50
Loggerhead shrike	NS	NS	2.05	0.90
Merlin	NS	NS	0.04	
Northern harrier	NS	NS	0.15	0.06
Prairie falcon	NS	NS	0.05	0.12
Southern bald eagle	NS	NS	0.08	
Tri-colored blackbird	NS	NS	0.69	2.41
Miles of transect per season			58.5	58.5

NS = not sampled

Table D-37

Red Bank Reservoir Avian Transect Results
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
Cooper's hawk		0.07	0.16	0.26
Golden eagle	0.09	0.25	0.30	0.32
Lark sparrow	NS	NS	0.18	4.79
Lawrence's goldfinch			0.36	0.78
Merlin				0.07
Northern harrier		0.08	1.07	0.26
Osprey				0.13

Table D-37
(Continued)

Species	Summer	Fall	Winter	Spring
Prairie falcon			0.00	0.13
Sharp-shinned hawk		0.19	0.40	0.06
Southern bald eagle		0.11	0.05	0.26
Miles of transect per season	25.5	53.0	55.0	68.0

NS = not sampled

Table D-38

Funks Reservoir Avian Transect Results (Existing Reservoir)
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
American bittern	0.84			
American white pelican		0.16	0.10	
California gull		0.32	1.84	0.43
Common loon				0.21
Cooper's hawk		0.48		
Double-crested cormorant	0.37	1.43	1.11	0.33
Golden eagle			0.13	0.05
Lark sparrow	NS	NS	8.18	
Loggerhead shrike		1.43	0.49	1.07
Long-billed curlew		4.20	17.73	
Northern harrier		0.53	3.89	0.75
Prairie falcon		0.09		
Sharp-shinned hawk			0.48	
Short-eared owl				0.43
Southern bald eagle			0.82	0.21
White-tailed kite			1.14	0.14
Miles of transect per season	6.0	21.5	18.0	20.5

NS = not sampled

Mammal Studies

A variety of field survey methods were used to sample the mammal populations at the four alternative sites. Preliminary research included general literature searches, consultation with agency and species experts, aerial photograph habitat interpretations, and landowner interviews. In addition, CDFG biologists reviewed the Natural Diversity Database, Wildlife Habitat Relationship System, the Federal Register of Threatened, Endangered, and Special Status Species, 1983 *Thomes/Newville Status Report,* and 1987 *Final Report on Reconnaissance Level Studies of the Fish and Wildlife Resources at the Dippingvat and Schoenfield Reservoir Sites* to gather additional species information for each project area. A list was then

compiled that included the following potentially occurring Special Status Species of mammals. While the species listed in Table D-39 remain the focus of survey efforts, sampling has been designed to include the detection and assessment of all mammal species.

Table D-39

Mammal Species Surveyed at Proposed North of the Delta Offstream Storage Reservoirs

Common Name	Scientific Name	Status
American badger	*Taxidea taxus*	CSSC
Fringed myotis	*Myotis thysanodes*	FSCS
Long-eared myotis	*Myotis evotis*	FSCS
Long-legged myotis	*Myotis volans*	FSCS
Pacific fisher	*Martes pennanti pacificus*	FSCS, CSSC, SS
Pacific western big-eared bat	*Corynorhinus townsendii townsendii*	FSCS, CSSC, SS
Pale big-eared bat	*Corynorhinus townsendii pallescens*	FSCS, CSSC, SS
Pallid bat	*Antrozous pallidus*	CSSC, SS
Pine marten	*Martes americana*	SS
Ringtail	*Bassariscus astutus*	CFPS
San Joaquin pocket mouse	*Perognathus inornatus inornatus*	FSCS
Small-footed myotis	*Myotis ciliolabrum*	FSCS
Spotted bat	*Euderma maculatum*	FSCS, CSSC
Western mastiff bat	*Eumops perotis californicus*	FSCS, CSSC
Western red bat	*Lasiurus blossivillii*	SS
Yuma myotis	*Myotis yumanensis*	FSCS, CSSC

CFPS = California Fully Protected Species
CSSC = California Species of Special Concern
FSCS = Federal Special Concern Species
SS = Sensitive Species

After the development of the species list, field surveys were designed to assess the presence, distribution, and, where possible, relative abundance of the mammal species at the four alternative reservoir sites. Field investigation methods included small mammal live trapping, mist netting, acoustical surveys, roost and hibernacula searches, track plates, photography stations, spotlighting, general habitat measurements, walking transects, road transects, and incidental observations.

Small Mammal Trapping

H.B. Sherman live traps were used by DFG staff to inventory the small mammal (rodent) populations. The trap size used was 3 by 3.5 by 9 inches, the standard for conducting small mammal inventories. Traps were set for three consecutive nights and checked and closed at sunrise. All captures were identified, measured, marked, recorded on data sheets, and released back in the field. Traps were baited with a mixture of birdseed and crushed walnuts each afternoon, approximately one-half hour before sunset. The initial surveys specifically targeted habitat areas identified from aerial photograph habitat interpretations

that appeared to have the greatest suitability for the target species. Those areas were ground checked and extensively surveyed with high densities of traps in an attempt to maximize capture success of Special Status Species, such as the San Joaquin pocket mouse.

During those efforts, trapping grids were implemented for larger sampling areas. Trapping locations, or grids, were randomly selected from each of the habitat types and designed so that the number of samples represented the amount and coverage area for each of the habitat types on the alternatives, a technique known as stratified sampling.

The trapping grids consisted of 200 traps within a 100 by 100-meter square. The grids were established by field crews using a compass and a 100-meter tape. Various colors of pin flags were used to mark the grids. One pin flag was placed every 10 meters on the grid, and 2 traps were set within 2 meters of each point (pin flag) on the grid.

Mist nets were the primary method of inventorying bat species. Nets were set over water sources (i.e., ponds, creeks, or water troughs), across draws or narrow canyons, in front of entrances of old buildings, in woodland or forest edges, and in small clearings within a woodland or forest. Various net sizes and configurations were used. Net configurations were primarily as simple as a single net but often involved several single nets spaced throughout an area. Other net configurations included "joining" several nets together and arranging them to form V, L, and T shapes. These configurations were used primarily in areas where there was a lot of known bat activity, but where previous capture efforts failed.

All captures were removed from the nets immediately upon capture and placed in a handling bag for later processing. Processing was conducted at the conclusion of netting efforts or when bat activity became slow. This reduced the potential for counting individuals of any particular species multiple times. Captures were all identified, measured, recorded on data sheets, recorded on the Anabat Detector, and released back into the field.

The Anabat Detector and software (Anabat) with a laptop computer or tape recorder was used to conduct acoustical surveys for free-flying bat species. The Anabat was used primarily to record free-flying bats at the nest sites during the initial efforts. As the studies progressed, other survey techniques were implemented. These techniques included recording while night driving and/or walking and at stationary points. Walking and driving surveys helped field crews identify potential trapping sites. When bats were detected, crews stopped for one minute and continued recording. If bat activity continued, an additional 5 minutes of recording was conducted. Those areas with a great amount of bat activity were mapped for future trapping efforts since long periods of activity probably indicate either a foraging area or a roost location.

Visual surveys were conducted during the daytime hours in rock outcroppings, out buildings, tree cavities, woodlands, and snags for evidence of bat presence. Visual inspections with the aid of a flashlight, if needed, in a rock crevice or tree cavity enabled field personnel to locate potential and existing roosts. The location of the site was recorded, and if the bat could be identified without disturbing the bat, the species was recorded. No bats were removed from the roost because it could cause them to abandon their roost.

Track plates were used to identify the presence of carnivores such as the marten and fisher. Track plates were set up in 3- to 4-foot-square areas. The site was prepared by raking a relatively flat surface and placing an aluminum plate on the ground. The bait included chicken parts or pieces or approximately one and one half ounces of canned mackerel.

Track plates were placed at intervals of approximately 1,000 meters. They were checked every morning by CDFG field staff. Any tracks were measured, identified, photographed, and recorded on data sheets. In addition, clear tape was used to lift the tracks from the plates and transfer them to data sheets.

Trailmaster Camera set-ups were used to survey for carnivores in a method similar to the track plates. Two types of Trailmaster sensors were used, infrared and motion sensors. When triggered, the sensors sent a signal to the camera, which then took a photograph. The area was baited with canned mackerel, commercial baits or scents, chicken, road-kill deer, or fish.

Each event (detection by the sensor) was recorded in the sensor's memory, which also differentiated which events were photographed. The camera setups were checked each morning by field personnel and recorded on data sheets.

Spotlight surveys were conducted by two- or three-person crews using handheld Q-beam spotlights (250,000 to 1,000,000 candle power) from a vehicle traveling between 10 and 15 miles per hour. When eye shine was detected, the vehicle was stopped, and CDFG personnel identified the species with the aid of binoculars or a spotting scope, when possible. Information such as location, habitat, species, time, distance traveled on the route, and weather was recorded on data sheets each night. All accessible roads in the study areas were included in spotlight surveys. Surveys began approximately one-half hour after sunset and concluded at approximately midnight.

Field personnel conducted walking transects throughout the different habitat types on the project areas. This effort was designed and implemented specifically to detect badger denning sites and rodent burrow areas. Field personnel performed walking transects between 10 and 50 meters (33 and 164 feet) apart, depending on terrain and ground cover. All potential denning sites and burrow areas were measured, mapped, counted, and recorded.

Road transects were used along with small mammal trapping to determine the prey base available to carnivores and raptors using the project areas. The main prey species sampled was the California ground squirrel (*Spermophilus beecheyi*). The technique involved driving the roads throughout the project areas at approximately 10 miles per hour and counting ground squirrels within 50 meters of the travel route.

Incidental observations were recorded by field personnel while conducting other, more formal, surveys. Observations from field personnel conducting surveys for other disciplines such as botany, birds, fish, and herps also were reported to CDFG and recorded. Reports from other field personnel were verified where possible.

Initial field investigations were designed and focused to detect the presence and distribution of Special Status Species in the proposed reservoir areas to provide decision-makers with some baseline information that might assist with assessing potential mitigation requirements. As the studies progressed, modifications were made to determine the presence and distribution of all mammal species in the alternative reservoir areas in an attempt to assess the cumulative potential impacts that would result from project construction.

General habitat measurements were made to assist with future efforts to conduct a Habitat Evaluation Procedure (HEP). Detailed vegetative inventories were conducted by DWR staff. CDFG staff focused primarily on identifying habitat features such as snags, logs, burrows, and basic vegetation measurements, such as plant heights and canopy cover, while conducting other surveys, such as trapping. This information was recorded and will be used in the future when the HEP Team is developed and begins the Habitat Suitability Index Model selection process.

As of August 13, 1999, six mammal Species of Special Concern were documented at the four project areas (Table D-40). The pallid bat (*Antrozous pallidus*) is the only species documented in all four of the project areas thus far. The American badger (*Taxidea taxus*) and Yuma myotis (*Myotis yumanensis*) were documented in three of the sites. The western red bat (*Lasiurus blossivillii*) and ringtail (*Bassariscus astutus*) were documented in two of the sites, while the San Joaquin pocket mouse (*Perognathus inormatus inornatus*) was documented in only one of the sites.

Table D-40

Sensitive Mammal Species by Project Area

Common Name	Scientific Name	Sites Reservoir	Colusa Reservoir	Thomes-Newville Reservoir	Red Bank Reservoir
American badger	*Taxidea taxus*	X	X	X	
Pallid bat	*Antrozous pallidus*	X	X	X	X
Ringtail	*Bassariscus astutus*	X		X	
San Joaquin pocket mouse	*Perognathus inornatus inornatus*			X	
Western red bat	*Lasiurus blossivillii*	X			X
Yuma myotis	*Myotis yumanensis*	X		X	X

Studies designed to evaluate the potential impacts of each of the alternatives on small mammals are not complete. Some areas have been surveyed lightly or not at all because of lack of vehicular access. Future surveys will require access to all areas throughout the year to allow a uniform effort at each of the alternative reservoir sites, which will be needed to make comparisons between the alternatives.

Special Status Species Survey

Valley Elderberry Longhorn Beetle Surveys

Elderberry bushes with stems greater than 1-inch in diameter at ground level are considered habitat for the valley elderberry longhorn beetle (VELB). Surveying of reservoir inundation areas identified mature elderberry bushes at each of the proposed reservoir locations. These bushes occur primarily adjacent to riparian habitat. However, several small stands of elderberry bushes were located in upland habitat within each of the proposed reservoir areas. A small number of beetle emergence holes were observed in elderberry stems at both the Sites and Thomes-Newville Reservoirs.

The VELB, *Desmocerus californicus dimorphus*, was listed by the USFWS as threatened, with Critical Habitat on August 10, 1980 (Federal Register 45:52803-52807). Although there were no known VELB sites within the proposed reservoirs, habitat was known to exist within the project areas and known VELB locations were recorded nearby. The purpose of this survey was to identify and record the presence of VELB and its habitat.

Surveys focused on identifying potential habitat for VELB, the number of elderberry stems found measuring one inch or more, and the presence of exit holes. All drainages and adjacent savannas were checked first with aerial photographs, and then by field surveying for all potential habitat.

Habitat for VELB occurs at each of the four proposed reservoir sites. VELB emergence holes were found within the proposed Sites and Thomes-Newville Reservoir areas. No emergence holes were found within

the proposed Colusa and Red Bank Reservoir areas. No adult beetles were observed at any of the proposed reservoir sites. Within the Sites Reservoir area, 672 elderberry stems were counted. Emergence holes were found on 18 individual stems. Only one stand of elderberry (consisting of 38 stems) was found within the Colusa Cell. In the Thomes-Newville Reservoir area, 552 stems have been counted. Emergence holes have been found in 42 stems. A total of 1,001 elderberry stems were found within the proposed Red Bank Reservoir area and 210 elderberry stems were found at the Dippingvat Reservoir site. At the Schoenfield Reservoir site, 791 individual stems were counted. No emergence holes were found at either proposed reservoir area. No elderberry plants were found at either the Bluedoor or Lanyan Reservoir sites; however, potential elderberry habitat does exist at both.

Areas not surveyed prior to this report, such as areas with restricted access, conveyance facility locations, and road relocations, will have to be surveyed. Analyses also will be needed to predict how possible changes in water regimes within the channels and associated savannas downstream will affect elderberry survival and distribution.

Special Status Shrimp Habitat Surveys

Surveys designed to detect federally listed fairy or tadpole shrimp have not yet been conducted. Potential vernal pool fairy and tadpole shrimp habitat is present within annual grassland habitat at the Sites, Colusa Cell, and Thomes-Newville Reservoir sites but absent within the Red Bank Reservoir area.

This section describes the methods and results of the mapping of potential special status shrimp habitat at the proposed Sites, Colusa, Thomes-Newville, and Red Bank Reservoir areas.

Under contract with DWR, Jones & Stokes Associates ecologists performed surveys of potential special status shrimp habitat at the potential reservoir sites in 1998 and 1999. The 1999 surveys were conducted to verify potential special status shrimp habitat mapped in 1998 and to survey in areas where access was unavailable in the previous surveys because of flooded creeks, washed-out roads, and issues with property owners.

Special status shrimp include species in the following categories:

- Shrimp listed or proposed for listing as Threatened or Endangered Species under the federal Endangered Species Act (50 Code of Federal Regulations [CFR] 17.11 for listed animals and various Federal Register notices for proposed species).
- Other shrimp species meeting the definition of Rare, Threatened, or Endangered Species under the California Environmental Quality Act (CEQA) Guidelines (Section 15380).

The surveys focused on identifying potential habitat for the federally listed Threatened vernal pool fairy shrimp (*Branchinecta lynchi*); the federally listed Endangered Conservancy fairy shrimp (*Branchinecta conservatio*); the federally listed Endangered vernal pool tadpole shrimp (*Lepidurus packardi*); and the Rare, non-listed "Mid-Valley" fairy shrimp. The following three fairy shrimp species that are not special status species but are found in the same types of habitat, also have the potential to occur within the proposed project areas: *Branchinecta coloradensis, Branchinecta lindahli,* and *Linderiella occidentalis*.

The 1999 surveys were conducted between April 5 and May 21. Twenty-eight days (56 person days) were spent in the field. Aerial photographs and existing data from DWR and the 1998 survey results were used to select areas most likely to support special status shrimp habitat. Potential habitat was mapped conservatively in an effort to be as inclusive as possible. Potential habitat surveyed included vernal pools, alkali flats, clay flats, ephemeral stock ponds, pools, and salt lakes. Therefore, it is likely that the results

of this study represent a high estimate of habitat extent. In certain instances, such as clay flats and nonvegetated artificial habitats that had dried for the season, precise boundaries were difficult to define and were estimated using best professional judgment. Future surveys conducted using the approved, more detailed USFWS protocol could result in the identification of a lesser amount of actual special status shrimp habitat.

Typical habitat for special status fairy and tadpole shrimp in California include vernal pools, ponded areas within vernal swales, rock outcrop ephemeral pools, playas, alkali flats, and salt lakes. Other kinds of depressions that hold water of a similar volume, depth, and area for a similar duration and seasonality, such as vernal pools and swales, also may be potential habitat. These other depressions, are typically artificial habitats and are unvegetated; nevertheless, they bear an equal potential for supporting special status shrimp.

Pool volume is important in determining potential shrimp habitat. Deeper pools with a large surface area can more easily maintain their dissolved oxygen levels. Deep pools will also pond long enough to allow the shrimp to complete their life cycle.

Common wetland plant species that typically occur with special status shrimp species generally need the same hydrologic conditions (i.e., ponding depth, ponded surface area, ponding duration). Therefore, the presence of these plant species within a potential habitat would imply a greater potential for a population of these shrimp to be present. Conversely, pools that are dominated by vernal pool plant species that tolerate only short inundation periods will have hydrology that cannot support shrimp species (i.e., ponding duration too short, pool area too shallow). Similarly, wetland habitats that support plant species that need water year round cannot support special status shrimp species because the shrimp's cysts must dry out before they can hatch.

Therefore, potential special status shrimp habitat is defined as seasonal wetlands and other temporarily ponded areas of sufficient size (depth and area) and seasonality to support specific vegetation. This vegetation indicates the potential for ponding for a sufficient duration to allow special status shrimp species to complete their life cycles and to maintain cool water temperatures conducive to special status shrimp species.

Unvegetated potential shrimp habitats (e.g., clay flats, road ruts, and alkali flats) were mapped to the perimeter (i.e., where the vegetation begins) or to highwater mark indicators, such as drift lines or dams.

All habitats mapped during the 1998 survey effort were revisited, in addition to areas previously inaccessible, for additional potential special status shrimp habitat. Habitats fulfilling these criteria were mapped on USGS 7.5-minute quadrangle maps. The shape and dimensions of the habitat sites were drawn and described in field notes and used to calculate habitat extent in acres.

A summary of potential special status shrimp habitat mapped in the 1998 and 1999 surveys is presented in Table D-41. Potential habitat was mapped conservatively, and the results represent a high estimate of habitat acreage. The highest quality, contiguous, potential special status shrimp habitat occurs at the Thomes-Newville Reservoir site. A greater extent of habitat occurs at the Sites Reservoir area; however, this habitat is degraded by cattle activity, erosion, and debris from cattle feeding areas. The potential special status shrimp habitat at the Colusa Reservoir site is similarly degraded by the activity of cattle, though not to the extent of the Sites Reservoir site. Implementation of the proposed Red Bank Reservoir would not result in impacts on special status shrimp or special status shrimp habitat.

Table D-41

Total Acreage of Potential Special Status Shrimp Habitat

Potential Reservoir Site	Total Extent of Potential Special Status Shrimp Habitat (Acres)		
	1998 Survey	1999 Survey	Difference
Sites	73	71	-2
Colusa Cell	12	12	0
Thomes-Newville	26	26	0
Red Bank	0.0	0.0	0.0

Sites Reservoir

Grasslands and vernal pools on heavy clay soils in basin terrain characterize the Sites Reservoir area, with low ridge lines near the valley margins. Clay slumps are common along the ridges, and clay flats occur in low-lying areas. The land is currently used for cattle and sheep grazing. During the 1999 surveys, 1.5 acres of potential special status shrimp habitat was determined to be incapable of supporting special status shrimp species based upon the dominant vegetation within those habitats. The revised total, potential, special status shrimp habitat is 71 acres.

Colusa Cell Reservoir

The terrain within the Colusa Cell Reservoir area is characterized by grassland and vernal pools on heavy clay soils in basin terrain, with low ridge lines near the valley margins. Clay slumps are common along the ridges, and clay flats occur in low-lying areas. Cattle grazing is the main agricultural practice in the area. During the 1998 surveys, 11.8 acres of potential special status shrimp habitat were mapped within the area. Potential habitat was predominantly vernal pools, clay flats, and ephemeral stock ponds. During 1999, surveys identified an additional 0.3 acre of potential special status shrimp habitat.

Thomes-Newville Reservoir

The Thomes-Newville Reservoir site is characterized by grassland and vernal pools on clay soils and Lodo shale in foothill-type terrain. Cattle grazing is the primary agricultural practice in this area. Potential habitat consisted predominantly of vernal pools and ephemeral stock ponds. During the 1999 surveys, an additional 0.3 acre of potential habitat was identified, making a total of 26 acres of potential special status shrimp habitat.

Red Bank Reservoir

The Red Bank Reservoir area consists of two main components: Schoenfield Reservoir on Red Bank Creek and Dippingvat Reservoir on South Fork Cottonwood Creek. Two smaller components include Lanyan Dam and Bluedoor Reservoir on North Fork Red Bank Creek. The terrain at this site is generally too sloped to support habitat suitable for special status shrimp species. DWR staff conducting the botanical, wetlands, wildlife, and geological studies all indicated that the soils are well drained and there was very little to no potential habitat in any of the component cells of this project area.

The Red Bank potential offstream reservoir site does not support suitable habitat for special status shrimp species and is considered outside of the range of special status shrimp species.

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