Napa River Fisheries Monitoring Program
Final Report
2005

Prepared for

U.S. Army Corps of Engineers

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NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
American Canyon • Calistoga • Napa
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Prepared by

Stillwater Sciences

Final Report **January 2006**

Executive Summary

The Napa River/Napa Creek Flood Protection Project was designed by the Napa County Flood Control and Water Conservation District and the U.S. Army Corps of Engineers to provide flood protection and improve habitat in the vicinity of the City of Napa by reconnecting the Napa River to its floodplain, creating wetlands throughout the area, maintaining fish and wildlife habitats, and restoring the natural characteristics of the river. The Napa Project is being implemented along 11.1 km (6.9 miles) of the Napa River in Napa County, California. The Project features include dike removal, channel modifications to create floodplain and marsh plain terraces, levees and floodwalls, bridge relocations, pump stations, and maintenance roads/recreation trails for the reach of the river from Highway 29 to Trancas Street. The Fisheries Monitoring Program involves sampling the enhanced areas and the surrounding habitats to evaluate the use of the areas by various fish species. The purpose of the Fisheries Monitoring Program is to determine fish use of the restored and created habitats (open water, marsh plain, and floodplain) created by the Napa Project, with special emphasis on threatened and endangered species.

Fish were captured using beach seines, otter trawls, purse seines, and fyke nets. The otter trawl was fished actively in the open water and floodplain sites. The purse seine was fished actively in the open water, during high tide slack water. The beach seine was fished in the marsh plain and floodplain terraces at varying tidal heights. Fyke nets were used in small channels in the floodplain where fish were likely to be concentrated during a falling tide.

The Fisheries Monitoring Program has documented that restoration of the area is providing habitat for native and non-native species. In 2005, a total of 928 larval fish and 2,170 juvenile and adult fish were captured. The larval catch was dominated by shimofuri goby, and the juvenile and adult species were dominated by inland silverside, threadfin shad, striped bass, and Sacramento splittail. The sampling program to date (March 2001 to July 2002, January 2003 to July 2003, March 2004 to July 2004, March 2005 to July 2005) has documented use of the Napa Project area by 74,952 larval, juvenile, and adult fish of 37 species. The number of fish captured varied widely between sampling sites within the Napa Project area.

Species assemblages varied annually and seasonally. In 2001, inland silversides dominated the catch in recently created/restored areas. In 2002, over 3,000 young-of-the-year Pacific herring were captured in created/restored habitats. In July 2003, an increase of striped bass and threadfin shad dominated the catch in created/restored and non-restored sites. Comparatively, in June–July 2004 and May–June 2005, Sacramento splittail were the most abundant native fish captured in the same created/restored habitats. Results to date indicate that: 1) juvenile Sacramento splittail abundance is positively correlated with salinity in created/restored habitat; 2) juvenile Sacramento splittail were more abundant in shallow created/restored habitat than surrounding deep non-restored habitat; 3) juvenile Sacramento splittail were found to have a greater abundance in created marsh plain habitat than in restored SWOA floodplain habitat; 4) striped bass appear to have a seasonal distribution and abundance is positively correlated with salinity; 5) inter-annual variability was observed with inland silverside, threadfin shad, Pacific herring, and Sacramento splittail. Variability in species assemblages reflects changes in environmental conditions and possibly successional changes in created flood and marsh plain habitat. Results of the monitoring

program have identified species that benefit from newly restored and created habitat, documented seasonal trends in habitat use, and revealed correlations between environmental conditions and fish distribution and abundance. The results of this project will be useful in developing approaches to restore fish habitat within the Bay/Delta.

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1 Introduction

1.1 Background

Restored SWOA Site 1A-6, April 2005.

The Napa River/Napa Creek Flood Protection Project ("Napa Project") was designed by the Napa County Flood Control and Water Conservation District and the U.S. Army Corps of Engineers (USACE) to provide flood protection for and improve habitat in the vicinity of the City of Napa by reconnecting the Napa River to its floodplain, creating wetlands throughout the area, maintaining fish and wildlife habitats, and restoring the natural characteristics of the river. The Project consists of five separate contracts developed as a cooperative effort between the City of Napa, Napa County, the USACE, Community Coalition, Federal and State resource agencies, and consultants. Construction of the Project is currently phased over seven years from 2000 through 2006.

The Napa River Fisheries Monitoring Program (FMP) was developed as a requirement of the 9 April 1999 U.S. Fish and Wildlife Service (USFWS) Biological Opinion for the Napa Project. The FMP is primarily designed to describe the presence of fish species in the area before and after construction of the Napa Project. Fish habitat restoration features of the flood protection project are being monitored to determine use of the area by various fish species. The latest work plan for the FMP was published in March 2003 (USACE 2003a). The FMP is coordinated with other government sponsored scientific studies in the Bay-Delta, and is Interagency Ecological Program Element 2005-105**.** Fish surveys began in July 2001 and have continued through July 2005.

1.2 Project Description

The Napa Project is being implemented along 11.1 km (6.9 miles) of the Napa River in Napa County, California (Figures 1-1 and 1-2). Project features include dike removal, channel modifications to create floodplain and marsh plain terraces, bridge relocations, and construction of levees and floodwalls, pump stations, maintenance roads, and recreation trails for the reach of the river from Highway 29 to Trancas Street.

The Napa Project also includes the Napa River Enhancement Plan for the South Wetlands Opportunity Area (SWOA). This enhancement plan calls for restoration of physical and biological processes in the Napa River estuary and the SWOA, extending along the west side of the river from Newport North Marina to the Highway 29 bridge, by creating 104 acres of emergent marsh, converting 262 acres of farmland to emergent marsh, and creating and enhancing 136 acres of seasonal wetlands (USACE 2001a). The enhancement plan includes lowering levees, breaching dikes, and constructing marsh plain and floodplain terraces. The SWOA is designed to provide flood relief for the town

of Napa and surrounding areas, once the Napa River reaches 12,000 cfs (William Hall, USACE, pers. comm., 2005).

The FMP involves sampling of the enhanced areas and surrounding habitats to monitor the use of the areas by various fish species. Information gathered as part of the FMP will potentially influence future management decisions and restoration designs, and serve to validate environmentally fish-friendly designs in future flood control programs. Data collected as part of the FMP will also be used to guide the adaptive management decisions described in the Mitigation Monitoring Program for the Napa Project (Jones and Stokes 2001).

1.3 Construction Project Status

The status of construction contracts for the Project is presented in Table 1-1.

Table 1-1. USACE Construction Project Status.[1]

Construction Project	Description	Status
Contract 1A	Terrace excavation and construction of vineyard dike	Completed Fall 2000
Contract 1A Plantings	Revegetation Contract	Completed Fall 2003
Contract 2	Napa Valley Wine Train Phase 1 Relocation	Completed January 2003
Petroleum Contaminated Soil Remediation	Creation of marsh plain terrace and floodplain terrace habitat	Completed December 2003
Contract 1B	Marsh plain and floodplain excavation	Completed April 2004
Contract 1B Plantings	Revegetation Contract	Completed Spring 2005
Remediation Area Plantings	Revegetation Contract	Completed Spring 2005
Sixth to Third Excavation	Marsh plain excavation	Completed Fall 2004
Napa Sanitation District Excavation	Marsh plain and floodplain excavation	Complete in Summer 2005
Hatt to First Reach	Marsh excavation and flood wall construction	Complete in Spring 2007
Napa Valley Railroad Phase 2 Relocation	Relocate 2,100 ft	Complete in 2008
Oxbow Bypass Excavation	Excavate dry bypass at oxbow	Complete in 2008

[1] Mike Dietl, USACE, pers. comm., 2002, Larry Dacus, USACE, pers. comm., 2004, Will Hall, USACE, pers. comm., 2003 and 2005.

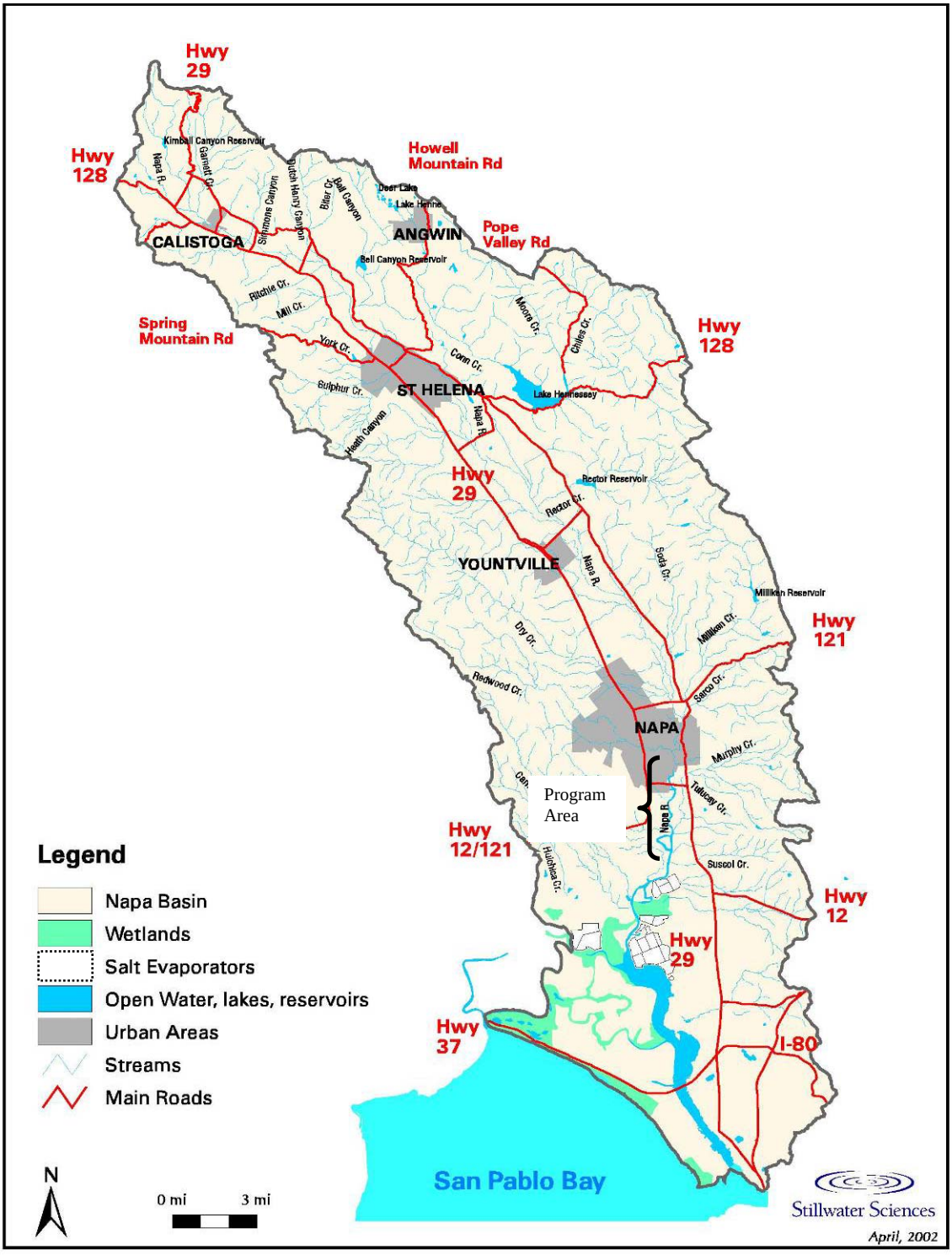


Figure 1-1. Map of the Napa River Fisheries Monitoring Program area.

Figure 1-2. Aerial photograph of the Napa River Fisheries Monitoring Program area.

1.4 Fisheries Monitoring Objectives and Status

The purpose of the FMP is to determine fish use of the restored and created habitats (open water, marsh plain, and floodplain) created by the Napa Project, with special emphasis on threatened and endangered species. Sampling efforts in 2005 consisted of monthly sampling between March and July, plus semi-monthly sampling in March and May.

Although this annual report is for 2005, parts of this report also include data from 2001, 2002, 2003, and 2004 (particularly Appendices A and B). Tables and figures are labeled according to the year data were collected.

The FMP has the following objectives:

1) Document presence and relative abundance of fish species (particularly delta smelt and Sacramento splittail) utilizing restored and created habitats.

2) Document life stages and seasonality of fish species (particularly delta smelt and Sacramento splittail) in restored and created habitats.

3) Determine if correlations exist between collected fish species and under specific environmental conditions at each sampling site.

In order to meet these objectives, the following hypotheses were developed as part of the monitoring program:

- Fish, in particular delta smelt and Sacramento splittail, will use habitat created or restored by the Napa Project.
- Certain life stages of fish species, in particular delta smelt and Sacramento splittail, will use specific habitat types in the Napa Project area during specific seasons and under specific environmental conditions.

Delta smelt captured in the restored SWOA, 2002

Fish surveys have documented that the restoration of the SWOA and marsh plain terraces is providing habitat for native and non-native species. In 2005, a total of 3,098 fish were captured, including 2,170 juvenile and adult fish from 37 species, and incidental capture of 928 larval fish from 6 species. To date (July 2001–July 2002, January 2003–July 2003, March 2004–July 2004, and March 2005–July 2005), a total of 14,961 juvenile and adult fish have been captured, representing 37 species. Native and non-native species captured in 2005 include the following:

Native species:

- chum salmon
- long-jawed mudsucker
- Pacific herring
- prickly sculpin
- Sacramento splittail
- Sacramento sucker
- staghorn sculpin
- starry flounder
- steelhead
- threespine stickleback
- tule perch

Non-native species:

- American shad
- bluegill
- common carp
- inland silverside
- rainwater killifish
- yellowfin goby
- shimofuri goby
- striped bass
- threadfin shad
- white crappie

Subsequent sections of this document present the methods and results of the FMP, and address the objectives and hypotheses stated above. Background information, data, and reports associated with the FMP (including this report) are available online at *http://www.napariverfishmonitoring.org*.

Results of the FMP have been presented at the 2005 State of the San Francisco Estuary Conference (Kramer *et al*. 2005), 2005 California-Nevada Chapter American Fisheries Society Annual Conference (Dusek *et al*. 2005), and the 2003 and 2005 CALFED Science Conference Annual Meetings (Dietl *et al*. 2003, 2005).

Long-jawed mudsucker captured at restored Site 1B-2, May 2005.

2 Methods

2.1 Site Selection

On 8 June 2001, Stillwater staff and USACE personnel established 13 fish monitoring sites along 11.1 km (6.9 mi) of the Napa River and SWOA within the Napa Project area (Figure 1-2, Table 2-1) (USACE 2001b). Individual sites were typically marked by 1.3–2.4 m (6–8 ft) metal posts driven into the substrate, spray-painted orange, and flagged with green tape. Chaudhary and Associates surveyed the selected sample sites (USACE 2001b) to a tolerance of 0.3 m (0.9 ft) for latitude and longitude, and 0.15 m (0.5 ft) for elevation. The 13 sites represented three habitat types that may attract breeding and rearing delta smelt and Sacramento splittail: marsh plain terrace (created), floodplain terrace (restored), and open water (non-restored) habitat. Seven sites were located in the SWOA, including two sites in the Horseshoe Bend channel and five sites north of the levee breach (Figure 1-2, Table 2-1). Three marsh plain sites were located east of the SWOA area and along the mainstem of the Napa River (Figure 1-2, Table 2-1). Five open water sites were located throughout the mainstem of the Napa River, from just east of the SWOA in the main channel continuing throughout the 11.1 km (6.9 mi) Project area (Figure 1-2, Table 2-1). Three sites were subject to minor relocations from 2001 to 2002 (Table 2-1). One site was eliminated because no fish were captured (Site 1A-5). In 2003, 2004, and 2005, two sites were not sampled due to lack of funding (Sites 1A-8 and 1A-9), and one new site was discontinued to concentrate sampling effort on sites with historical data (Site 2-2).

Table 2-1. Sampling Site Locations for the Napa River Monitoring Fisheries Program.

Site No.	Latitude			Longitude			Elevation (mean sea level)
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds	(feet)
1A-1	38	15	17.70	122	17	0.30	N/A
1A-2[a]	38	14	54.57	122	17	16.94	4.0
1A-3	38	16	2.07	122	17	11.43	0.6
1A-4[b]	38	16	1.38	122	17	15.73	5.7
1A-6[a]	38	15	13.49	122	17	37.57	-3.2
1A-7	38	15	21.59	122	17	34.58	-0.5
1A-8[c]	38	15	21.34	122	17	38.15	-1.1
1A-9[c]	38	15	11.12	122	17	38.16	4.3
1A-10[a]	38	14	57.73	122	17	16.78	-3.3
1B-1	38	16	23.10	122	17	4.70	N/A
1B-2	38	16	38.40	122	16	50.30	N/A
2-2	38	17	24.70	122	16	53.90	N/A
2-1	38	17	10.10	122	17	0.20	N/A
3-1	38	18	8.71	122	16	43.88	26.5
Standpipe[b]	38	16	4.84	122	17	26.26	2.6

[a] Positions approximate due to minor relocations in 2002.

[b] Standpipe and a t-bar post at Site 1A-4 were used for obtaining position bearings during roving beach seines in the SWOA if a GPS signal could not be recorded.

[c] Positions not sampled in 2005.

2.2 Site Descriptions

Sampling locations are documented in Figure 1-2, with brief descriptions of each site provided below.

Site 1A-1 was sampled with an otter trawl. The site position was previously established by CDFG for the 20 mm tow-net surveys in 2001. This site was located by the SWOA in the main Napa River channel, in close proximity to the peninsula formed by Horseshoe Bend.

Site 1A-2 was sampled with an otter trawl. It was originally located in the upper reaches of the main drainage channel in Horseshoe Bend (west of current Site 1A-10). However, due to excessive and repeated clogging of the otter trawl by debris (e.g., automobile tires), the site was relocated to the main channel that flows north-south through the SWOA.

Site 1A-3 was sampled with a beach seine and was located on the west bank of the main channel of the Napa River, just upstream of the JFK Park boat ramp. The site was located on bare earth or mud where a levee was removed by the USACE as part of the Napa Project. The site was inundated during high tides. Site 1A-3 was originally sampled with a fyke net, but it was found to be more effectively sampled with a beach seine.

Creation of marsh plain terrace Site 1A-3: Pre-restoration condition (left), post- construction habitat (middle), and sampling habitat at high tide (right).

Site 1A-4 was an area at the north end of the SWOA sampled by beach seine. The beach seine was used to sample various locations in the marsh during flood, high, and ebb tides.

Site 1A-5 was sampled by fyke net and was initially sampled through November 2001. However, since the fyke net did not capture any fish, sampling effort was redirected to other sites.

Site 1A-6 was sampled by fyke net. The location of this site was moved out of the main SWOA channel due to human safety and fish injury concerns: the location in the main channel exposed the fyke net to high water velocities making placement and removal of the fyke net dangerous and increasing the potential for injury and mortality to the fish captured. The net at this site was originally positioned to sample fish that concentrated in the tidal channel during a receding tide. In 2001, the site was moved to the east side of the terrace where water velocities were lower. In 2002, the site was relocated about 7 m (23 ft) west from its original location, across the main channel, in a small channel that drains the southwest portion of the SWOA.

Site 1A-7 was sampled by fyke net. This site was located in a tidal channel that drains from the eastern side of the SWOA marsh into the main marsh channel, which drains into Horseshoe Bend. This site was established to sample fish that concentrate in the tidal channel during a receding tide.

Site 1A-8 was also sampled by fyke net. The site was located in a tidal channel that drains from the western side of the SWOA marsh and captured fish that concentrated in the tidal channel during a receding tide. This site was not sampled in 2004 and 2005 due to budget constraints.

Pre-restoration condition in the SWOA in June 2001 (left) and post-construction habitat (middle and right).

Site 1A-9 was sampled with a purse seine and was located at the levee breach where the main SWOA marsh channel enters Horseshoe Bend. This site was established to sample fish distributed in mid-water depths at the levee breach. This site was not sampled in 2004 and 2005 due to budget constraints.

Site 1A-10 was sampled with a fyke net and was located slightly upstream of the peninsula levee breach (on Horseshoe Bend). This site was established to sample fish concentrated in the channel during a receding tide. The location of this site was moved out of the channel due to human safety and fish injury concerns: the location in the channel exposed the fyke net to high water velocities making placement and removal of the fyke net dangerous and increasing the potential for injury and mortality to the fish captured. In 2002, the site was moved about 9.5 m (31 ft) northwest from its initial location to an outflow channel that allowed safer boat and wading access.

Site 1B-1 was in open water and was sampled by otter trawl. It was located in the main Napa River channel, 1 km (0.6 mi) upstream of the JFK Park boat ramp.

Non-restored Site 1B-1, July 2002

Site 1B-2 was sampled with a beach seine and was located on the east bank of the main channel of the Napa River, just across from River Park Marina. The site was located where a levee was removed by the USACE as part of the Napa Project. The site was only inundated during flooding and high tides.

Site 2-1 was in open water and was sampled by otter trawl. It was located in the main Napa River channel, at Jacks Bend (Tulocay Creek confluence).

Site 2-2 was sampled with a beach seine and was located on the east bank of the main channel of the Napa River, just upstream of Tulocay Creek. The site was located where a levee was removed by the USACE as part of the Napa Project. The site was only inundated during flooding and high tides.

Site 3-1 was in open water and was sampled by purse seine. This site was located in the main Napa River channel, just downstream of the First Street Bridge, and provided a more upstream mid-water habitat site.

2.3 Sampling Schedule

Selected sites were used to sample on a monthly or semi-monthly schedule (Table 2-2).

Table 2-2. Napa River Fisheries Monitoring Program: Monthly Sampling Schedule in 2005.*

Site	Classification	Description	March		April	May		June	July
			9–10	23–24	20–21	5–6	18–19	29–30	28–29
1A-1	Open water	Open water (river)	OT	OT	OT	OT	OT	OT	OT
1A-2	SWOA	SWOA slough	OT	OT	OT	OT	OT	OT	OT
1A-3	Marsh plain	Marsh plain terrace	BS	BS	BS	BS	BS	BS	BS
1A-4	SWOA	Floodplain terrace	BS	BS	BS	BS	BS	BS	BS
1B-2	Marsh plain	Marsh plain terrace	BS	BS	BS	BS	BS	BS	BS
2-2	Marsh plain	Marsh plain terrace	BS	BS	BS	BS	BS	BS	BS
1A-6	SWOA	SWOA marsh	FN	FN	FN	FN	FN	FN	FN
1A-7	SWOA	SWOA marsh	FN	FN	FN	FN	FN	FN	FN
1A-10	SWOA	SWOA HB marsh	FN	FN	FN	FN	FN	FN	FN
1B-1	Open water	Open water (river)	OT	OT	OT	OT	OT	OT	OT
2-1	Open water	Open water (river)	OT	OT	OT	OT	OT	OT	OT
3-1	Open water	Open water (river)	PS	PS	PS	PS	PS	PS	PS

*FN = fyke net; PS = purse seine; OT= otter trawl; BS = beach seine.

2.4 Sampling Methods

Various gear types tested in 2001 and subsequent adjustments are presented in detail in the 2001 Napa River Fisheries Monitoring Program Annual Report (USACE 2002). Except where noted, sampling during the March 2005 through July 2005 periods used the same gear types and methods.

Four gear types were used to sample fish in the Project area, using a 6.4 m (21 ft) aluminum workboat. Fyke nets were used in small channels in the marsh plain and floodplain terraces where fish were likely to be concentrated during a falling tide. The purse seine was fished in the open water sites, during high tide slack water. The otter trawl was fished in the open water sites at varying tidal heights. The beach seine was fished in the marsh plain and floodplain terraces at varying high tidal heights and during flooding periods. Gear specifications and replicate numbers are presented in Table 2-3.

Table 2-3. Napa River Fisheries Monitoring Program: Gear Specifications and Level of Effort in 2005.

Gear/ Sampling Technique	Dimensions	Mesh Size	Site Locations	Sampling Duration	Number of Samples per Sampling Event
Fyke Nets	Opening: 0.9-1.2 m Length: 6.1-9.2 m Leads: 3.1 m	0.64 cm	SWOA Slough (1A-6), SWOA Marsh (1A-7), SWOA-Horseshoe Bend Marsh (1A-10)	4-6 hours per set	1 set
Otter Trawl	Opening: 1 x 2.5 m Length: 5.3 m	Variable: 0.64 cm–3.8 cm	Open Water-Horseshoe Bend (1A-2), Open Water (1A-1), Open Water (2-1), Open Water (1B-1)	10-15 minutes per tow, at 1-2 knots	2-3 tows
Purse Seine	Length: 30.5 m Depth: 1.8 m	0.64 cm	Open Water (3-1)	20-30 minutes per set	2-3 sets
Beach Seine	Length: 30.5 m (2001–2002) and 15.2 m (2003–2005) Depth: 1.2 m plus bag	0.64 cm	Floodplain Terrace (1A-4), Marsh Plain Terrace (1A-3), Marsh Plain Terrace (2-2), Marsh Plain Terrace (1B-2)	20 minutes per haul	2-3 hauls

2.4.1 Fyke nets

Fyke net

Fyke nets were deployed to capture fish in shallow marsh areas with moderate to swift current. The fyke nets were approximately 3.6 m (12 ft) long with 0.64 cm (¼ in) mesh. Each net consisted of seven 0.91 m (3 ft) diameter hoops with two 3 m (10 ft) leads. Fyke nets were secured in the current by t-posts that had been driven into the substrate. Four pieces of PVC pipe were attached to the entrance of the net and each wing, and slid over the t-posts. The pipe facilitated deployment and retrieval, and a secure fit of the nets to the t-posts. Fyke nets were deployed during daytime high tides and were fished for approximately four to six hours during the receding tide. During the receding tide, the fyke net wings diverted the fish into the traps. The field crew retrieved the nets during the ebbing tide, and collected all fish that were captured. All fyke nets were removed from the water after each sample was collected. Catch per unit effort (CPUE) was calculated by dividing the number of fish of each species by the time the fyke net was fished (beginning at the time of slack tide).

2.4.2 Otter trawl

Otter trawl

An otter trawl was used to sample benthic and mid-water column fish. The body and the tail, or "cod" end of the net was 0.64 cm (¼ in) mesh. The mouth opening was 1 m (3.3 ft) x 2.5 m (8.2 ft) and the length was approximately 5.3 m (17.4 ft). The otter trawl was towed from the stern of the boat for approximately 10 minutes to minimize stress to captured fish. The otter trawl was fished once or twice a month during daylight hours, around high tide slack water. The water volume sampled by the trawl was calculated using a General Oceanics flow meter that was towed from the side of the boat. The flow meter was calibrated over a measured distance prior to sampling. Trawl volume was calculated by multiplying the amount of water sampled (represented by flow meter readings) by the known area of the net opening. CPUE was calculated by dividing number of fish of each species by the volume of water sampled.

2.4.3 Purse seine

A purse seine was used to sample fish concentrated in the mid-water zone. The seine was 30.4 m (100 ft) long by 2.5 m (8 ft) deep with 0.64 cm (¼ in) mesh. The top of the net was connected to floats which supported the net in open water. The net was deployed off the boat in a circular pattern. Once the circle was completed, the purse line along the bottom of the net was pulled tight to seal the opening, trapping the fish. The volume of water sampled was calculated by estimating the length and width, or the diameter, of the enclosure formed by the deployed seine. CPUE was calculated by dividing the number of fish of each species by the water volume.

Purse seine

2.4.4 Beach seines

Two beach seines were used alternately to target fish in shallow water habitats with low to moderate water velocities. The beach seines sampled the entire water column. The nets were supported at the surface by floats and weighted with a lead line to provide contact with the bottom. The first beach seine, measured 30.5 m (100 ft) long by 1.8 m (6 ft) high was used in 2001 and 2002. The second beach seine, measured 15.3 m (50 ft) long by 1.8 m (6 ft) high was used between 2003 and 2005. Both seines had 0.64 cm (¼ in) mesh with a 1.8 m^2 (6 ft^2) bag. One sampling method involved deploying the beach seine from the boat, which required one end of the seine to be secured onto the bank and one end secured to the boat. The boat was backed away from the shore, deploying the net, and then was driven back to the shore downstream or upstream of where the seine was secured on the bank. The seine was then pulled onto the shore by hand. Alternatively, in shallow water, the beach seine was stretched out between two people and dragged through the water toward shore or back to the boat where it was hauled out of the water. Beach seining was conducted during the day, near slack water at high tide each month. The volume of water sampled was estimated by multiplying the seine width by water depth and the distance covered. CPUE was calculated by dividing the number of fish of each species by the calculated volume of water sampled.

Beach seine

2.4.5 Fish processing

After retrieving the sampling gear, fish were placed into buckets with water. Fish were kept in water during processing, and gloves used where necessary and practical to minimize injury to fish. All fish specimens were collected, processed, and returned to the water as soon as possible.

The following data were recorded for fish collected at each sampling site:

- Identification to species level;
- Fork length (FL) (mm). If large numbers of a non-listed fish species were captured (e.g., inland silversides), then the total number of fish was counted and a representative sample (n=50) was measured. Starting July 2003, standard length (SL)(mm) and total length (TL) (mm) of splittail was measured to facilitate age/length correlations. For the 2001-2003 Sacramento splittail data analysis, fork length was converted to standard length (FL = 0.8722 x SL – 0.2657) (Randy Baxter pers. comm., California Department of Fish and Game, 2003). Splittail were classified as juveniles when less than 170 mm SL and adults when greater than 170 mm SL (Moyle *et al.* 2004).
- Weight (g) was measured for all listed species and splittail;
- Reproductive state or spawning stage was verified for splittail by applying mild pressure to the abdomen to determine if milt or eggs could be expressed;
- Noticeable lesions were recorded for listed species and splittail;
- Photos were taken of representative fish species.

2.4.6 Larval fish processing

The 2005 surveys incidentally captured larval fish in the adult and juvenile sampling gear (fyke nets, beach seines, and otter trawls). Larval fish captured in 2005 were processed using the larval fish processing protocol described in USACE 2002. Larval fish species were identified in the laboratory. For samples containing more than one hundred fish of the same species, the first one hundred were measured and lengths were estimated for the remaining fish. Quality Assurance and Quality Control (QA/QC) was performed by a larval fish specialist to insure correct identification of larval fish.

2.4.7 Environmental conditions

Environmental conditions were measured while sampling at each site on each sampling day. The Napa River discharge was determined from the Napa River gaging station. The Napa River gaging station near Napa (#11458000) is operated by U.S. Geological Survey and Department of Water Resources. The gaging station is located 9.6 km (6.0 mi) upstream of the Project area (38^{o} 36’ 70”N, 122^{o}30’00”W) and did not include inflow

from Napa Creek and Soda Creek, as their confluence with the Napa River is below the gaging station.

Digital photographs were taken at each site to document vegetation conditions, site conditions, and examples of captured fishes. These digital photographs were catalogued along with the associated site identification. The following data were collected at each site and input into the FMP database:

- Dissolved oxygen (mg/l), water temperature (^{o}C), and salinity (ppt) were measured at the surface and bottom at each site with a YSI Model 85 meter.
- Turbidity (mm) was measured using a Secchi disk. The disk was lowered into the water column on a cable, and the greatest depth at which the disk could be observed was recorded in cm.
- Tidal elevation (ft) was noted daily from a Napa River gage near the Horseshoe Bend confluence. The tide elevation during each sampling event was calculated with the use of a Nautical Software tidal chart for the Napa River.
- Water depth (ft) was measured via marks on a stadia rod or with a depth sounder.
- Photos were taken with a Cannon A40 digital camera (resolution 1024x768).

2.5 Quality Control Procedures

The methodology and standard operating procedures implemented for quality control (Q/C) are described in the Final Workplan and QA/QC Plan for Implementation of the Year 2001 Napa River Fisheries Monitoring Program (USACE 2001a) and are summarized below.

2.5.1 Preparation of equipment

All equipment was prepared and calibrated prior to each sampling trip. The following list itemizes equipment preparation procedures:

- YSI 85 meter (DO, Salinity, Temperature, Conductivity): calibrate to manufacturer's specifications.
- General Oceanics flow meter: initially calibrate the number of revolutions with the distance traveled through the water. Recheck calibration prior to each sampling trip.
- The "calibration checklist" on the data sheets was used to verify completed calibration procedures for all equipment, and completion was noted on the data sheets for each field effort.

2.5.2 Sample replications

Replicate samples of two or three tows, or sets, were performed at sites where an otter trawl, purse seine, or beach seine was used.

There were no replicate samples taken at the fyke net sites. Individual fyke nets were set monthly or semi-monthly at each site, and generally "fished" from high slack tide until their retrieval near low tide.

2.5.3 Sample preservation, transportation, storage and disposal

Specimens used to confirm positive fish species identification in larval and adult samples collected by the FMP Implementation Team were preserved in 10 percent formalin and placed in glass or plastic specimen jars for storage. Jars were labeled with date, time, location, and the sample collector's name. Fish collected for fish identification are currently being stored at Stillwater Sciences in Arcata.

2.5.4 Sample and data collection

Field data were collected on standard forms to minimize the potential for missing values. The Field Leader, or other crew members that did not record the data, reviewed the datasheets on a daily basis for the following:

- Completion of all data fields
- Reasonableness of measurements
- Legibility of recorded data

The reviewer initialed each data sheet as having been reviewed for accuracy and completeness before leaving the site on each sampling date.

2.5.5 Data summary and processing

Following field data checking, additional Q/C measures were implemented during data entry and data summary. During data entry into the relational database, the database software was able to prevent or detect many types of errors with the following methods:

Mandatory Fields. Although not all fields must be entered for every record, there are many mandatory fields, such as sampling-site identification number and date.

Data Format Checks. The data entry form prevented the wrong type of data from being entered into a field. For example, text could not be entered into numeric fields, and numeric data must be entered with the correct decimal placement.

Lookup Tables. Many data elements had unique values that must be used, such as fish sample method and sampling site identification number. Rather than enter values for these fields and risk making a typographical error, lookup tables were used with data entry drop-down menu lists, so that only a listed, valid value could be selected.

Numeric Range Tests. For numeric data elements, such as fish counts, the value entered was tested against preset minimum and maximum values, to ensure that the data entered was within the valid range.

Incomplete or Illegible Data. If the field data collection forms had illegible or missing mandatory data, the data was corrected and a member of the QA/QC team revised the database with the correct information.

Data Entry Report and Field Form Comparison. At the completion of each data entry session, the data entry technician printed out a report of the data entered. This printout was compared to the field data entry forms for accuracy.

3 Results

3.1 Fish Relative Abundance and Distribution

In 2005, 2,170 juvenile and adult fish were sampled, representing 12 native and 10 non-native species (Table 3-1 and Table B-1, Appendix B). In addition, 928 larval fish were captured (Table 3-2), representing 2 native and 4 non-native species (Table 3-1 and Table B-2). The most abundant juvenile or adult species captured in 2005 was inland silverside (n=860, 39 percent), followed by threadfin shad (n=338, 16 percent), striped bass (n=325, 15 percent), and Sacramento splittail (n=305, 14 percent) (Table B-1, Figure 3-1). The remaining 17 species comprised 16 percent of the 2005 catch.

All gear types captured fish in 2005 (Figure A-1 [Appendix A]): the beach seine captured the greatest percentage of fish (73 percent), followed by otter trawl (18 percent), fyke net (5 percent), and purse seine (4 percent). The dominant species captured by each gear type was striped bass in the otter trawl (44 percent), inland silverside in the beach seine (51 percent), Sacramento splittail in the fyke nets (40 percent), and threadfin shad in the purse seine (64 percent) (Figure A-2).

Differences in fish species composition were observed in different habitat types from March to July 2005 (Figures A-3 through A-5). Marsh plain habitats were dominated by inland silverside (53 percent) followed by Sacramento splittail (14 percent), threadfin shad (10 percent), and striped bass (10 percent). In open water habitats, threadfin shad was the most abundant (41 percent) followed by striped bass (34 percent) and tule perch (8 percent). SWOA habitats were dominated by Sacramento splittail (27 percent), followed by striped bass (13 percent) and threadfin shad (9 percent).

Larval fish were incidentally captured in 2005 with fyke nets, beach seines, and otter trawls while sampling for juvenile and adult fish in the SWOA, marsh plain, and open water habitats. The dominant larval species was shimofuri goby (84 percent), followed by *Tridentiger* or other unidentified goby species (6 percent), and striped bass (3 percent) (Figure A-6, Tables 3-1 and 3-2). Larval longfin smelt and yellowfin goby were most abundant in May; larval Pacific herring, striped bass, *Tridentiger* spp., and threadfin shad were most abundant in June, and shimofuri goby was most abundant in July (Table 3-2).

Non-native species were always a higher percentage of the catch than native species in every month surveyed in 2005 (Figure 3-2). Native species abundance was highest in May, June, and July (Figure 3-2).

Restored Site 1A-10, May 2005.

As in previous years of sampling, there was a notable difference between the distribution of native and non-native species by the habitat types in the Napa River Project area in 2005. Non-native species represented 85 percent of the catch in the open water habitat, 78 percent in the marsh plain habitat, and 65 percent in the SWOA habitat (Figure 3-3). In the SWOA and open water habitats the proportion of native and non-native species was similar (9 native, 8 non-native species), compared to the marsh plain where a lower proportion of native species was observed (7 native, 8 non-native species) (Figure 3-4).

3.2 Fish Relative Abundance and Distribution

In 2005, physical conditions in the project area varied similarly to surveys from previous years. During winter, physical conditions were characterized by low water temperatures, very low salinities, high dissolved oxygen, and high freshwater inflow (Figures A-7 through A-10). In the spring, salinity and water temperature began to increase, while dissolved oxygen decreased. Summer conditions exhibited moderately high temperatures, low dissolved oxygen, and higher salinity levels. These conditions are associated with changes in freshwater inflows from the Napa River that are typically highest in December and decrease in the spring. With low freshwater inflow in the summer and fall months, salinities and temperatures increased, and dissolved oxygen decreased. Environmental conditions at each sample site between 2001 and 2005 are provided in Table C-1 (Appendix C).

Monthly mean water temperature during the 2005 field effort ranged from a low of 13.7^{o}C (56.7^{o}F) in March and steadily increased into early summer to a high of 24.2^{o}C (75.6^{o}F) in July. Salinity ranged from a low of 0.1 ppt in March to a high of 9.5 ppt in July, and dissolved oxygen decreased from a high of 10.8 mg/l in April to a low of 5.1 mg/l in July. Average monthly Secchi readings ranged from a relatively high visibility reading of 0.7 m (2.3 ft) in April to a low of 0.3 m (0.9 ft) in June. However, unlike seasonal trends observed in temperature, salinity, and dissolved oxygen, there was no apparent trend between water clarity and season. Average daily mean flows measured at the USGS Napa River gaging station near Napa (# 11458000) decreased from a high of 700 cfs in March to a low of 13 cfs in July 2005 (Table 3-3).

Table 3-1. Napa River Fisheries Monitoring Program: Fish Species Captured in 2001–2005.

Common Name	Scientific Name	Native or Non-native	Mar–Dec 2001	Feb–Jul 2002	Jan–Jul 2003	Mar–Jul 2004	Mar–Jul 2005
Atherinopsidae, silverside family							
Inland silverside	*Menidia beryllina*	Non-native	■	■	■	■	■
Catostomidae, sucker family							
Sacramento sucker	*Catostomus occidentalis*	Native	■		■	■	■
Centrarchidae, sunfish family							
Black crappie	*Pomoxis nigromaculatus*	Non-native		■	■	■	
Bluegill	*Lepomis macrochirus*	Non-native			■		■
Largemouth bass	*Micropterus salmoides*	Non-native			■	■	
White crappie	*Pomoxis annularis*	Non-native					■
Clupeidae, herring family							
American shad	*Alosa sapidissima*	Non-native	■	■	■	■	■
Northern anchovy	*Engraulis mordax*	Native	■	■			
Pacific herring	*Clupea pallasii*	Native	■	■	■	■	■
Threadfin shad	*Dorosoma petenense*	Non-native	■	■	■	■	■
Cottidae, sculpin family							
Prickly sculpin	*Cottus asper*	Native	■	■	■	■	■
Staghorn sculpin	*Leptocottus armatus*	Native	■	■	■	■	■
Cyprinidae, minnow family							
Common carp	*Cyprinus carpio*	Non-native	■	■	■	■	■
Golden shiner	*Notemigonus crysoleucas*	Non-native		■		■	
Sacramento splittail [CSC]	*Pogonichthys macrolepidotus*	Native	■	■	■	■	■
Sacramento pikeminnow	*Ptychocheilus grandis*	Native				■	
Embiotocidae, surfperch family							
Tule perch	*Hysterocarpus traski*	Native	■	■	■	■	■
Fundulidae, killifish family							
Rainwater killifish	*Lucania parva*	Non-native			■	■	■
Gasterosteidae, stickleback family							
Threespine stickleback	*Gasterosteus aculeatus*	Native	■	■	■	■	■
Gobiidae, goby family							
Arrow goby	*Clevelandia ios*	Native	■				
Bay goby	*Lepidogobius lepidus*	Native	■				
Long-jawed mudsucker	*Gillichthys mirabili*	Native	■	■			■
Shimofuri goby	*Tridentiger bifasciatus*	Non-native	■	■	■	■	■
Yellowfin goby	*Acanthogobius flavimanus*	Non-native	■	■	■	■	■
Ictaluridae, catfish family							
Channel catfish	*Ictalurus punctatus*	Non-native		■			
White catfish	*Ameiurus catus*	Non-native			■		
Moronidae, temperate bass family							
Striped bass	*Morone saxatilis*	Non-native	■	■	■	■	■
Osmeridae, smelt family							
Delta smelt [FT, CT]	*Hypomesus transpacificus*	Native	■	■			
Jack smelt	*Atherinopsis californiensis*	Native	■				
Longfin smelt [CSC]	*Spirinchus thaleichthys*	Native	■	■	■	■	■
Wakasagi	*Hypomesus nipponensis*	Non-native	■	■			

Table 3-1 (continued). Napa River Fisheries Monitoring Program: Fish Species Captured in 2001–2005.

Common Name	Scientific Name	Native or Non-native	Mar–Dec 2001	Feb–Jul 2002	Jan–Jul 2003	Mar–Jul 2004	Mar–Jul 2005
Pleuronectidae, flounder family							
Speckled sanddab	*Citharichthys stigmaeus*	Native					
Starry flounder	*Platichthys stellatus*	Native					
Poeciliidae, livebearer family							
Western mosquitofish	*Gambusia affinis*	Non-native					
Salmonidae, salmon and trout family							
Chinook salmon	*Oncorhynchus tshawytscha*	Native					
Chum salmon	*Oncorhynchus keta*	Native					
Steelhead [FT]	*Oncorhynchus mykiss*	Native					

FT = Listed as threatened under ESA

CT = Listed as California Threatened

CSC = Listed as California Species of Concern

Table 3-2. Larval Fish Captured in the Napa River Project Area in 2005.

Location Code / Gear Type / Replicate Number	Longfin smelt	Pacific herring	Shimofuri goby	Yellowfin goby	Striped bass	Threadfin shad	*Tridentiger* spp.	Unidentified (damaged)	Total
Date: 20 April									
1A-2 Otter Trawl 2 of 2	0	0	2	0	0	0	0	0	2
1A-6 Fyke Net	1	0	1	0	0	0	0	0	2
April Subtotal	1	0	3	0	0	0	0	0	4
Date: 5 May									
1A-6 Fyke	0	1	0	0	0	0	0	0	1
1A-2 Otter Trawl 1 of 2	0	0	0	2	0	0	0	0	2
1B-1 Beach Seine 1 of 2	0	0	1	0	0	0	0	0	1
Date: 18 May									
1A-1 Otter Trawl 1 of 2	1	0	0	0	0	0	0	0	1
1A-2 Otter Trawl 1 of 2	1	0	0	1	0	0	0	0	2
1A-2 Otter Trawl 2 of 2	3	0	1	2	0	0	0	0	6
1B-1 Beach Seine 2 of 2	0	0	1	0	0	0	0	0	1
1A-7 Fyke Net	0	0	1	0	0	0	0	0	1
May Subtotal	5	1	4	5	0	0	0	0	15
Date: 29 June									
1A-1 Otter Trawl 1 of 2	0	0	41	0	2	0	0	0	43
2-1 Otter Trawl 2 of 2	0	5	0	0	4	1	0	0	10

Table 3-2 (continued). Larval Fish Captured in the Napa River Project Area in 2005.

Location Code / Gear Type / Replicate Number	Longfin smelt	Pacific herring	Shimofuri goby	Yellowfin goby	Striped bass	Threadfin shad	*Tridentiger* spp.	Unidentified (damaged)	Total
Date: 30 June									
1A-3 Beach Seine 1 of 3	0	0	0	0	0	0	0	1	1
1A-3 Beach Seine 3 of 3	0	3	2	0	0	0	0	0	5
1B-2 Beach Seine 1 of 2	0	1	0	0	0	1	0	0	2
1B-1 Otter Trawl 1 of 2	0	0	89	0	1	0	0	5	95
1B-1 Otter Trawl 2 of 2	0	1	275	1	9	0	40	7	333
2-1 Otter Trawl 1 of 2	0	0	82	0	3	0	0	7	92
2-1 Otter Trawl 2 of 2	0	5	263	1	6	2	15	0	292
June Subtotal	0	15	752	2	25	4	55	20	873
Date: 29 July									
2-1 Otter Trawl 1 of 2	0	0	8	0	0	0	0	4	12
2-1 Otter Trawl 2 of 2	0	0	23	0	0	0	0	0	23
1B-1 Otter Trawl 2 of 2	0	0	1	0	0	0	0	0	1
July Subtotal	0	0	32	0	0	0	0	4	36
Total larval fish 2005	6	16	791	7	25	4	55	24	928

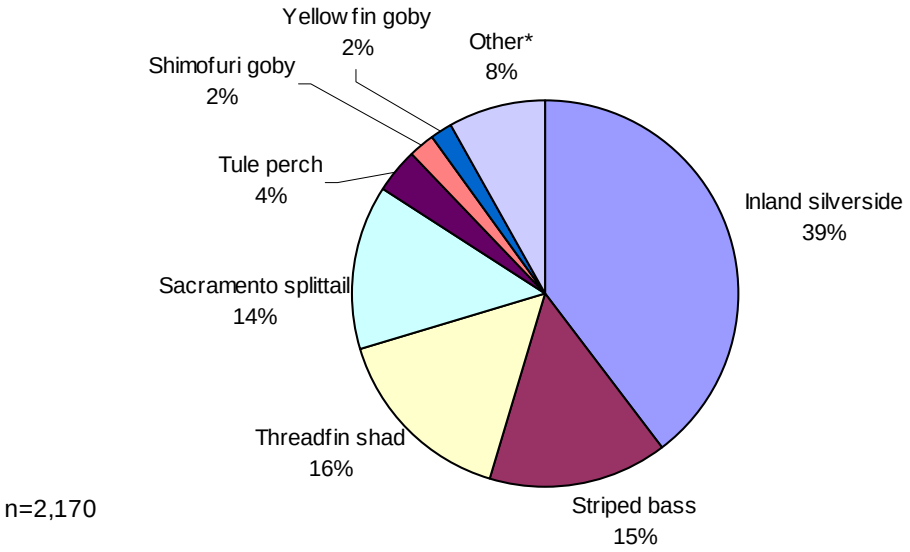


Figure 3-1. Composition of juvenile and adult fish captured in the Napa River Project area in 2005.

* Species comprising less than 1 % of the catch: American shad, bluegill, carp, chum salmon, long-jaw ed mudsucker, Pacific herring, prickly sculpin, rainw ater killifish, staghorn sculpin, Sacramento sucker, starry flounder, steelhead, threespine stickleback, w hite crappie.

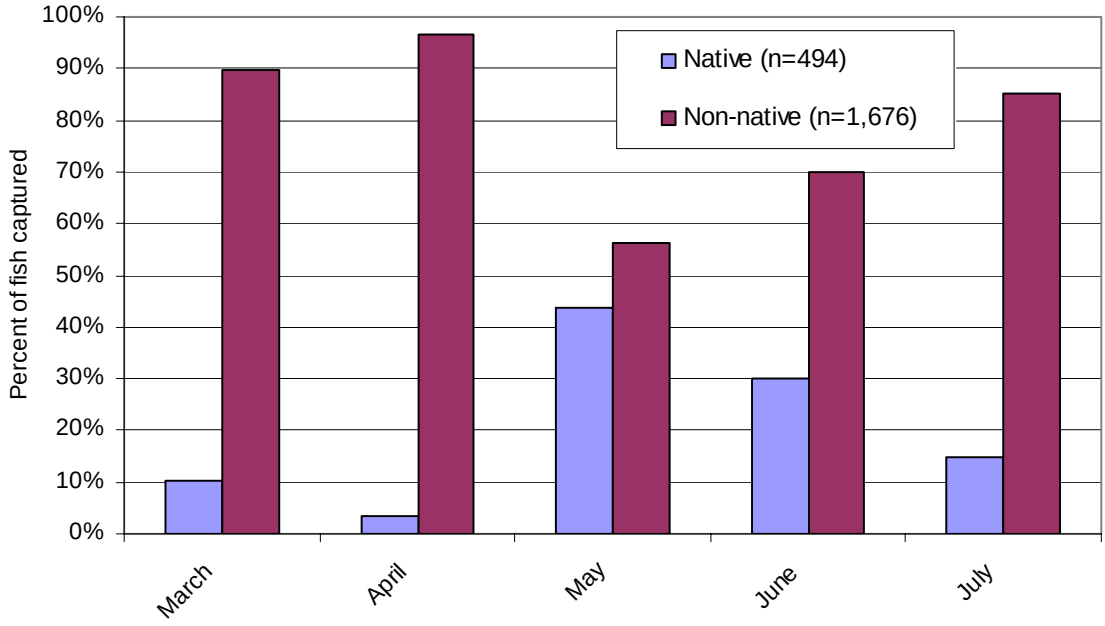


Figure 3-2. Percent of native and non-native fish captured in 2005 by month in the Napa River Project area.

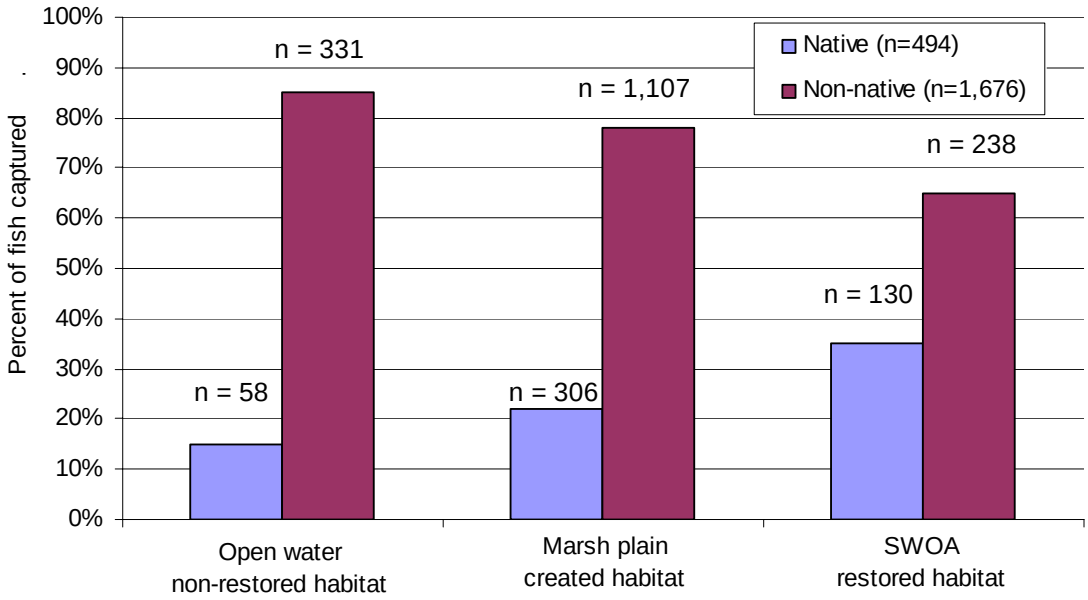


Figure 3-3. Percent of native and non-native juvenile and adult fish captured in all habitat types in the Napa River Project area in 2005.

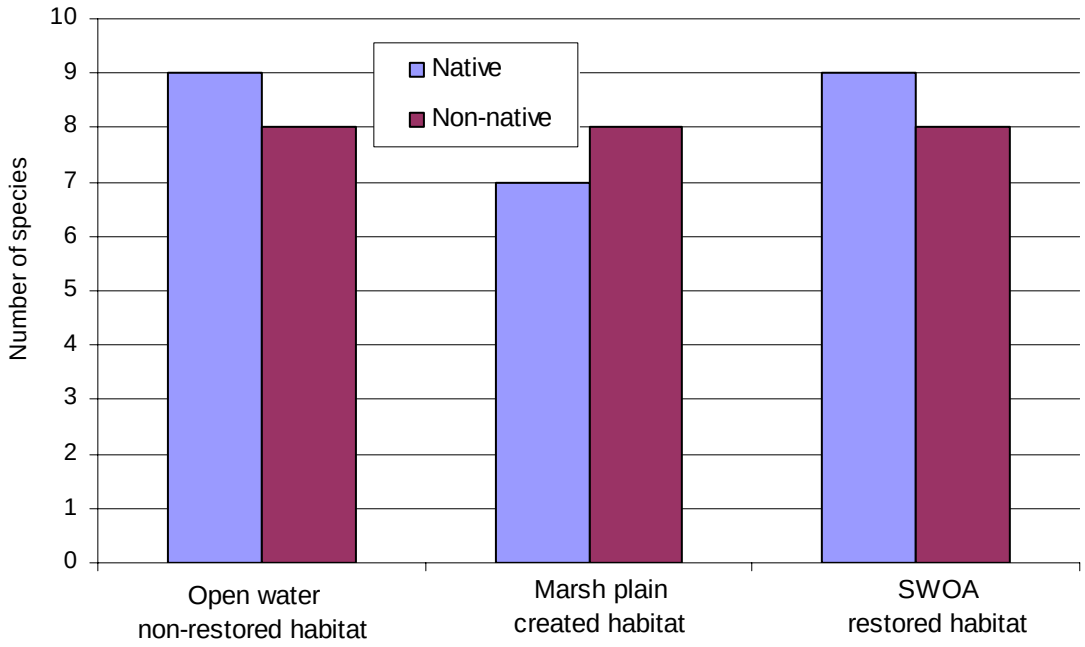


Figure 3-4. Number of species captured by habitat type in the Napa River Project area in 2005.

Table 3-3. Napa River Fisheries Monitoring Program: Monthly Average Environmental Conditions in 2005.

Month	Location	Water Depth [m (ft)]	Water Temperature Surface [°C (°F)]	Water Temperature Bottom [°C (°F)]	Water Turbidity [Secchi Depth] [m (ft)]	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Daily Mean Flow (cfs)*
Mar-05	Open Water	4.7 (15.4)	14.8 (58.6)	14.4 (57.9)	0.6 (2.0)	9.6	9.5	0.1	0.1	700
	SWOA	0.9 (3.0)	13.7 (56.7)	13.7 (56.7)	0.3 (1.0)	8.4	7.6	0.3	0.3	
	Marsh Plain	0.6 (2.0)	14.8 (58.6)	14.5 (58.1)	0.5 (1.6)	9.5	9.6	0.1	0.1	
Apr-05	Open Water	4.8 (15.8)	17.0 (62.6)	16.7 (62.1)	0.9 (3.0)	9.4	9.7	0.5	0.6	299
	SWOA	1.2 (3.9)	17.6 (63.7)	17.4 (63.3)	0.4 (1.3)	8.4	7.8	1.5	1.6	
	Marsh Plain	0.4 (1.3)	18.2 (64.8)	17.9 (64.2)	0.7 (2.3)	10.4	10.8	0.2	0.2	
May-05	Open Water	3.5 (11.5)	17.9 (64.2)	17.8 (64.0)	0.5 (1.6)	7.6	7.2	1.2	1.2	275
	SWOA	1.4 (4.6)	18.1 (64.6)	18.1 (64.6)	0.3 (1.0)	5.4	5.7	1.7	1.7	
	Marsh Plain	0.4 (1.3)	18.6 (65.5)	18.4 (65.1)	0.3 (1.0)	8.5	8.4	0.5	0.5	
Jun-05	Open Water	4.5 (14.8)	22.9 (73.2)	22.2 (72.0)	0.3 (1.0)	6.6	7.0	1.2	1.4	57
	SWOA	1.0 (3.3)	20.7 (69.3)	20.8 (69.4)	0.3 (1.0)	5.4	5.3	3.8	3.8	
	Marsh Plain	0.4 (1.3)	22.8 (73.0)	22.7 (72.9)	0.3 (1.0)	6.5	6.9	1.7	1.7	
Jul-05	Open Water	4.1 (13.4)	24.2 (75.6)	23.6 (74.5)	0.5 (1.6)	6.2	5.4	6.3	7.2	13
	SWOA	0.8 (2.6)	23.1 (73.6)	23.2 (73.8)	0.6 (2.0)	5.9	5.1	9.5	9.5	
	Marsh Plain	0.6 (2.0)	24.0 (75.2)	23.9 (75.0)	0.5 (1.6)	6.2	5.9	6.5	7.1	

* Measured at USGS Napa River gaging station near Napa (#11458000).

3.3 State and Federally Listed Species

Reporting requirements were established as part of the take permit for listed species (steelhead, delta smelt, and Sacramento splittail). Sacramento splittail were removed from the list of threatened species by the USFWS on 22 September 2003 (USFWS 2003) and are currently considered as a federal and state listed species of special concern. During the 2005 field effort, Sacramento splittail, longfin smelt, and chum salmon (each state-listed species of special concern) were captured. In 2005, steelhead was the only federally listed species captured.

Steelhead

Five steelhead were captured in 2005; the dates, locations, and environmental conditions were recorded at the time of capture are provided in Table 3-4. All steelhead were weighed, measured, photographed, and released unharmed. The National Marine Fisheries (NMFS), part of the National Oceanic and Atmospheric Administration (NOAA), and California Department of Fish and Game (CDFG) were notified.

Steelhead captured at Site 3-1, May 2005.

Table 3-4. Steelhead captured in the Napa River in 2005.

Date	Site	Gear	Habitat type	Fork length [mm (in)]	Environmental Conditions		
					Temperature [^{o}C (^{o}F)]	Salinity (ppt)	Dissolved oxygen (mg/l)
23 March	1A-6	Fyke net	Restored SWOA	140 (5.5)	12.0 (53.6)	0.3	7.8
5 May	2-2	Beach seine	Created marsh plain	175 (6.9)	21.1 (69.9)	0.2	10.4
18 May	3-1	Purse seine	Open water	266 (10.5)	16.4 (61.5)	0.1	8.4
19 May	1A-3	Beach seine	Created marsh plain	68 (2.7)	17.5 (63.5)	0.1	7.7
19 May	1B-2	Beach seine	Created marsh plain	59 (2.3)	15.9 (60.6)	0.1	7.9

Chum salmon

In 2005, 31 juvenile chum salmon were captured in March, April, and May, primarily in the created marsh plain habitat (81 percent) and the restored SWOA (16 percent). One individual was captured in the open water habitat at the upstream-most site on the Napa River (Site 3-1). A few individuals were preserved to confirm the identification. Chum salmon had not previously been documented in the Napa River watershed before 2004 surveys conducted as part of the FMP. In 2004, Dr. Peter Moyle's laboratory at the University of California at Davis confirmed a sample individual to be a chum salmon. In 2005, juvenile chum salmon identification was confirmed by John Stadler of NMFS at the Washington State Habitat Branch and Chris Howard of Green Diamond Resource Company, both of whom have extensive experience distinguishing juvenile chum and Chinook salmon.

Sacramento splittail

During the 2005 field effort, 305 Sacramento splittail were captured (Table B-1). Splittail were caught in March, May, June, and July, and in all habitat types, including open water, marsh plain, and SWOA with the beach seine, fyke net, and otter trawl (Table 3-5; Figures A-11 through A-16).

Sacramento splittail were examined for their reproductive state at the time of capture. Of the 305 splittail captured in 2005, 8 adults showed no evidence of spawning (no eggs or milt were observed with pressure applied to the abdomen), 1 adult had spawning colors but no evidence of spawning, 1 adult male had evidence of spawning, and 295 were identified as juveniles. The mature male was observed in late March. Adult Sacramento splittail with no evidence of spawning were all observed in May. Juvenile Sacramento splittail were most abundant in June 2005. A total of 762 splittail were captured in the FMP field effort from 2001–2005. Adults were most abundant between February and April, and juveniles became more abundant between May and July (Figure 3-5).

Sacramento splittail captured at Site 1A-2, April 2005.

Sacramento splittail were most abundant in May and June in 2005 (Figure A-11), with the majority comprised of juveniles. The CPUE of splittail captured by each gear type varied with habitat type (Figures A-12 through A-15). In 2005, the CPUE of splittail captured by otter trawl was higher in the restored SWOA than in the main channel, and the beach seine had a higher CPUE in the created marsh plain terraces than in the restored SWOA in late May and June. In 2005, the fyke net had the highest CPUE (fish/minute) in early May, which was also substantially higher than previous years (Figure A-15). In 2005, the beach seine had the highest CPUE (fish/m^3) in June (Figure A-16). The most successful gear type for capturing splittail during the five years of monitoring was the beach seine (82 percent), followed by the otter trawl (9 percent), fyke net (8 percent), and purse seine (1 percent) (Figure A-17).

There appears to be a close association between juvenile splittail and shallow water habitat. Throughout the FMP, although juvenile splittail were observed in open water habitat, the majority (97 percent) were captured in shallow marsh plain or SWOA habitats. Adult splittail were most abundant in the deeper open water habitat (42 percent), although they were also observed in the shallow SWOA (30 percent) and marsh plain (26 percent) habitats.

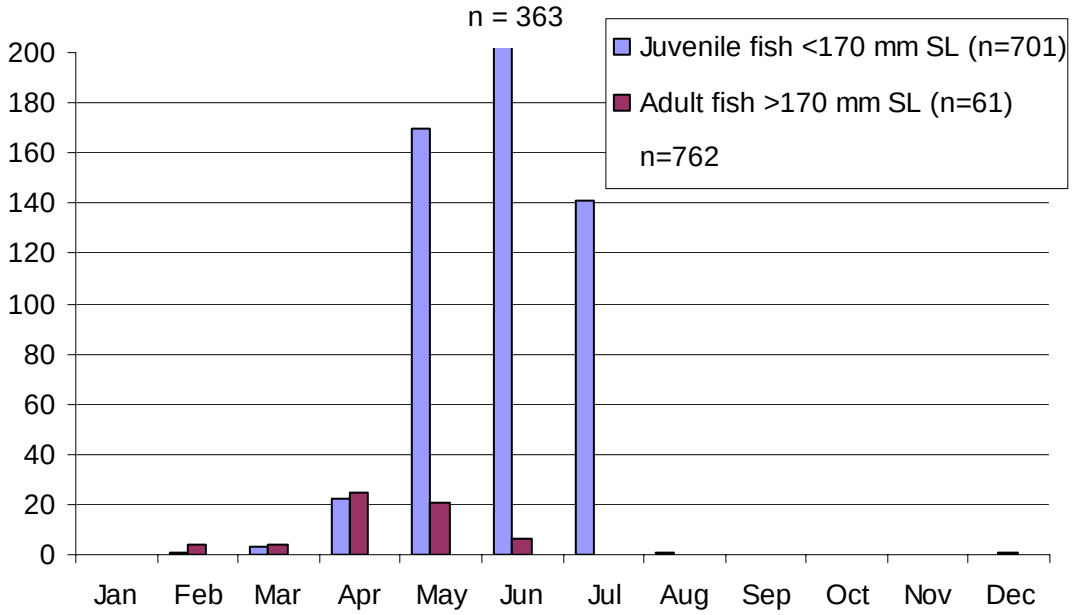


Figure 3-5. Juvenile and adult Sacramento splittail captured in the Napa River Project area in July 2001-July 2002, January 2003-July 2003, March 2004-July 2004, and March 2005-July 2005.

Table 3-5. Sacramento Splittail Captured in the Napa River Project area in 2005.

Gear type:	**Beach seine**				**Fyke net**			**Otter trawl**				**Purse seine**	**Total**
Habitat type:	**SWOA**	**Marsh plain**			**SWOA**			**SWOA**	**Main channel**			**Main channel**	
Site:	**1A-4**	**1A-3**	**2-2**	**1B-2**	**1A-6**	**1A-7**	**1A-10**	**1A-2**	**1B-1**	**2-1**	**1A-1**	**3-1**	
Sampling event													
Early March													0
Late March		1					1	1					3
April													0
Early May	22	5		6	3	23		1	1				61
Late May	9	43	2	20	2	8	2	1					87
June	25	39	19	44		1		1	1				130
July		17	7										23
Total Per Site	56	105	28	70	5	32	3	4	2	0	0	0	305

Analysis of length-frequency data (Daniels and Moyle 1983) indicate that age 1+ splittail range from 111.4–171.2 mm, age 2+ fish range from 171.2–215 mm, and age 3+ fish range from 215–250 mm. In 2004 and 2005, young-of-year (YOY) were most abundant, but older age classes were also represented (Figure 3-6).

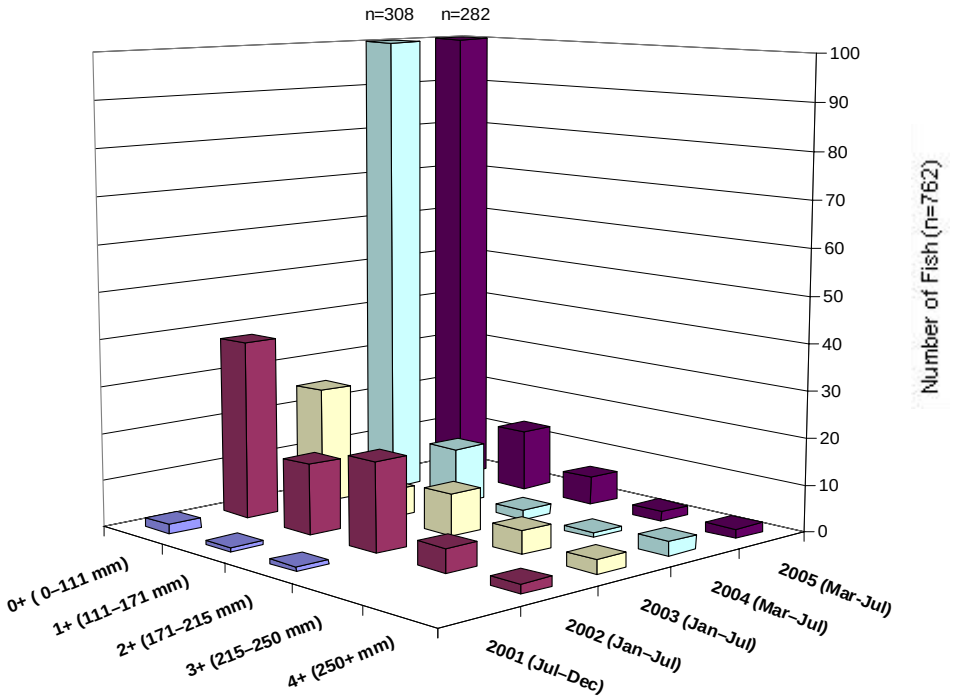


Figure 3-6. Age class and lengths of Sacramento splittail in the Napa River Project area in 2001–2005.

3.4 Vegetation Types

To increase bank stabilization along floodplain and marsh terraces, emergent vegetation was planted along the east side of the river, near Kennedy Park, New Tulocay Creek, and Soscol Avenue. The following species were to be planted: coyote brush, mule fat, mugwort, California wild rose, salmonberry, bulrush spp., common cattails, willow spp., Fremont cottonwood, box elder, Oregon ash, oak spp., and native perennial grasses (USACE 1999).

Non-native *Cotula coronopifolia* (brass buttons) inhabiting the SWOA, 2004.

Following the SWOA levee breach in June 2001, pasture vegetation began to rapidly convert to mud flats. In 2005, most of the SWOA was still in the early stages of transition from mud flats to estuarine aquatic vegetation. The substrate is currently mud with some vegetation, primarily consisting of previously established estuarine plants (such as tules, pickleweed, and algae). Photos taken at sampling sites in the SWOA reflect the rapid transformation from meadow to mudflats. This transition appears to be followed by a very gradual colonization by various aquatic and emergent estuarine plants, which in turn will provide habitat for various fish species and support aquatic food webs.

Plant species in the SWOA are typical of both salt and brackish marsh habitat (CH2MHill 2005). Brackish marsh vegetation occurs in the transitional zone between the tidally inundated mudflats and the adjacent grasslands that is inundated only during extreme high tides. Species identified included brass buttons, brass button thatch, spearscale, annual beard grass, alkalai heath, perennial ryegrass, curley dock, alkali weed, Mediterranean barley, bristly ox-tongue, pickleweed, saltgrass, fleshy jaumea, and gumweed. Additional species, identified on the eastern side of the SWOA along terraces on the edge of the Napa River included California bulrush, tule, and California aster.

Field observations estimated that tidal influence has been restored to approximately 351 acres, which includes 278 acres of mudflats, 28 acres of low marsh, and 45 acres of open water and tidal channels (CH2MHill 2005). This total amount is approximately 83–87 percent of the target acreage objective for restoration of tidal influence and marshland. Over time the extent of tidal inundation could become smaller and objectives may not be met without active management such as recontouring and vegetation manipulation (CH2MHill 2005). A more accurate investigation of the situation was recommended (CH2MHill 2005).

The brackish marsh acreage restoration target in the SWOA is 503 acres. Only 28 percent or 140 acres was mapped in 2004 (CH2MHill 2005). Brackish marsh species are expected to increase over time. However, conversion of other habitats such as open water, freshwater wetland, and

uplands will be required to meet the goal of 503 acres (CH2MHill 2005). Recontouring and vegetation manipulation may be required for this to happen (CH2MHill 2005).

Native *Scirpus californicus* (California tule) inhabiting the SWOA, 2004.

The 278 acres of tidal mudflats that were created exceeds the target for the entire Napa River Flood Protection Project. This habitat is likely to be temporary and is expected to convert to brackish marsh over the long term (CH2MHill 2005). Planting will be required to establish riparian forest, shaded river habitat, and oak woodland habitats (CH2MHill 2005).

The primary goals to restore tidal influences and tidal marshland are gradually being met. Although the extensive mudflat is currently lacking emergent brackish marsh vegetation over much of its area, it has become a highly productive environment based on a variety of micro- and macro- algae carried by tidal currents. This has provided a food base for many invertebrates, which in turn provide food for many mammal, bird, and fish species.

Restoration of vegetation in the SWOA, 2005.

Restoration of tidal inundation and creation of wetland and other habitat types are expected to take place over the long term, which was defined as 40 years in the Mitigation and Monitoring Plan (CH2MHill 2005).

4 Discussion of 2005 Results

4.1 Fish Abundance and Distribution

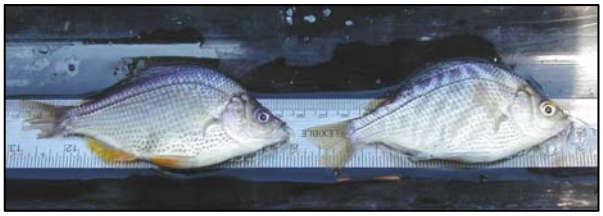
In this section, fish species abundance, composition, and proportion of native and non-native fish species and distribution are compared between open water habitat, created marsh plain habitat, and recently restored SWOA habitat. General comparisons are made between the 2005 survey and the 2001–2004 FMP surveys. In addition, the results of the 2005 field efforts are compared with 21 years of surveys from nearby Suisun Marsh and Bay, located approximately 20 km southeast of the Napa FMP study area, to better understand fish species relationships to environmental variables in the Napa River. Although close in proximity, Suisun Bay differs from the Napa River and estuary because it is primarily influenced by inflows from the Sacramento and San Joaquin rivers.

Relative abundance

The species composition in 2005 was similar to that found from 2001–2004, although the most abundant species varied annually. In 2005, inland silverside continued to be the most abundant species captured, followed by threadfin shad, striped bass, and Sacramento splittail. Inland silverside were also the most abundant species in 2004, however threadfin shad were most abundant in 2003 and Pacific herring were most abundant in 2002 (Table B-1). The species collected in the Napa River were also collected in nearby Suisun Marsh; however, the order of relative abundance differed, with striped bass, inland silverside, yellowfin goby, and threespine stickleback being the most abundant (Matern *et al.* 2002). A variety of factors in the Napa River such as environmental conditions, numbers of spawning adults, spawning success and other variables may favor one species over another and influence yearly and seasonal abundance.

Native and non-native fish

The proportion of native and non-native fish in the Napa River study area varied seasonally, annually, and by habitat type. Non-native fish dominated the catch between March and July 2005 in the open water, marsh plain, and SWOA habitat types, with native fish representing a larger percentage of the catch in May and June. Similarly, from 2001 to 2004, non-native fish dominated the catch except when juvenile Pacific herring were abundant in April 2002 and April 2003 (USACE 2003b and USACE 2004). During the 2001–2005 sampling period, non-native fish ranged from 13 to 98 percent of the catch per year. Non-native fish were the most abundant during summer and winter 2001. Non-native species represented 61 percent of the overall FMP catch from 2001–2005.



Tule perch captured at non-restored Site 2-1, November 2001.

To date, the FMP project has documented the presence of 37 species (20 native, 54 percent) in the study area, as compared to the 53 species (28 native, 52 percent) found in

Suisun Marsh by Matern *et al*. (2002). The percentage of native species found in the two studies is similar. The Napa River feeds into San Pablo Bay, which is part of the San Francisco Estuary and is considered one of the most disturbed aquatic ecosystems in North America (USFWS 1995).

Populations of native fish species that are only seasonally present in Suisun Marsh (e.g., longfin smelt and delta smelt) appear to be experiencing long-term declines (Matern *et al.* 2002, Bennett 2005). Populations of Sacramento splittail, a year-round resident, have decreased since 2001, although a general increase has been observed since 1994 (Stover *et al*. 2004). In addition, Sacramento sucker, another year-round resident, appears to have declined and then stabilized at lower numbers (Matern *et al.* 2002). Non-native species that tend to be found in Suisun Marsh year-round (e.g., striped bass, yellowfin goby, shimofuri goby, carp, white catfish, inland silverside) have exhibited no clear trends in long-term abundance (Matern *et al*. 2002). Due to the short-term duration of the FMP and associated Napa Project, no strong conclusions regarding long-term trends in abundance of fishes in the Napa River estuary can be made at this time.

Inland silverside

Inland silverside were the most abundant species captured in 2001 (88 percent), 2004 (81 percent), and 2005 (40 percent), and were abundant during all seasons. All life stages of inland silverside were observed throughout the FMP sampling area. Inland silversides are fractional spawners, most spawning and dying within first or second summer of life (Moyle 2002). Throughout the FMP, inland silversides were most abundant in the shallow water SWOA and marsh plain habitats (92 percent). Inland silverside was less abundant in deep open water habitat (8 percent). They were the second-most abundant species captured in Suisun Marsh beach seine surveys (Matern *et al*. 2002) and are considered to be the most abundant fish inhabiting shallow water in the San Francisco Estuary (Moyle 2002).

Threadfin shad

Threadfin shad was the second most abundant species in 2005 (16 percent) and in 2003 (53 percent). Adults, larger than 60 mm standard length at the end of the first year (Moyle 2002), were the most abundant life stage captured throughout the FMP, although all life stages were captured. The life span of threadfin shad is two years and average length at this age is 100 mm SL (Moyle 2002). The Napa River may provide optimal growth for threadfin shad, as during the spring and summer sampling months of the FMP, threadfin shad larger than 120 mm and up to 155 mm fork length were captured. Threadfin shad were most abundant in both the open water and marsh plain habitat in July 2005 when water temperatures were warm [22.4–22.9^{o}C (72.3–73.2^{o}F)]. The water temperatures in

Threadfin shad captured in the created habitat Site 1B-2, May 2005.

July are within the 22–24°C (71.6–75.2°F) range which provides optimal survival and growth for threadfin shad (Moyle 2002). Similar to 2003, threadfin shad were most abundant in the shallow marsh plain terraces, although also abundant in open water habitat in July [25.9–26.1°C (78.6–78.9°F)]. Throughout the FMP, threadfin shad were abundant in the marsh plain terraces and open water habitat in July when temperatures were warm, although less than 5 percent were observed in the restored SWOA.

Striped bass

Striped bass captured at Site 1A-2, 2005.

Striped bass (mostly juveniles) were the third most abundant species captured in 2005 (15 percent). They were most abundant in marsh plain sites sampled by the beach seine in June and open water sites sampled by otter trawl in July 2005. They were also the most abundant fish captured in open water sites in 2004 (24 percent), with the highest numbers captured in April and May. Similarly in 2003, 85 percent of the striped bass were captured in open water sites, although the highest numbers were captured in July. In Suisun Marsh, striped bass were most abundant in June (Matern *et al*. 2002) and the majority of the striped bass captured were juveniles (Stover *et al.* 2004). Although striped bass was the most abundant species captured in Suisun Marsh, the number of juvenile striped bass appears to be declining significantly over the long term (Matern *et al*. 2002). Striped bass may spawn in the Napa River, although spawning has not been documented. Their main spawning area is the nearby Sacramento River (Moyle 2002). Striped bass are known to rear in Suisun Bay (Stevens *et al*. 1985, as cited in Moyle 2002) and based on the FMP surveys, the capture of larval and juvenile striped bass suggests that spawning and rearing likely takes place in the Napa River.

Sacramento splittail

Sacramento splittail was the fourth most abundant species and the most abundant native species captured from March through July 2004 (11 percent) and 2005 (14 percent). Splittail was also one of the most abundant species captured in Suisun Marsh (Matern *et al*. 2002). In 2005, juvenile splittail were most abundant in May and June. The majority of splittail were juveniles captured on the created marsh plain terraces (65 percent) and the restored SWOA (31 percent). As in 2004, the high numbers of juveniles (n= 295) captured in 2005 suggest another strong year class. Because only 11 of the captured splittail were adults, it is likely that the splittail are spawning earlier in the year or further up in the watershed. The high numbers of juvenile Sacramento splittail captured indicate that they are using the marsh plain terraces for rearing, most likely to forage and escape from larger predators found in open water habitat.

The abundance of splittail varied annually between 2002 and 2005. Splittail were not commonly captured in 2002 and 2003. In 2002, 79 splittail were captured in the Project area compared to 48 captured in 2003, 326 in 2004, and 305 in 2005. Seasonal abundance of Sacramento splittail in both 2002 and 2003 increased beginning in April,

peaked in June, and then declined in July. In 2004, the greatest abundance of Sacramento splittail (comprised mostly of juveniles) occurred in July 2004. In 2005, juvenile splittail numbers began increasing in May and peaked in June. In contrast, in Suisun Marsh the numbers of splittail of all sizes captured remained consistent throughout the year (Matern *et al.* 2002).

Adult and juvenile splittail appear to use different habitat types. During the course of the FMP, adult splittail were typically captured in deep, open water, whereas juveniles were typically captured in the shallower SWOA and marsh plain habitats. Similarly, young-of-the-year splittail were caught in large numbers in shallow water habitats sampled by beach seines in Suisun Marsh from June to September (Matern *et al*. 2002).

Spawning of Sacramento splittail, which occurs primarily from March through May, is believed to be triggered by rising temperatures in the spring (Moyle 2002). Spawning habitat consists of slow-moving reaches in large rivers, flooded vegetation in tidal freshwater, and in estuarine marshes and sloughs (Moyle 2002). Shallow water habitats, such as inundated floodplains, provide important spawning, rearing, and foraging habitat for Sacramento splittail (Sommer *et al.* 1997 and. 2002). Splittail have been abundant in the Napa Marsh during wet years and rare or absent during low discharge years (Moyle *et al.* 2004).

All life stages of splittail have been captured within the study area. This study, along with the 2001 CDFG 20-mm tow-net surveys, successfully captured splittail of various size and age classes, including larvae, and age 0, 1+, 2+, and 3+ fish. Sexually mature adults (typically age 2+ and greater) were identified by their spawning coloration or the presence of milt and eggs. The presence of mature adults indicates that spawning is likely occurring in or near the project area.

Restored Site 2-2, 2005.

Pacific herring

Only 16 juvenile Pacific herring were captured in 2005 compared to 30 captured in 2004, and 648 in 2003. In 2002, juvenile Pacific herring was the most abundant species (n=3,338, 75 percent) captured. Pacific herring may be using the restored SWOA for rearing. Throughout the FMP the herring were most abundant in the restored SWOA habitat (95 percent) compared to the created marsh plain terraces and open water habitat. Lower numbers of juvenile herring in our surveys since 2002 may reflect lower adult spawner abundance, or reduced spawning success in the San Francisco Bay area during those years.

In San Francisco Bay, Pacific herring spawn adhesive eggs on seagrasses and other substrates along the shoreline in intertidal and shallow subtidal areas primarily from the Richmond-San Rafael Bridge in the north to Candlestick Point in the south (Watters *et al.* 2001). Based on the size of Pacific herring captured between 2002 and 2005, the age was estimated to be two to three months (Johnson Wang, USBR, pers. comm., 2005). Pacific herring are transported by tides into the upper estuary of San Francisco Bay, which includes the Napa River and Suisun Marsh to be used as extended nursery areas (Johnson Wang, USBR, pers. comm., 2005).

Pacific herring captured at Site 1B-1, July 2003.

Similar to the high capture rate of Pacific herring in 2002 and 2003 on the Napa River, the largest catch (since 1979) of Pacific herring was observed in Suisun Marsh in 2001 (n=56), 2002 (n=42), and 2003 (n=133) (pers. comm., 2005, Robert Schroeter, University of California at Davis and Stover *et al*. 2004). Prior to this recent abundance of Pacific herring, this species made up less than one percent of total catch in Suisun Marsh (Matern *et al.* 2002).

Longfin smelt

Larval longfin smelt show strong annual variation in the study area, with smelt not as abundant in 2005 compared to prior sampling years. Low numbers of larval longfin smelt were incidentally captured in the study area in 2002 (n=5, 1 percent of total larval catch), 2004 (n=20, 20 percent), and 2005 (n=5, <1 percent) and with higher numbers in 2003 (n=3,547, 88 percent) and 2001 (n=932, 55 percent) (USACE 2003b, USACE 2004). These larval longfin smelt were captured in both the restored SWOA (47 percent) and open water (54 percent) habitats. The majority (98 percent) of the longfin smelt captured in the FMP (2001–2005), were captured in March and April 2003. Longfin smelt was also the most abundant larval fish captured in CDFG's 20-mm tow-net trawls in open water habitat (over 30,000) in March, April, and May 2001 (USACE 2002). Larval longfin smelt were captured when water was the freshest (salinity ranging 0.4–5.6 ppt) in March–May 2001 and March–May 2003.

Longfin smelt, captured in the restored SWOA, December 2001

Based on the high abundance of larval longfin smelt, spawning is likely occurring in or near the study area. Longfin smelt concentrate in San Pablo Bay in April-June, and move upstream to spawn in fresh water (Moyle 2002). Spawning has been documented in the estuary below Medford Island in the San Joaquin River and in the nearby Sacramento River below Rio Vista (Moyle 2002). The decrease in the number of longfin smelt captured in 2004 and 2005 may be due to decreased abundance of spawning adults near the study area. The general trend of longfin smelt in Suisun Marsh appears to be decreasing (Stover *et al*. 2004).

4.1.1 State and federal listed species

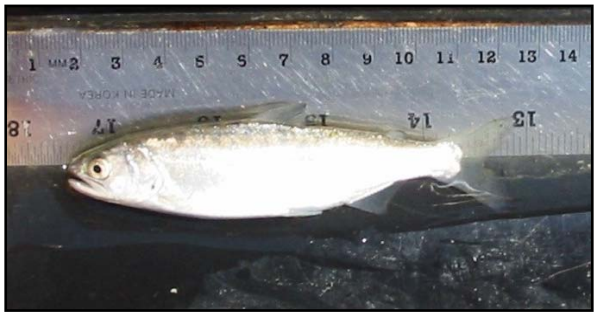
Sacramento splittail

Sacramento splittail was removed from federal listing in 2003, but remains a species of special concern in California. Recently, genetic differences were documented among splittail in the Napa, Petaluma, and Sacramento/San Joaquin River systems (Melinda Baerwald and Bernie May, UCD, pers. comm., 2004). Genetic differences between Sacramento splittail populations could have resulted from reproductive fidelity and basin-specific adaptation to environmental conditions. The Napa/Petaluma Sacramento splittail population is important because this unique population may contain adaptive alleles that allow this population to survive an environmental change, while another population (in a neighboring river) becomes extirpated (Melinda Baerwald and Bernie May, UCD, pers. comm., 2004). Based on splittail monitoring in the Suisun Marsh, catch increased from 1994–2001, and has declined since then (Stover *et al*. 2004).

The results of the FMP suggest strong year classes in 2004 and 2005. This may be due, in part, to the restoration and creation of shallow water habitat used by juveniles for rearing. The majority of Sacramento splittail captured throughout the FMP were captured in restored SWOA (25 percent) and created marsh plain (68 percent) habitats. The greatest abundances of Sacramento splittail captured in Suisun Marsh were also captured in shallow habitats (Stover *et al*. 2004). Continued monitoring would provide additional information on long-term splittail population trends in the Project area.

Chinook salmon

No Chinook salmon were captured in the Project area in 2005. In previous years, four Chinook salmon were captured; individuals were captured in April 2002 (clipped adipose fin), March 2003, May 2003, and March 2004. The adipose fin-clipped Chinook salmon may be from a hatchery release from the Sacramento/San Joaquin River system (Brown *et al.* 1996). The Mokelumne Hatchery releases 200,000–500,000 salmon fry with coded wire tags and adipose fin clips into the Shore Terminal, near Mare Island, between 15 April and 30 June (Bob Anderson, CDFG, pers. comm., 2005). The Feather River Hatchery releases 800,000 fall-run Chinook salmon, of which 10 percent are coded wire tagged, into San Pablo Bay (Anna Kastner, CDFG, pers. comm., 2005). The Nimbus Hatchery also releases fall-run Chinook salmon into San Pablo Bay (Brown 2003).



Chinook salmon captured at Site 1A-7, May 2003.

The Napa River is not included in the NOAA Fisheries ESU maps for ESA listed Chinook salmon in California (NOAA 2005). Chinook salmon ESUs in the region include Sacramento River Winter-Run, California Coast, and the Central Valley Spring, Fall and Late-fall runs. Further investigations, such as conducting spawning surveys on

the Napa River and genetic testing of juvenile fish collected in the Napa River would determine whether the juvenile Chinook salmon captured in the Napa River originate from any of these ESUs.

Delta smelt

Delta smelt, a state and federal listed species, dramatically declined in the early 1980s, although the exact cause of the decline is relatively unknown (Bennett 2005). Delta smelt spawn in fresh water, but prefer euryhaline habitats. Shortly before spawning, adult delta smelt disperse widely into river channels and tidally influenced backwater sloughs (Moyle 2002, Radtke 1966, Wang 1991). Spawning takes place in shallow, fresh, or slightly brackish water (Wang 1991), primarily in sloughs and along the shorelines of large rivers (Moyle 2002; USFWS 1995); however, spawning locations in the delta have not been identified and are inferred from larval catches (Bennett 2005). The spawning season varies from year to year and may occur from early winter (December) to mid-summer (July). Eggs are adhesive and demersal, and are usually attached to substrate (Moyle 2002; Wang 1991). In the main stem of the Napa River, the 2001 capture of larval delta smelt documented that spawning occurred in this area. Although rearing habitat requirements of delta smelt are unknown, one hypothesis is that shallow water areas with low salinity and dense patches of zooplankton in Suisun Bay constitute a vital nursery (Herbold *et.al.* 1992 and Moyle *et al.* 1992 as cited in Bennett 2005). After the June 2001 levee breach, the restored SWOA habitat would have provided similar low salinity and shallow water habitat for rearing larval delta smelt.

CDFG biologists captured thousands of delta smelt larvae during daytime 20-mm tow-net surveys in the main channel in 2001 (USACE 2002). Only one adult delta smelt was captured by fyke net in 2002 in the SWOA (1A-7), and none were captured in 2003, 2004, or 2005. Considering that thousands of larvae were captured in 2001, juveniles and/or adults were expected to be collected during the 2002–2005 sampling efforts. The capture of a single adult delta smelt may be due to several factors, including gear selectivity, movements of delta smelt, inter-annual variability in the habitat use throughout the Bay-Delta, habitat conditions, or low adult abundance. The mesh size used in these studies was not designed to capture larval delta smelt, although delta smelt were captured in otter trawls and beach seines with similar mesh sizes in Suisun Marsh (Matern *et al.* 2002). In addition, the daily or monthly sampling times may not have been conducive for sampling delta smelt. All sampling was conducted in daylight and at a similar phase of the tidal cycle, which may have decreased the opportunity to capture delta smelt. Alternatively, delta smelt may not have used these habitats between 2002 and 2005. To assess delta smelt abundance and distribution in the Project area, increased efforts to sample both larval and adult stages would be required. Conducting surveys at different times of the tidal cycle, at night, or use of different gear may be necessary to increase the probability of capturing delta smelt.

Steelhead

During fall through spring, winter-run steelhead generally enter spawning streams as sexually mature adults and spawn a few months later in late winter or spring (Roelofs 1985, Meehan and Bjornn 1991, Behnke 1992). In California, juvenile steelhead

typically rear in freshwater for one to two years before migrating downstream to the ocean as smolts from April through June, typically at a lengths ranging from 150 to 200 mm (Meehan and Bjornn 1991). Steelhead return to their natal streams and spawn in their fourth or fifth year of life (Shapovalov and Taft 1954, Behnke 1992). A small percentage of returning adults may stray to non-natal streams for spawning

The Napa River historically supported a run of 6,000–8,000 steelhead (USFWS 1968). The run had declined to an estimated 2,000 adults by the late 1960s (USFWS 1968, Anderson 1969). The current run of steelhead is estimated to be less than 200 adults (J. Emig and M. Rugg pers. comm., 2000 as cited in Stillwater Sciences and Dietrich 2002). Steelhead spawning has been observed in Dry Creek, a tributary of the Napa River near the Project area (J. Cook, tenant, pers. comm., 2003). Juvenile steelhead have been documented in 26 streams in the Napa River drainage (USACE and Stillwater Sciences 2005 unpublished data, NCRCD 2005, and Ecotrust Environmental and Friends of Napa River 2001 and 2002).

NMFS included the Napa River within its Central California Coast steelhead ESU (NOAA 2005). This ESU extends from the Russian River to Aptos Creek and includes tributaries to San Francisco and San Pablo Bay eastward to the Napa River, excluding the Sacramento and San Joaquin river basins (NOAA 2005).

Seven steelhead have been captured to date. In May 2002, one outmigrating steelhead smolt (208 mm FL) was captured, and in April 2004, a juvenile steelhead (90 mm FL) was captured; both were captured in open water habitat at the uppermost site near downtown Napa. In March and May 2005, three steelhead smolts (140–230 mm FL) were captured in created marsh plain habitat and at the uppermost open water habitat site in downtown Napa. On 19 May 2005, two 0+ (59 and 68 mm FL) steelhead were captured in created marsh plain sites. By the time of capture, flows had increased from 129 cfs on 17 May to 540 cfs on 18 May, and to 1,737 cfs on 19 May. The two 0+ steelhead may have been displaced from rearing habitats further upstream on the Napa River or from tributaries to the Napa River.

Low steelhead capture rates may be due to gear inefficiency but more likely, low capture rates reflect low steelhead abundance in the Project area. A limiting factor analysis for the Napa River Basin (Stillwater Sciences and Dietrich 2002) indicated that habitat loss caused by channel incision primarily explains why current conditions are unfavorable for steelhead spawning. Under current conditions, fine sediment intrusion into spawning gravels is reducing permeability and likely decreases survival of steelhead eggs and alevins. Other factors that likely adversely affect steelhead survival in the Napa River basin include migration barriers such as dams, road crossings, and other blockages, warm summer temperatures, and lack of habitat-forming large woody debris. It is hypothesized that surface water diversions and ground water extraction are reducing pool volumes and creating intermittent stream conditions that trap juveniles in isolated pools and dewater riffles that limit macroinvertebrate production and food for rearing juveniles (Stillwater Sciences and Dietrich 2002). Also, the potential for estuary rearing may have been seriously reduced due to diking and dredging.

Chum salmon

Chum salmon are a state listed species of special concern (CDFG 1995). Spawning occurs in either intertidal areas or within 200 km (125 mi) of the ocean (Moyle 2002). Due to the low abundance of chum salmon captured in the delta system, information on habitat use in this system is scarce. In Alaska, juvenile chum salmon spend a short time in fresh water and spend a longer time time in estuaries before migrating to the ocean (Moyle 2002). Past observations suggest that chum salmon may have a greater tendency to stray than other salmonid species (Johnson *et al.* 1997a). To date, 39 juvenile late fall-run chum salmon were captured between March and April 2004 and March and May 2005. It is not known whether these fish are progeny of fish that spawned naturally in the Napa River, the Sacramento/San Joaquin Rivers, or in other watersheds in San Francisco or San Pablo bays.

Recent sightings of chum salmon have been documented in central California. Mokelumne River Hatchery biologists documented chum salmon in 2001 but no additional fish have been observed since (Bob Anderson, CDFG, pers. comm. 2005). At the Noyo Coho Salmon Station in Fort Bragg, a female chum was captured in December 2001 and a male was captured in December 2003 (Alan Grass, CDFG, pers. comm., 2005). Chum salmon have also recently been observed on Lagunitas Creek (Alan Grass, CDFG, pers. comm., 2005). Although chum salmon are occasionally observed in hatcheries, chum salmon have not been observed spawning during stream surveys in the northern San Joaquin or Sacramento River drainage (Moyle 2002).

Chum salmon, April 2004.

In California, chum salmon are included in the Pacific Coast ESU (Johnson *et al.* 1997b). Under the federal ESA, NMFS determined that chum salmon were not warranted for listing in the Pacific Coast ESU (NMFS 1998). This ESU includes all naturally spawned populations of chum salmon from the Pacific coasts of California, Oregon, and Washington, west of the Elwha River on the Strait of Juan de Fuca. Current maps for the Pacific Coast chum salmon ESU extend to slightly south of Crescent City, CA (NOAA 2005). The southern boundary of this ESU is uncertain. The capture of 39 juvenile chum salmon in FMP surveys in 2004 and 2005 may indicate that an extension of the southern boundary, to include the Napa River or the San Francisco/San Pablo Bay region, may be warranted.

4.2 Vegetation Types

At present, the substrate in the SWOA is mostly mud with some vegetation, including previously established estuarine plants (such as tules, pickleweed, and algae). Plant species in the SWOA are typical of both salt and brackish marsh habitat, and up to 17 species have been identified (CH2MHill 2005). The rapid transformation from meadow

to mud flats in the SWOA that occurred after levee breaching, appears to be followed by a very gradual colonization by various aquatic and emergent estuarine plants, which in turn will provide habitat for various fish species and prey organisms.

Vegetation that has been re-established in the Napa River Project area and the SWOA is also providing habitat for terrestrial species. The area is attracting large numbers and a wide variety of shorebirds, waterfowl, and their predators, including peregrine falcons. This diversity of bird species using the SWOA indicates that salt marsh restoration efforts are proceeding towards attaining their goals.

Brackish marsh species are expected to increase over time. However, conversion of other habitats such as open water, freshwater wetland, and uplands will be required to meet goals and active management may be required for this to happen (CH2MHill 2005). Restoration of tidal inundation and creation of wetland and other habitat types is expected to occur over the long term, which was defined as 40 years in the Mitigation and Monitoring Plan (MMP) (CH2MHill 2005).

As the vegetation communities continue to mature, habitat conditions are expected to change for fish. Continued monitoring would clarify the relationship between vegetation restoration and fish communities.

4.3 New Zealand Mudsnail

New Zealand mudsnails (NZMS) were collected in the SWOA mud flats with a beach seine in July 2004, and CDFG subsequently confirmed the species identification. The snails were found in filamentous algal mats. The NZMS is a non-native species that is spreading rapidly throughout the western United States. The snail consumes native algal food sources and utilizes space, leaving less space for native macroinvertebrates. As a result, fish populations in areas invaded by NZMS are expected to decline due to low food availability.

A specific survey for NZMS was not conducted in 2005, but their presence is assumed to continue. To prevent potential spread of NZMS, field personnel followed the protocol created by California Department of Fish and Game for sterilization of sampling gear, waders, and other equipment used in the Project area.

4.4 Environmental Conditions and Habitat Use

4.4.1 Environmental conditions

Environmental conditions in the Napa River varied by season, habitat type, and year. As in previous years, temperatures and salinities increased from spring to summer as dissolved oxygen and flow decreased.

In 2003 and 2005, salinity did not appear to increase as rapidly as in 2002 and 2004. This

may be associated with high and prolonged discharges from the Napa River in 2003 and 2005, which began during winter and persisted at high levels until May and June before declining. In 2001, 2002, and 2004, flows declined sharply by May. For March–June periods, the daily average discharges were 77 cfs in 2002, 204 cfs in 2003, 98 cfs in 2004, and 268 cfs in 2005. The highest daily discharge to date for the FMP (8,016 cfs) was observed in February 2004, which represents a two-year flood event on the Napa River.

Similar to previous years, as flow decreased, water temperatures increased from March to July 2005. In 2005, average temperatures were similar in the open water, marsh plain, and SWOA habitats, ranging from 14.3 to 23.7°C (57.7 to 74.7°F) depending on the month. Temperature did not appear to correspond to any particular habitat types or to discharge from the Napa River.

Water clarity in each of the three habitat types increased from March to July 2005. The non-restored open water habitat had higher water clarity during the sampling period. Water clarity in the restored SWOA habitat and created marsh plain habitat was relatively lower than the open water habitat. This may be due to tidal cycle inundation and dewatering of the shallow mud substrate. Water clarity in all three habitat types was highest in April 2005. Water clarity and discharge from the Napa River were not correlated (R^2=0.02).

Similar to previous years, dissolved oxygen decreased between March and July 2005. In 2005, the average dissolved oxygen recorded in the open water (7.8 mg/l) and marsh plain (7.3 mg/l) habitats were similar and slightly higher than the shallow SWOA (6.5 mg/l). The lower dissolved oxygen in the SWOA may be a result of the increased turbidity.

In Suisun Bay, environmental variables such as temperature, salinity, and freshwater flow were correlated with catch, but Matern *et al.* (2002) did not believe that correlation implied cause. In general, they noted that fish species' response to environmental variables appeared weak and hypothesized that younger life stages were affected by environmental variables more than juvenile or adult life stages. The relationship between species relative abundance and environmental variables for the Napa FMP is evaluated further in Section 5.

Starry flounder captured in non-restored Site 1A-1, September 2001.

Relative abundance of native and non-native fish species may shift on the basis of environmental conditions such as water temperature and salinity. Non-native fishes can tolerate warmer water temperatures better than native species (Moyle 2002).

4.4.2 Habitat use

Restored Habitat

Restored and created habitats consist of marsh plain sites along the main channel of the Napa River, and all sites located in the SWOA, which are separated but linked to the Napa River main channel by approximately 0.8 km (0.5 mi) of an oxbow channel. In the Sacramento-San Joaquin Bay Delta, intertidal areas appear to favor native fishes, compared to deeper subtidal areas, where non-native fishes are abundant (Brown 2003, Simenstad *et al.* 2000). In 2005, the shallow restored intertidal areas of the Napa River Project area provided habitat for both non-native inland silverside, striped bass, and threadfin shad, and native Sacramento splittail and tule perch.

SWOA habitats were used seasonally by native Pacific herring and Sacramento splittail, with larval Pacific herring using the SWOA in March and April, and juvenile splittail using the SWOA in May and June. Although juvenile splittail were captured in the SWOA, most juvenile splittail utilized shallow marsh plain habitats, possibly due to the easy access from the main Napa River channel.

Restored SWOA Site 1A-6, April 2005.

Adult Sacramento splittail were not captured in high numbers during the FMP, but of those captured, two mature adults captured in 2005 were observed in the SWOA, and two spawning adults captured in 2004 were observed in the open water habitat. Temperatures in the SWOA appear to be favorable during the spawning season; however, continually inundated vegetation is required as fertilized eggs must be submerged until they hatch (Moyle 2002). The majority of the SWOA does not provide consistently submerged vegetation, with exposure of vegetation occurring daily at low tides. The shallow water habitat in the SWOA mainly provides foraging and rearing habitat for juvenile splittail.

Adult and juvenile splittail were more abundant in marsh plain habitat than in SWOA or open water habitats, even though splittail were the most abundant species captured in the SWOA in May 2005. The marsh plain habitat type is typified by shallow water depth, along with temperatures and salinities similar to those measured in open water habitats, which is expected because marsh plains are adjacent to open water habitats and are tidally inundated. Although spawning adults and juveniles were captured in marsh plain areas throughout the FMP, the majority of fish caught were juveniles. Juvenile splittail may be using these marsh plain terraces to forage and to escape from predators in the open water habitats.

In the early stages of restoration, the SWOA appears to be utilized by non-native species. Inland silverside utilized the SWOA during all seasons. In 2001, 2002, 2003, and 2004, recently restored wetlands were initially dominated by inland silverside, similar to the

pattern found during other evaluations of restoration projects in the Sacramento-San Joaquin Delta (Lindberg and Marzuola 1993, and England *et al.* 1990 as cited in Brown 2003). In 2005, inland silverside continued to dominate the catch in early spring until Sacramento splittail became more abundant and dominated the catch in May, threadfin shad and splittail in June, and striped bass in July.

During the FMP, the most abundant non-native species captured in the restored SWOA and created marsh plain were inland silverside and threadfin shad. Juvenile threadfin shad were primarily utilizing the restored marsh plain, whereas juvenile and adult life stages of inland silverside were utilizing the restored marsh plain as well as the SWOA.

Non-restored Habitat

In the Project area, historic land management has channelized and eliminated shallow water habitats. Sampled non-restored areas consisted of all sites located in deep, open water in the main channel. No shallow water habitats were sampled, because the majority of the non-restored Project area is deeper water habitat. Throughout the FMP, the average water salinity was typically higher in the deep, non-restored sites than in the SWOA or the restored marsh plain. In the deeper non-restored habitat, the salinity at the bottom of the water column was typically higher than at the surface. In 2005, the deeper non-restored areas appeared to be providing habitat primarily for non-native threadfin shad, striped bass, and inland silverside.

Open water habitat was dominated by juveniles of non-native species, particularly threadfin shad and striped bass. These species were mostly captured in June and July, as temperature and salinity began to increase as freshwater discharge decreased. The majority of threadfin shad and striped bass were found in open water habitats (47 percent); however, they were also captured in the shallow marsh plain (45 percent) and SWOA (8 percent) habitat.

In 2005 in the non-restored habitat, the abundances of non-native species were much greater than the abundances of native species. The two most abundant native species in the non-restored habitat in 2005 were tule perch and Pacific herring. Tule perch were captured primarily in July, although they were captured in the created and restored habitats in May and June. Although Pacific herring were captured in open water habitats in July, they were not observed in either created or restored habitats in 2005.

Non-restored Site 3-1, January 2003.

5 Analysis of the FMP-to-date

5.1 Methods

Relationships between fish abundance and environmental variables were analyzed, using basic multivariate linear modeling techniques as specified in the "Final Work Plan and QA/QC Plan for Implementation for the Year 2002 Napa River Fisheries Monitoring Program" (USACE 2001a). Data from 2002–2005 for Sacramento splittail, Pacific herring, inland silverside, and striped bass were used. Sacramento splittail was chosen as a cumulative analysis species because it was a federally listed species when this project was initiated, even though it was removed from federal listing in 2003. Pacific herring and inland silverside were selected because these two species dominated the overall catch. Striped bass was selected because it is an abundant species that may have impacts on native species. Delta smelt were omitted from the analysis because very few fish were captured (one fish during 2001–2005).

Some data were omitted from the multivariate linear modeling analysis due to either the seasonal timing or length of record. Data from 2001 were omitted because sampling was conducted during different seasons (July to December in 2001, versus January to July in 2002 and 2003, and March to July in 2004 and 2005). Data from Sites 2-2 and 1B-2 were also omitted, because these sites were established in 2002 and 2003, respectively, resulting in smaller data sets than those for the other sites.

All analyses were performed using the S-Plus 6 statistical package (Version 6.2.1, Insightful Corp., Seattle, WA, USA). For analysis purposes, habitats were classified into the following area types: open water (non-restored), SWOA (channel or restored floodplain), and marsh plain (created) (Table 5-1).

Table 5-1. Classification of area types for sites sampled (2002–2005) and used for the cumulative-program-to-date analysis, Napa River Fisheries Monitoring Program.

Site	Area Type Classification	Gear Type
1A-1	Open water	Otter trawl
1A-2	SWOA (channel)	Otter trawl
1A-3	Marsh plain (created)	Beach seine
1A-4	SWOA (restored floodplain)	Beach seine
1A-6	SWOA (restored floodplain)	Fyke net
1A-7	SWOA (restored floodplain)	Fyke net
1A-8*	SWOA (restored floodplain)	Fyke net
1A-9*	SWOA (restored floodplain)	Purse seine
1A-10	SWOA (restored floodplain)	Fyke net
1B-1	Open water	Otter trawl
2-1	Open water	Otter trawl
3-1	Open water	Purse seine

*Sampled in 2002 only.

The main purpose of this multivariate linear modeling analysis was to identify possible relationships between catch-per-unit-effort (CPUE, the response variable), and explanatory environmental parameters. Potential explanatory parameters were assigned into one of two groups, categorical or numerical variables, and included: a) categorical variables: gear type, year, season, and habitat area type; and b) numerical variables: turbidity, salinity, and temperature.

For salinity and temperature, the average of surface and bottom measurements was used in the analysis. Averages were used because the sampling methods could not distinguish if analysis species were associated with either the bottom or the surface. For the created marsh plain and SWOA habitats, the bottom and surface measurements were similar, but in deep open water habitats, surface and bottom measurement differences were greater (Table 3-3).

Many measurable quantities were not included. Water depth and tidal variables were not included because gear types were not deployed over the full range of depths, tidal stages, and tidal cycles. Napa River discharge was not included, due to the difficulty in separating its effect from those of other environmental variables. Dissolved oxygen was not included in the analysis since concentrations are related to temperature.

Catch-per-unit-effort, a measure of species abundance, was calculated as: $CPUE_i = C_i/E_i$, where C_i is the total catch and E_i is the total expended capture effort for a single given location and set of environmental parameters i. Site-specific capture effort was uniquely characterized for each gear type as:

Carp captured in the restored SWOA, 2001.

$$E(F)_{ij} = m_{ij}$$

for fyke (F) net sampling, where m_{ij} is the number of minutes that the fyke net was fished during sampling event j for a given set of environmental parameters i (beginning with slack tide);

$$E(O)_{ij} = \frac{r_{ij}}{c} \cdot 2.5 \cdot 1$$

for otter (O) trawl sampling, where r_{ij} is the total number of rotations recorded on a General Oceanics flow meter per trawl j, c is a constant representing the calibrated number of rotations per meter, and 2.5 m and 1 m are the trawl opening dimensions respectively;

$$E(B)_{ij} = s_{ij} \cdot w_{ij} \cdot d_{ij}$$

for beach (B) seining during set j, where s_{ij} is the visually estimated linear distance (in meters) from the physical start of the seining event to the bank, w_{ij} is the visually

estimated width (in meters) of the seining area, and d_{ij} is the visually estimated average water depth (in meters);

$$E(P)_{ij} = l_{ij} \cdot w_{ij} \cdot d_{ij}$$

for purse (*P*) seining during set *j*, where l_{ij} (in meters) and w_{ij} (in meters) are the visually estimated length and width of an approximately rectangular seining area, and d_{ij} (in meters) is the depth of the purse seine.

Total daily capture effort for a single location and set of environmental parameters was then calculated as:

$$E(gear)_i = \sum_{j=1}^{T} E(gear)_{ij} ,$$

where *gear* is gear type *B*, *F*, *O*, or *P*; *j* identifies the specific sampling event; and *T* is the total number of sampling events.

Water depth at the time of sampling was typically less than 1 m for habitat sampled by beach seine or fyke net, but water depth was greater than 1 m for habitat sampled by purse seine or otter trawl. Therefore, data from beach seine or fyke net sampling were considered to be representative of "shallow" water habitat, whereas data from purse seining or otter trawling were considered to be representative of "deep" water habitat.

Tule perch captured at Site 1B-1, July 2003

Separate linear model analyses were conducted for each gear type to examine the relationship between CPUE and the environmental variables among habitat area types (i.e., open water, marsh plain, and SWOA). Analyses were conducted separately for each gear type, because by necessity, effort was different for each gear type, and each method likely had a different capture efficiency. For Sacramento splittail and striped bass, only data from beach seine and otter trawl sampling were used. Pacific herring data were analyzed for all gear types, and inland silverside data were analyzed for all gear types except the otter trawl (Table 5-2). The objective of the analysis was to detect relationships between CPUE and environmental variables, and to determine if CPUE varied among habitat area types. Where possible, data were compared from non-restored and restored habitats sampled by the same gear type.

The variables temperature and salinity were clustered into one group, but season and turbidity were not grouped. Significant relationships of CPUE with either temperature or salinity were considered to be evidence of a relationship with both variables, since these variables are typically interrelated (R^2=0.42 for this study).

Sizes of Sacramento splittail and striped bass (fork length in mm) were compared in different habitat area types using a standard two-sample *t*-test. Sizes were only compared between different habitat areas sampled by the same gear type. The purpose of this comparison was to determine if these species' adult and juvenile life stages used habitat area types differently. Area types compared were shallow water habitats sampled by beach seine (SWOA floodplain and the created marsh plain on the main channel), and deeper water habitats sampled by otter trawl (open water and the SWOA channel).

5.2 Results and Discussion

5.2.1 Sacramento splittail

Juvenile Sacramento splittail were found to have greater abundance in created marsh plain habitat than in restored SWOA floodplain habitat. Beach seine CPUE was significantly higher within the created marsh plain habitat ($p = 0.0023$) (Table 5-2). Juveniles represented 94 percent of the Sacramento splittail catch by beach seine. Beach seine CPUE comparisons could not be evaluated between the created marsh plain or restored SWOA areas, and the non-restored open water habitat, because beach seines only sampled created and restored habitats that are shallow, and the otter trawl and purse seine sampled only deep, non-restored open water habitat.

Fyke net CPUE comparisons could not be evaluated between shallow water habitats, because fyke nets sampled only restored SWOA floodplain areas. However, within the restored SWOA floodplain, fyke nets captured only 61 Sacramento splittail in 2002–2005, of which 59 were juveniles. This observation of low Sacramento splittail captures is explained by either limited fish use of the sampled SWOA floodplain (which is supported by the beach seine data), and/or fyke nets were not an effective gear type for capturing Sacramento splittail. The majority of these fish were captured in 2005, possibly suggesting that the SWOA habitat is becoming more favorable for Sacramento splittail rearing over time, or that habitat conditions for spawning and early rearing supported increased production and/or survival of Sacramento splittail in the Napa River watershed.

Sacramento splittail abundance did not differ between habitat area types within deep water habitats (i.e., SWOA channel or open water), based on otter trawl data ($p = 0.9094$) (Table 5-2). The otter trawl catch primarily consisted of adults in 2002, 2003, and 2005 (64 percent), although in 2004, juveniles comprised the majority of the catch (77 percent) (Table 5-3).

Based on otter trawl data, more adult Sacramento splittail utilized deep water habitat in the Project area during 2002 than in any other year, since relative abundances of adult Sacramento splittail in 2003 and 2005 differed significantly from that in 2002 ($p = 0.0169$ and $p = 0.0096$, respectively) (Table 5-2). No statistical difference was detected between relative abundances in 2002 and 2004 ($p = 0.4631$), although the majority of the otter trawl catch was juveniles in 2004, in contrast to adults in 2002.

Juvenile Sacramento splittail numbers were similar in 2002 and 2003, with increased abundances in 2004 and 2005. No statistical difference in relative abundance was found between beach seine data of 2002 and 2003 (p=0.1602), although relative abundances in 2004 and 2005 were significantly greater than abundance in 2002 (p = 0.0025 and p = 0.0314, respectively). Based on the analysis of beach seine (p>0.8) and otter trawl (p>0.1) data, no seasonal difference in relative abundances of juvenile or adult Sacramento splittail were found.

Table 5-2. Values of coefficients and *p*-values for linear models fitted by gear type for Sacramento splittail, inland silverside, Pacific herring, and striped bass, Napa River Fisheries Monitoring Program, 2002–2005.[a,b,c] Bold type indicates statistical significance.

Gear	Coefficients	***p* values:**							
		Sacramento splittail		**Inland silverside**		**Pacific herring**		**Striped bass**	
		Value	***p***	**Value**	***p***	**Value**	***p***	**Value**	***p***
Beach seine	Intercept	0.0306	0.4301	0.0283	0.4888	0.0463	0.2289	-0.0129	0.2924
	Year (2003)	0.0211	0.1602	0.0102	0.5168	-0.0229	0.1232	-0.0024	0.6025
	Year (2004)	0.0457	**0.0025**	0.0389	**0.0134**	-0.0187	0.1969	0.0001	0.9854
	Year (2005)	0.0376	**0.0314**	0.0032	0.8611	-0.0283	0.0980	-0.0037	0.4960
	Season (summer)	0.0021	0.9134	-0.0023	0.9102	0.0085	0.6511	0.0248	**0.0001**
	Season (winter)	-0.0019	0.8827	-0.0180	0.1939	-0.0179	0.1685	0.0009	0.8306
	Area (SWOA)	-0.0322	**0.0023**	-0.0022	0.8395	0.0088	0.3793	-0.0019	0.5476
	Salinity	0.0047	**0.0440**	-0.0008	0.7344	-0.0018	0.4250	-0.0021	**0.0048**
	Temperature	-0.0009	0.6803	-0.0001	0.9527	-0.0010	0.6468	0.0016	**0.0229**
	Turbidity	-0.0007	**0.0360**	-0.0001	0.8861	0.0000	0.9929	-0.0002	0.0607
	Overall model		**0.0022**		0.3130		0.5135		**0.0017**
	R^2	0.3390		0.1546		0.1232		0.3469	
Fyke net	Intercept			0.0190	0.6767	2.1738	**0.0264**		
	Year (2003)			-0.0033	0.8758	-1.3054	**0.0043**		
	Year (2004)			0.0070	0.7506	-1.2602	**0.0080**		
	Year (2005)			-0.0205	0.4049	-1.5787	**0.0031**		
	Season (summer)			0.0287	0.2557	0.5098	0.3374		
	Season (winter)			-0.0107	0.5830	-0.2673	0.5154		
	Salinity			0.0027	0.3431	-0.0618	0.2950		
	Temperature			-0.0029	0.2132	-0.0380	0.4331		
	Turbidity			0.0012	**0.0278**	0.0037	0.7415		
	Overall model				**0.0036**		0.1035		
	R^2			0.2723		0.1683			

Table 5-2 (continued). Values of coefficients and *p*-values for linear models fitted by gear type for Sacramento splittail, inland silverside, Pacific herring, and striped bass, Napa River Fisheries Monitoring Program, 2002-2005.[a,b,c] Bold type indicates statistical significance.

Gear	Coefficients	***p* values:**							
		Sacramento splittail		**Inland silverside**		**Pacific herring**		**Striped bass**	
		Value	***p***	**Value**	***p***	**Value**	***p***	**Value**	***p***
Otter trawl	Intercept	0.0007	**0.0072**			-0.0006	0.8354	0.0000	0.9895
	Year (2003)	-0.0003	**0.0169**			0.0015	0.3136	0.0008	0.6808
	Year (2004)	-0.0001	0.4631			-0.0003	0.8426	-0.0007	0.7231
	Year (2005)	-0.0004	**0.0096**			-0.0001	0.9400	-0.0012	0.5839
	Season (summer)	0.0000	0.8239			-0.0010	0.5675	0.0058	**0.0110**
	Season (winter)	-0.0002	0.1818			-0.0022	0.1018	0.0005	0.7569
	Area (SWOA)	0.0000	0.9094			0.0003	0.8182	-0.0014	0.3895
	Salinity	0.0000	0.8076			0.0001	0.8286	-0.0001	0.6782
	Temperature	0.0000	0.7932			-0.0001	0.7146	0.0002	0.2340
	Turbidity	0.0000	0.1116			0.0001	**0.0441**	-0.0001	0.0937
	Overall model		**0.0207**				0.4182		**0.0313**
	R^2	0.1612				0.07931		0.1518	
Purse seine	Intercept			-0.0419	0.1911	-0.0060	0.6215		
	Year (2003)			-0.0022	0.8775	0.0006	0.9210		
	Year (2004)			0.0053	0.7218	-0.0008	0.8947		
	Year (2005)			-0.0008	0.9531	0.0058	0.2978		
	Season (summer)			0.0024	0.9003	0.0048	0.5235		
	Season (winter)			-0.0061	0.6261	0.0014	0.7777		
	Salinity			-0.0025	0.4464	0.0002	0.8421		
	Temperature			0.0029	0.1352	0.0003	0.6986		
	Turbidity			0.0000	0.6098	0.0000	0.9191		
	Overall model				0.6685		0.5980		
	R^2			0.2338		0.2557			

[a] *p*-values are based on t-tests for the coefficients and F-statistic computed for the overall model.

[b] Reference categories were: year (2002); season (spring); area (created marsh plain) for beach seine data, or area (open water) for otter trawl and purse seine data.

[c] R^2 = Proportion of the total variation of the CPUE explained by the fitted regression model.

Table 5-3. Numbers of adult and juvenile Sacramento splittail by gear type and year, Napa River Fisheries Monitoring Program, 2002–2005.

Gear Type	Year	Number of Adults			Number of Juveniles
		Spawning	Not Spawning	Total	
Beach seine	2002	2	6	8	40
	2003	2	10	12	23
	2004	0	0	0	160
	2005	0	6	6	253
	Total	4	25	29	472
Fyke net	2002	0	1	1	2
	2003	0	0	0	1
	2004	0	0	0	17
	2005	1	0	1	39
	Total	1	1	2	59
Otter trawl	2002	5	13	18	7
	2003	0	5	5	6
	2004	2	3	5	17
	2005	1	3	4	2
	Total	8	24	32	32
Purse seine	2002	1	2	3	0
	2003	0	0	0	1
	2004	0	0	0	0
	2005	0	0	0	0
	Total	1	2	3	1

In 2004 and 2005, juvenile Sacramento splittail abundance was high in shallow water habitat (98 percent of all juveniles captured were in shallow water habitat), which contrasts strongly with the relatively low abundance of adult Sacramento splittail during the same period. Only two of five adults captured in 2004, and two of 11 adults captured in 2005, showed evidence of spawning (i.e., spawning colors or milt/eggs); slightly more captured adults showed evidence of spawning in 2003 (two of 17 adults) and in 2002 (eight of 30 adults). The large numbers of juveniles captured in 2004 and 2005 could be accounted for by a number of factors, including successful spawning upstream or downstream of the Project area, saturation of carrying capacity at upstream rearing locations, greater juvenile survival from 2003 to 2004 than in previous years, and/or continually improving rearing conditions in the SWOA and the created marsh plain. The decline of Sacramento splittail documented in Suisun Marsh from 1979 to 1999 was not exhibited elsewhere in the San Francisco estuary; one hypothesis explaining these observations was that localized spawning occurred outside of the marsh in some years, with more widespread spawning in others (Matern *et al*. 2002). A more intensive sampling effort would be needed to evaluate the distribution of Sacramento splittail spawning in the Napa River.

The abundance of juvenile Sacramento splittail may be associated with salinity. Juvenile Sacramento splittail data exhibited a significant relationship ($p = 0.0134$) between

relative abundance and salinity within shallow water habitat (Table 5-2). The relationship may be specific to the Napa River estuary, however, the significance of the relationship could also be a statistical artifact, due to the short duration of this data set (4 years). Based on 21 years of sampling, no significant relationships were found between relative abundance of Sacramento splittail and any environmental variables in Suisun Marsh (Matern *et al*. 2002).

For Sacramento splittail, a significant relationship was exhibited between abundance and turbidity, which could be due to a number of factors, including increased capture efficiency (e.g., capture efficiency increased because turbidity decreased fish ability to see and avoid the sampling gear), a behavioral response (e.g., increased foraging under turbid conditions), or a simple statistical artifact. A change in the relationship between fish caught and effort complicates any kind of data interpretation between CPUE and environmental parameters, because the statistical model assumes that CPUE remains constant for a specific gear type.

5.2.2 Inland silverside

The data indicate that inland silverside did not use habitat area types differently. No statistical difference in relative abundance was detected between the SWOA floodplain and created marsh plain habitat, based on analysis of the beach seine data ($p = 0.8395$) (Table 5-2). Statistical analyses could not be conducted for habitat area type comparisons based on fyke net or purse seine data, because fyke nets only sampled SWOA floodplain habitat and purse seines only sampled open water habitat.

Fyke nets captured 366 inland silversides, the second highest total of any species captured by this gear type, from 2002 to 2005. Either the fyke net capture probability of inland silversides was much higher than that of the other species, and/or inland silverside were more abundant than the other species within the SWOA floodplain.

Seasonal differences in relative abundance of inland silversides were not detected. However, in Suisun Bay, inland silverside catches have been recorded as peaking in July, although no long-term pattern in relative abundance was observed (Matern *et al*. 2002).

There did appear to be differences in relative abundance of inland silversides in shallow water habitats between years. When comparing relative abundances between years 2002 and 2004, a statistically greater CPUE was found in 2004, based on beach seine data ($p = 0.0134$).

Inland silversides were found to be associated with turbidity but with no other environmental parameters. There was a significant positive relationship between fyke net CPUE and turbidity ($p = 0.0278$), potentially due to the same factors noted for juvenile Sacramento splittail.

Sampling restored SWOA Site 1A-7, 2001.

5.2.3 Pacific herring

Pacific herring were more abundant in 2002 compared with catches in 2003, 2004, or 2005. CPUE was significantly greater in 2002 than in any of the other years, based on the analysis of fyke net data ($p < 0.01$) (Table 5-2).

Pacific herring did not exhibit any clear relationships between abundance and environmental parameters. Based on analysis of data from otter trawl sampling, a significant relationship ($p = 0.0441$) was calculated between abundance and turbidity in deep open water habitat (Table 5-2); again, this relationship could be due to factors previously noted for Sacramento splittail and inland silverside (i.e., increased capture efficiency, foraging under more turbid conditions, or a statistical artifact).

5.2.4 Striped bass

Striped bass abundance did not appear to differ among years. There was no statistical difference in abundance when comparing relative abundance from 2003 to 2005 with 2002 for striped bass in any of the sampled habitats; this contrasts with the other non-native analysis species, inland silverside, which demonstrated a statistically significant increase in relative abundance from 2002 to 2004.

In shallow water habitats, more juvenile striped bass were captured during summer than in spring, as indicated by analysis of beach seine data ($p = 0.0110$). Most striped bass captured by beach seine (84 percent) were juveniles less than 80 mm FL. This observation is supported by data collected in Suisun Bay, in which the peak beach seine catch of juvenile striped bass was recorded in June (Matern *et al*. 2002).

Juvenile striped bass were associated with warmer temperatures. There was a significant relationship between beach seine CPUE and temperature within shallow water habitats for juvenile striped bass ($p = 0.0229$) (Table 5-2). In their 21-year study of Suisan Marsh, Matern *et al.* (2002) also found that juvenile striped bass exhibited a strong association with warmer temperatures.

Striped bass could prey upon other smaller fishes; being highly piscivorous, striped bass would likely count Sacramento splittail among their prey. Native Sacramento splittail have been historically found in great abundance, along with large striped bass populations (Moyle 2002). However in shallow water habitats, striped bass predation on juvenile Sacramento splittail appears unlikely in the Napa River. The majority (84 percent) of the striped bass captured in shallow water habitats were juveniles of similar size to juvenile Sacramento splittail. When tide elevation decreases and shallow water habitat becomes dewatered, fish "funnel" into the SWOA channel, where adult striped bass have been captured.

Based on otter trawl data, the relationship between striped bass relative abundance and turbidity approached statistical significance, ($p = 0.0937$). The relationship between

striped bass abundance and turbidity is likely affected by the same factors that potentially affect similar relationships for inland silverside and Pacific herring (i.e., increased catch per effort under more turbid conditions, possible behavioral responses, or a statistical artifact).

5.2.5 Size distribution of Sacramento splittail and striped bass

Striped bass were larger in SWOA habitats. In the SWOA channel, striped bass were larger than in open water, based on striped bass data from 2002–2005 using a standard two-sample *t*-test ($p<0.0001$) (Table 5-4). Striped bass were also larger within the SWOA floodplain than in the created marsh plain ($p=0.0002$).

Younger juvenile Sacramento splittail (< 1 year) tended to use shallow water habitat area types, such as the SWOA floodplain and created marsh plain; older juveniles (> 1 year) tended to use deeper water habitat area types, such as SWOA channel and open water. Sizes of Sacramento splittail did not differ between the shallow water habitats; the sizes of Sacramento splittail between the shallow restored SWOA floodplain and the created marsh plain were not significantly different ($p = 0.0944$). In deep water habitats, Sacramento splittail sizes from the SWOA channel and the open water were not significantly different ($p = 0.2007$) (Table 5-4).

Table 5-4. Mean fork length (mm) and *t*-test results for Sacramento splittail and striped bass, comparing the SWOA floodplain to created marsh plain habitat (based on beach seine data), and open water to SWOA channel (based on otter trawl data), 2002–2005.

Species	Gear Type*	SWOA			Created marsh plain			Open water			*t*-test results**
		n	Mean FL (mm)	SD	n	Mean FL (mm)	SD	n	Mean FL (mm)	SD	*p*
Sacramento splittail	Beach seine	108	66.5	52.17	296	75.0	42.12	-	-	-	0.0944
	Otter trawl	14	207.0	91.81	-	-	-	51	177.6	70.41	0.2007
Striped bass	Beach seine	13	112.2	110.75	62	52.2	22.99	-	-	-	**0.0002**
	Otter trawl	77	172.5	111.89	-	-	-	407	118.3	66.41	**<0.0001**

*Comparison for beach seine was based on SWOA floodplain versus created marsh plain; for otter trawl, based on SWOA channel versus open water.

**two-sided test for the equality of means; significance level of 0.05.

5.2.6 Use of created and restored areas

Based on 2002 to 2005 data, Sacramento splittail use the created marsh plain and restored SWOA areas. Sacramento splittail sizes indicate that the vast majority of Sacramento splittail captured in the restored SWOA areas were juveniles (Figure 5-2). Sacramento splittail may be using the restored areas for rearing. Moyle *et al*. (2004) suggested that both stream margin and brackish water habitats were important for juvenile rearing; these

types of habitat are represented in the created marsh plain and SWOA, respectively. However, based on beach seine data, Sacramento splittail commonly use the created marsh plain areas more than the restored SWOA floodplain areas. Sacramento splittail abundance as measured by CPUE was significantly higher in the created marsh plain than in the restored SWOA floodplain.

Inland silversides were abundant in newly created and restored areas, and their presence could be detrimental to native species because they are known to prey upon fish larvae, and may prey upon larval delta smelt (Moyle 2002). Indirect effects on growth and survival of other species are also possible, if these other species share the same prey base (Moyle 2002). In Suisun Bay, delta smelt and inland silverside were identified as co-occurring plankton-feeding fish (Matern *et al*. 2002).

Pacific herring are using the SWOA areas for rearing. The majority of herring (89 percent) were captured within the SWOA floodplain fyke net sites; the largest measured herring was 67 mm in fork length. No significant relationships were detected between CPUE and any of the environmental variables (Table 5-2). This suggests that the range of sampling seasons, salinity, turbidity, and temperature in the SWOA do not significantly affect use of the habitat by Pacific herring

Striped bass were found in created marsh plain and restored SWOA habitat. Striped bass captured in the SWOA habitat were typically larger than those captured elsewhere (Figure 5-1). Striped bass captured by otter trawl in the SWOA channel were significantly larger ($p < 0.0001$, mean length = 172.5 mm FL, n = 77) than in open water habitat (mean length = 118.3 mm FL, n = 407). Larger fish could be taking advantage of the increased feeding opportunities in the narrow SWOA channel, as prey move in and out of the floodplain as tides change. In 2004, a few larger striped bass individuals were also captured in created marsh plain areas, suggesting that predation on juvenile Sacramento splittail could be occurring in the created marsh plains. Larger striped bass were also found in open water habitats near created marsh plain terraces where the relative abundance of juvenile Sacramento splittail was highest. In the Sacramento-San Joaquin Delta, stomach contents of piscivorous fishes (largemouth bass, white catfish, and striped bass) included Sacramento splittail (Simenstad *et al*. 2000, as cited in Brown 2003).

Prior to 2005, smaller striped bass and Sacramento splittail used the main channel habitats (i.e., open water, created marsh plain) more than the shallow floodplain terrace or the deep channel in the SWOA, based on lengths of fish captured by otter trawl and beach seine (USACE 2005). However in 2005, smaller striped bass and Sacramento splittail (< 60 mm FL) were commonly captured in the restored SWOA areas, appearing to utilize these habitats nearly as frequently as the open water habitats (Figures 5-1 and 5-2). Based on otter trawl sampling, smaller striped bass utilize the deeper open water more frequently than the SWOA channel (Figure 5-1). Based on beach seine and otter trawl sampling, smaller Sacramento splittail utilize created marsh plain habitat more than deeper waters and shallow restored SWOA areas (Figure 5-2). The lower relative abundance of smaller fish in SWOA habitats suggests that the SWOA channel and

floodplain are not as suitable for rearing habitat by young Sacramento splittail and striped bass. In addition, strong currents, lack of vegetative cover, and the relatively narrow outlet of the SWOA channel, may leave any smaller striped bass and Sacramento splittail that do utilize this area especially susceptible to predation. Adult Sacramento splittail use all habitats that were sampled by beach seine and otter trawl (Figure 5-2), whereas adult striped bass use primarily SWOA habitats and the deeper open water habitat (Figure 5-1). Larger Sacramento splittail and striped bass may be using the SWOA areas for foraging during high tides. Larger Sacramento splittail utilize the created marsh plain, whereas larger striped bass do not appear to use this habitat to any great extent.

Otter trawl capture probabilities for larger fish are likely to be higher in the SWOA channel than in open water habitat. The SWOA channel (Site 1A-2) can be more thoroughly sampled than the open water habitat, because the otter trawl can sample a relatively high proportion of the volume in the confined SWOA channel, which is approximately 9 m (30 ft) wide, compared to that of the main channel which is approximately 30 m (98 ft). Capture probabilities for smaller fish may be similar between the SWOA channel and open water; by being weaker swimmers, they are less likely to avoid the otter trawl. However, fewer small fish were captured in the SWOA channel than in the open water, indicating that larger individuals are typically using the SWOA channel.

Although very few listed species (i.e., delta smelt, steelhead, and Chinook salmon) were captured, the majority of them were captured within the restored SWOA floodplain or the created marsh plain habitats. The listed species were captured in 8 of the 14 sites sampled from 2002 to 2005, including Sites: 1A-3 (created marsh plain), 1A-4 (restored SWOA floodplain), 1A-6 (restored SWOA floodplain), 1A-7 (restored SWOA floodplain), 1A-10 (restored SWOA floodplain), 1B-2 (created marsh plain), 2-2 (created marsh plain), and 3-1 (open water).

Currently, the created and restored areas do not appear to be benefiting native species more than non-native species. In the Sacramento-San Joaquin Bay Delta, most resident fishes utilizing freshwater tidal wetlands are non-native (Brown 2003). Non-native species (e.g., inland silverside), as well as native species, appear to be benefiting from the restored SWOA and created marsh plain habitats. The created marsh plain may have greater potential for native species such as Sacramento splittail, based on higher abundance and CPUE for this species in the marsh plain areas. Although the SWOA habitat was not as heavily used by Sacramento splittail as the marsh plain terraces, rearing of juvenile Sacramento splittail in the SWOA increased in 2005.

The restored habitats of the Napa River FMP project area are still in the early stages of regeneration and have not yet become fully restored marshland. At this time, for native species, drawing conclusions about the effectiveness of the habitat alterations is premature. To draw stronger conclusions about restoration effectiveness efforts over the long term, further monitoring may be necessary.

Figure 5-1. Size distribution for striped bass by habitat type and gear type, 2002-2005, Napa River FMP.

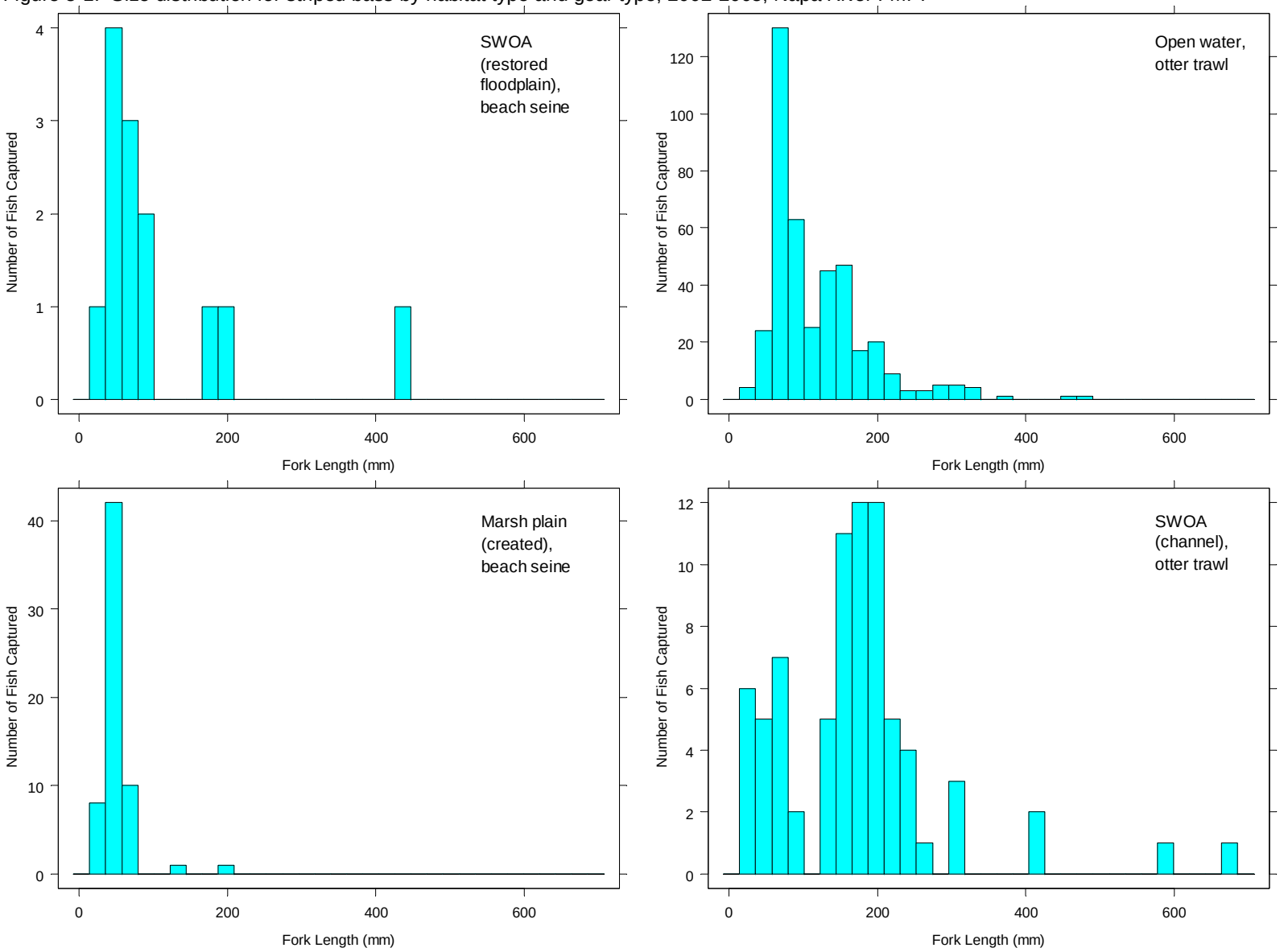
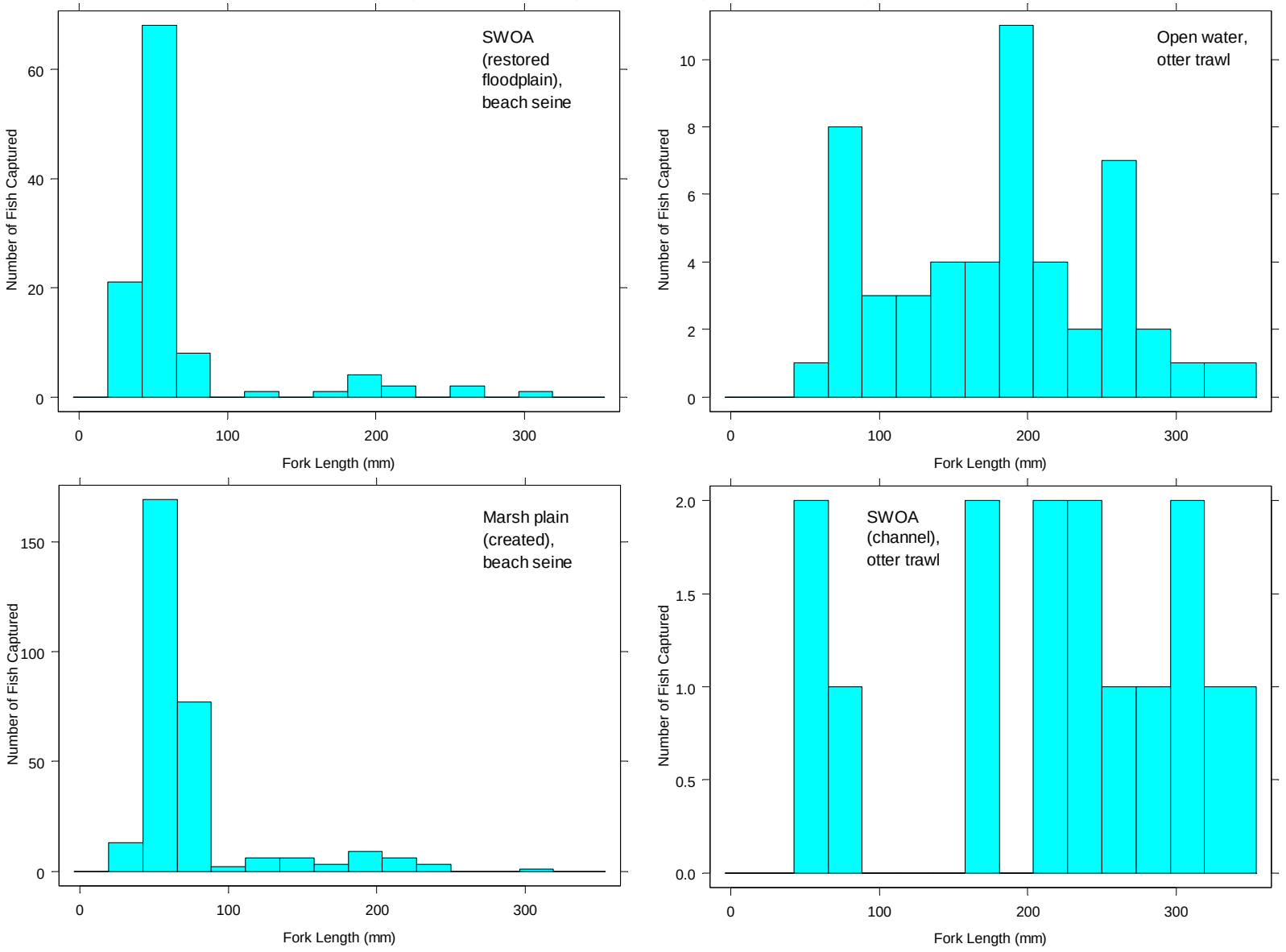


Figure 5-2. Size distribution for Sacramento splittail by habitat type and gear type, 2002-2005, Napa River FMP.



6 RECOMMENDATIONS

6.1 Monitoring Recommendations

Continued monitoring of fisheries and vegetation in the Project area is recommended. Surveys to date indicate that native and non-native fish species began to use the restored areas almost immediately following restoration of tidal inundation. Abundance of some native fish species, such as Sacramento splittail, has increased over the 5 year monitoring program, indicating that the Napa Project is having positive effects on fish numbers by either providing additional habitat for specific life stages or by potentially increasing production. However, several years of sampling were required to gather enough data to reveal initial trends. It is not possible to understand the full effects of the project on fish populations without continued monitoring, since restored habitat areas are still in a period of relatively rapid change, and fish populations lag in their response to these changes. Continued studies are recommended to determine the actual effects on fish populations following project completion.

In addition to the effects of the Napa Project, the ecosystem is not static. Non-native species are continually invading the San Francisco Bay ecosystem at a rate of 1 species every 14 weeks (CDFG 2001). The future effects of such introductions, as well as changes in environmental conditions, particularly associated with drought cycles, should be addressed by continuing certain aspects of the monitoring program.

Vegetation is very slowly returning to the restored SWOA. One of the recommendations from the CH2MHill vegetation surveys is that physical manipulation of some areas of the Napa Project may be required to enhance vegetation growth. Without additional vegetation monitoring, the status of vegetation will remain unknown. It will not be possible to determine when and where additional manipulation of habitat may be required for meeting stated goals without additional monitoring.

Monitoring efforts should be continued following completion of all flood control components on the Napa Project to determine if the Project goals are being met and to account for any lag time in effects. Monitoring should also continue until vegetation restoration and succession has proceeded further, and decisions regarding additional action towards attaining the goals and objectives can be made. At a minimum, a yearly sampling effort should be conducted to document species composition with changes in habitat as vegetation communities change. Photo points should be continued to document recovery of estuarine habitats. At a minimum, a reduced sampling effort, over the same time frame that this study occurred (potentially March, May, and June), should be conducted to continue to document habitat use by steelhead, Sacramento splittail, Chinook and chum salmon.

Year round future monitoring is recommended to continue to evaluate the sites and habitat sampled throughout the FMP field effort from 2001–2005. Data collected would improve the understanding of how fish use restored habitats during all seasons.

Although, if only limited funding was awarded, continued monitoring of all sites during March, April, and May is recommended.

Documenting the use of delta smelt in the project area is also of importance. The CDFG captured over 3,800 delta smelt larvae in 20-mm tow-net surveys in the Napa River/Project area in 2001 (USACE 2002). In contrast, only one adult delta smelt was captured by fyke net in the restored SWOA in 2002. Sampling of larval stages in restored and created habitats with larval light traps may help to identify early rearing areas, elucidate factors affecting survival of larval and juvenile fish in the project area, and help to understand the effects of environmental conditions/variables on their abundance and distribution; this type of approach is also suggested by Matern *et al.* (2002). Sampling between November and February with an otter trawl and purse seine may also increase catch of juvenile and adult delta smelt.

Sacramento splittail was removed from the federal listing in 2003, but because this species remains of special concern in California, continued monitoring is recommended. Clear genetic differences among splittail in the Napa, Petaluma, and Sacramento/San Joaquin River systems have been recently found (Melinda Baerwald and Bernie May, UCD, pers. comm., 2004). The Napa/Petaluma Sacramento splittail population is important because this unique population may contain different adaptive alleles of genes that could allow one population to survive an environmental change while another population (in a neighboring river) becomes extirpated (Melinda Baerwald and Bernie May, UCD, pers. comm., 2004). Continued monitoring of population abundance trends would be especially useful for the Napa/Petaluma population, given its smaller size and unique genetic makeup (Melinda Baerwald and Bernie May, UCD, pers. comm., 2004).

Few long-term monitoring efforts are being conducted in the lower Napa River and estuary at this time. Future pressures such as increased human population and water demands in the Napa River basin will require baseline and restoration success information to make future management decisions.

6.2 Restoration recommendations

The Napa Project presents a unique opportunity to learn about the effects of wetland and estuary restoration on fish and plant communities. The Napa Project can inform future estuarine and wetland restoration projects and improve designs and practices.

Sacramento sucker captured at restored Site 1A-3, May 2005.

Creating shallow water habitat, specifically marsh plain terraces, has provided additional flood relief and habitat for fish species. A strong association was found between the numbers of juvenile

Sacramento splittail and the created marsh plain terraces. These shallow water terraces may be providing both foraging opportunities and refuge habitat from larger predators found in the deep non-restored habitat.

To improve the restored SWOA, breaching additional levees between the Napa River and the SWOA is suggested. Breaching levees along the main river would provide better access for fish into the SWOA by allowing the fish to move directly from the Napa River to the SWOA, without having to go through the narrowly channeled Horseshoe Bend area where fish are likely to have an increased risk of predation by larger fish (i.e., striped bass). In addition, breaching additional levees near the SWOA is expected to provide better conditions for fish by increasing water circulation along the mud flats, increasing dissolved oxygen, and decreasing salinity.

Future habitat creation or restoration efforts should consider providing shallow water areas that remain inundated during low tide (stepped terraces). The created marsh plain terraces and restored SWOA completely dewater during low tide, requiring all fish to return to the deep non-restored open water habitat. Providing shallow habitat that remains inundated even during low tides may increase vegetation growth and create additional spawning habitat for native species (i.e., Sacramento splittail) and refuge for larval and juvenile life stages.

7 Program Team Members

The Napa River Fisheries Monitoring Program team members for 2005 are listed in Table 7-1.

Table 7-1. Napa River Fisheries Monitoring Program Team.

Name	Affiliation	Experience	Program Responsibility
Mike Dietl	Army Corps of Engineers	B.S. Fisheries Nine years experience in environmental management and fishery biology.	USACE Program Manager, Contracting Officer's Representative
Sharon Kramer	Stillwater Sciences	Ph.D. Marine Biology M.S. Zoology B.S. Aquatic Biology 29 years experience in marine, estuarine, and stream ecology in California and elsewhere.	Principal Investigator
Scott Wilcox	Stillwater Sciences	M.Ed. Natural Resources Management; B.S. Wildlife and Fisheries Biology. 26 years experience in fisheries and aquatic resource studies in California.	Project Manager
Steven Kramer	Stillwater Sciences	M.S. Natural Resources/Fisheries B.S. Fisheries Biology 29 years experience in marine, estuarine, and stream ecology.	Senior Fisheries Biologist
Lauren Dusek	Stillwater Sciences	B.S. Wildlife, Fish, and Conservation Biology. Five years of experience conducting fisheries studies in the Delta and tributary streams.	Deputy Project Manager and Field Leader
Peter Baker	Stillwater Sciences	Ph.D. Mathematics B.A. Mathematics 17 years of experience analyzing fisheries data.	Statistical Analysis
David Zajanc	Stillwater Sciences	B.S. Resource Management M.S. Fisheries Biology Seven years of statistical analysis experience.	Statistical Analysis
Donna Maniscalco	Jones and Stokes	B.S. Wildlife, Fish, and Conservation Biology Seven years conducting fisheries surveys of anadromous salmonids.	Field Biologist
Susan Davis	Jones and Stokes	M.A. English Literature B.A. English Literature Eight years of technical computer experience.	Web Developer
Michael McNabb	Jones and Stokes	B.S. Fisheries Three years of experience in programming and database development and 12 years experience in fisheries biology.	Fisheries Biologist/Programmer/ Database Developer
Johnson Wang	Consultant	Ph.D. Fisheries Over 30 years experience in larval fish studies.	Larval Fish Expert

8 Materials Purchase Report

No durable, capital expense items were purchased for the Napa River Fisheries Monitoring Program in 2005.

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Appendix A

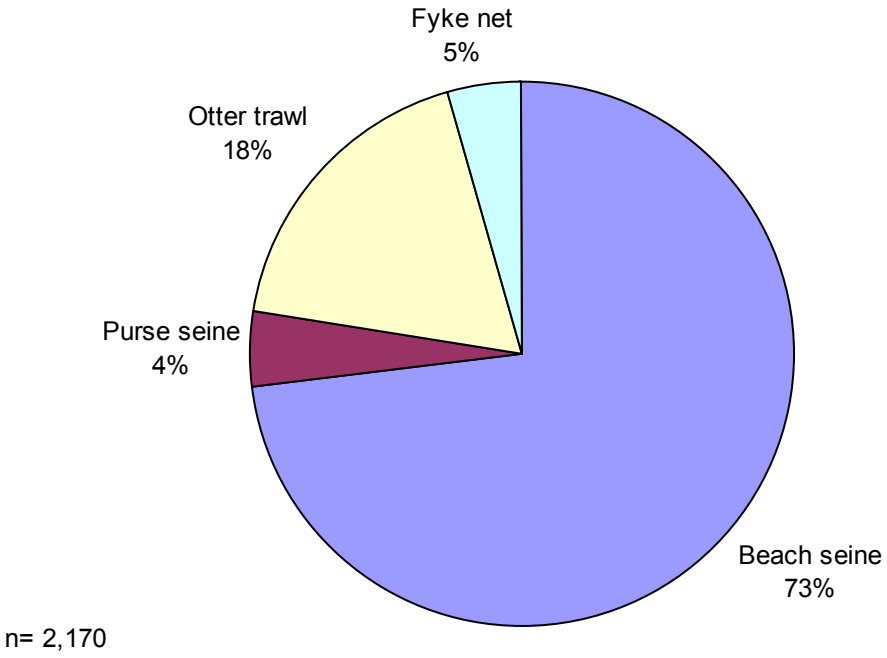


Figure A-1. Percent of juvenile and adult fish captured by gear type in the Napa River Project area in 2005.

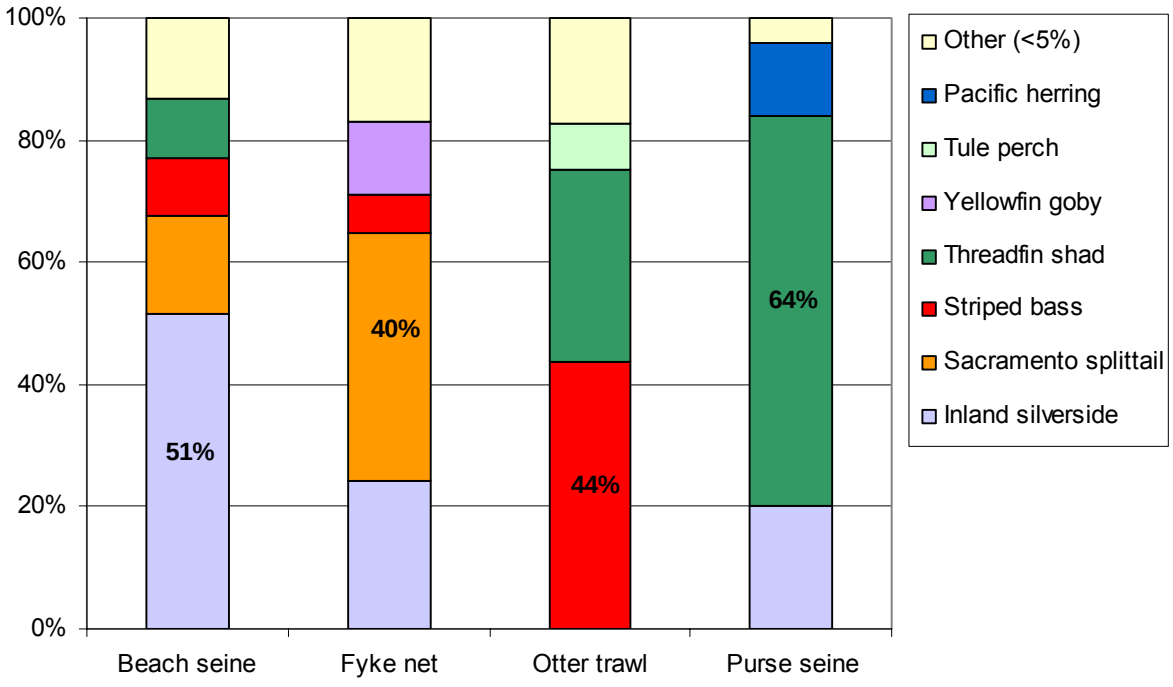


Figure A-2. Fish species composition by gear type in the Napa River Project area in 2005.

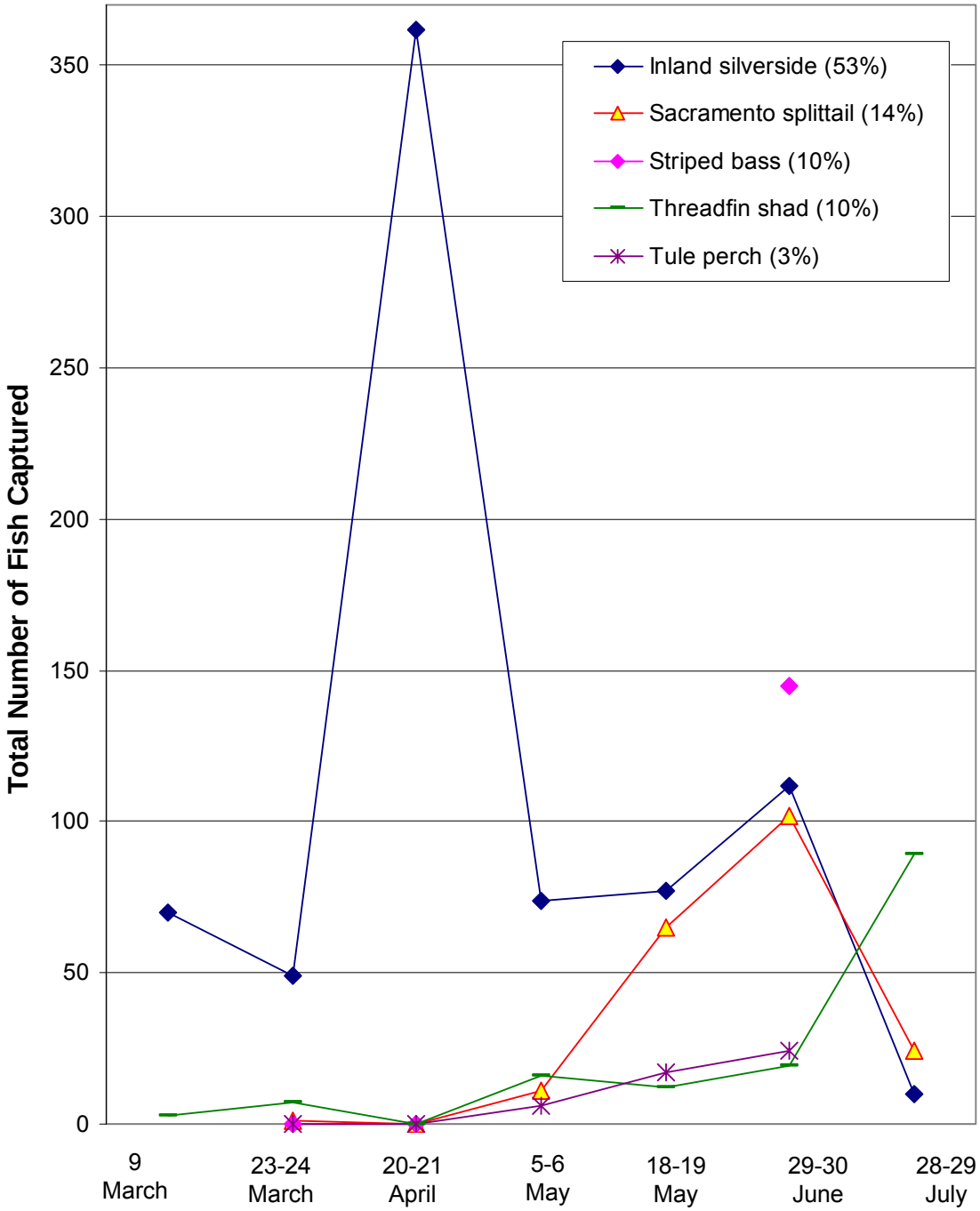


Figure A-3. Relative abundance of juvenile and adult fish species (>2% each of total catch) captured in the marsh plain terraces in 2005 in the Napa River Project area.

Fish species <2% each of catch (totaling 8% of total catch) include bluegill, carp, chum salmon, prickly sculpin, rainwater killifish, Sacramento sucker, shimofuri goby, staghorn sculpin, steelhead, yellowfin goby.

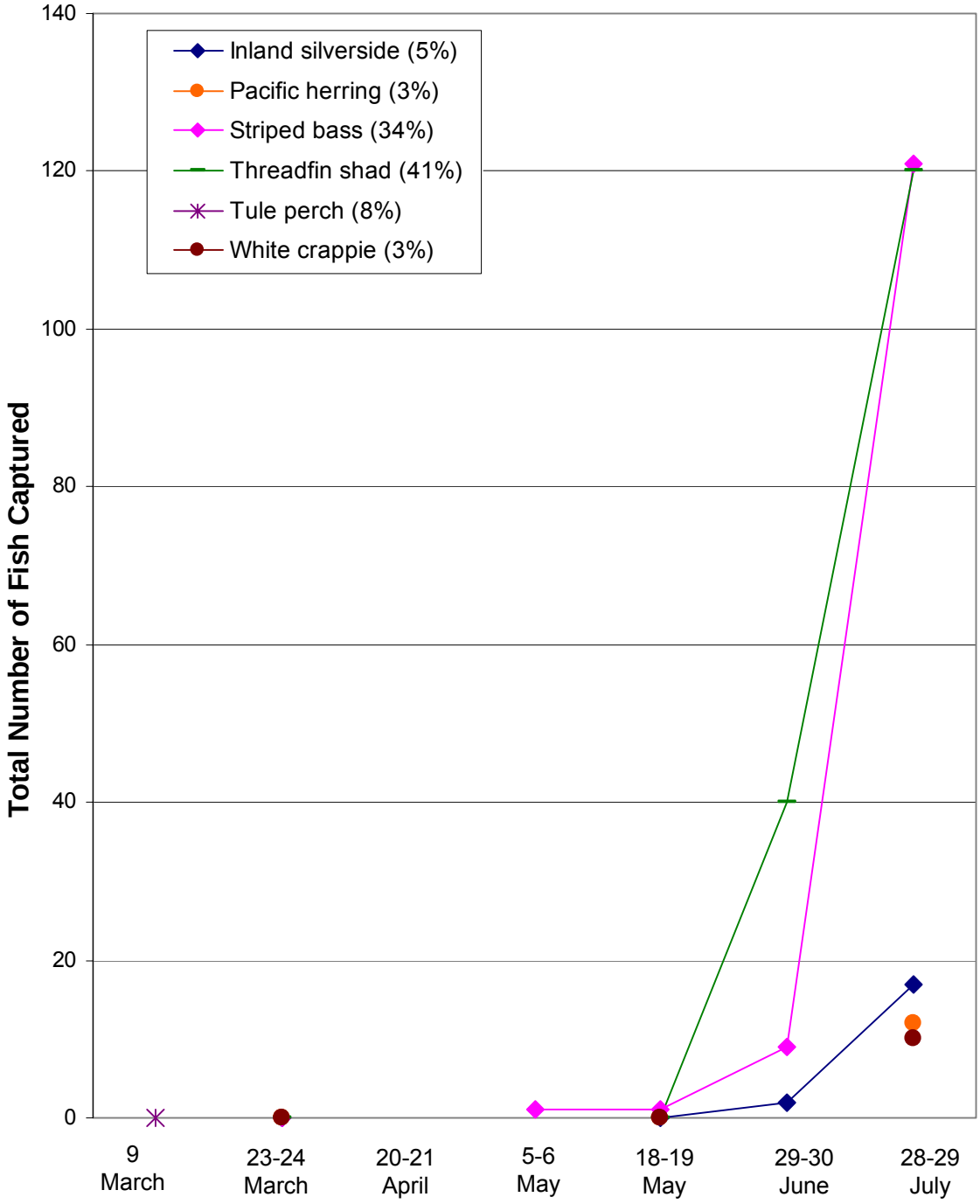


Figure A-4. Relative abundance of juvenile and adult fish species (>2% each of total catch) captured in the open water in 2005 in the Napa River Project area.

Fish species <2% each of catch (totaling 7% of total catch) include American shad, carp, chum salmon, prickly sculpin, Sacramento splittail, Sacramento sucker, shimofuri goby, staghorn sculpin, starry flounder, steelhead, yellowfin goby.

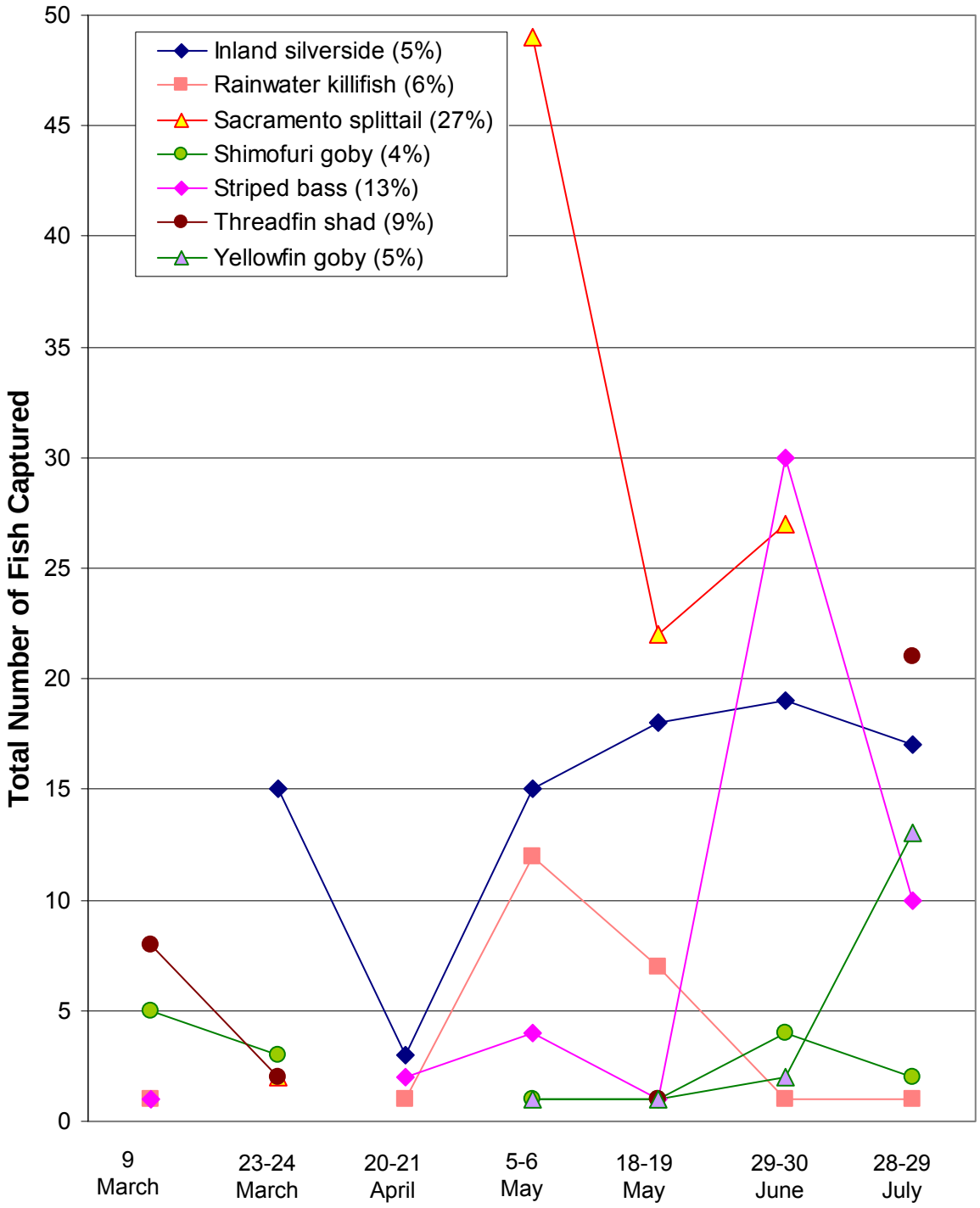


Figure A-5. Relative abundance of juvenile and adult fish species (>2% each of total catch) captured in the SWOA in 2005 in the Napa River Project area.

Fish species <2% each of catch (totaling 9% of total catch) include bluegill, chum salmon, long- jawed mudsucker, Pacific herring, prickly sculpin, steelhead, threespine stickleback, carp.

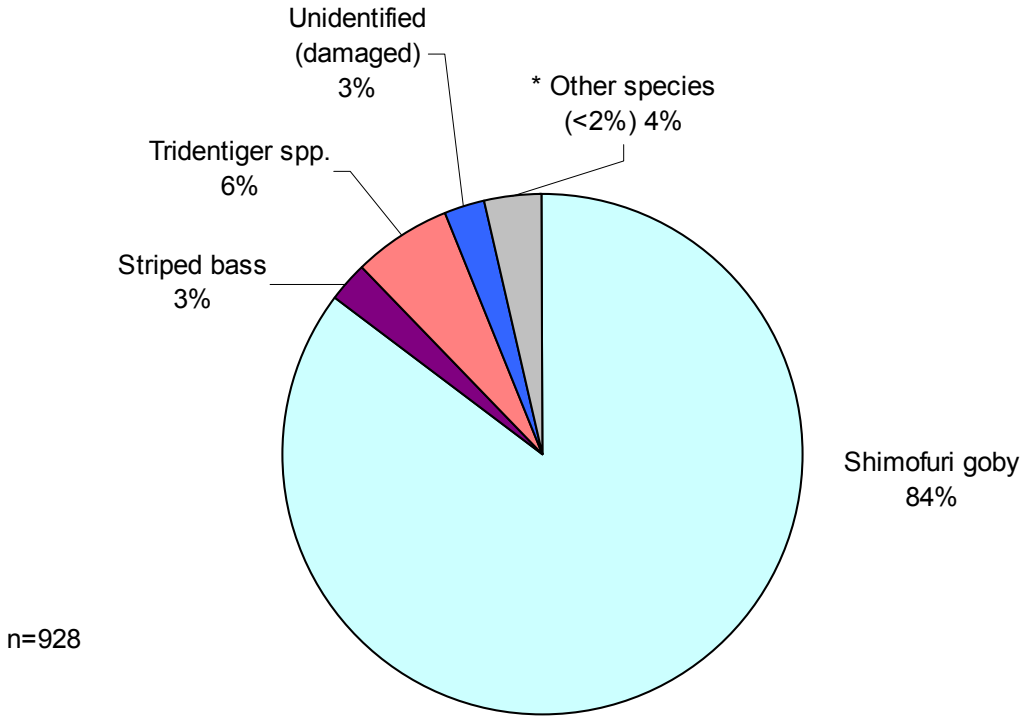


Figure A-6. Composition of larval fish by-catch in the Napa River Project area in 2005.
*Pacific herring (1.7%), threadfin shad (0.4%), yellowfin goby (0.8%), longfin smelt (0.6%).

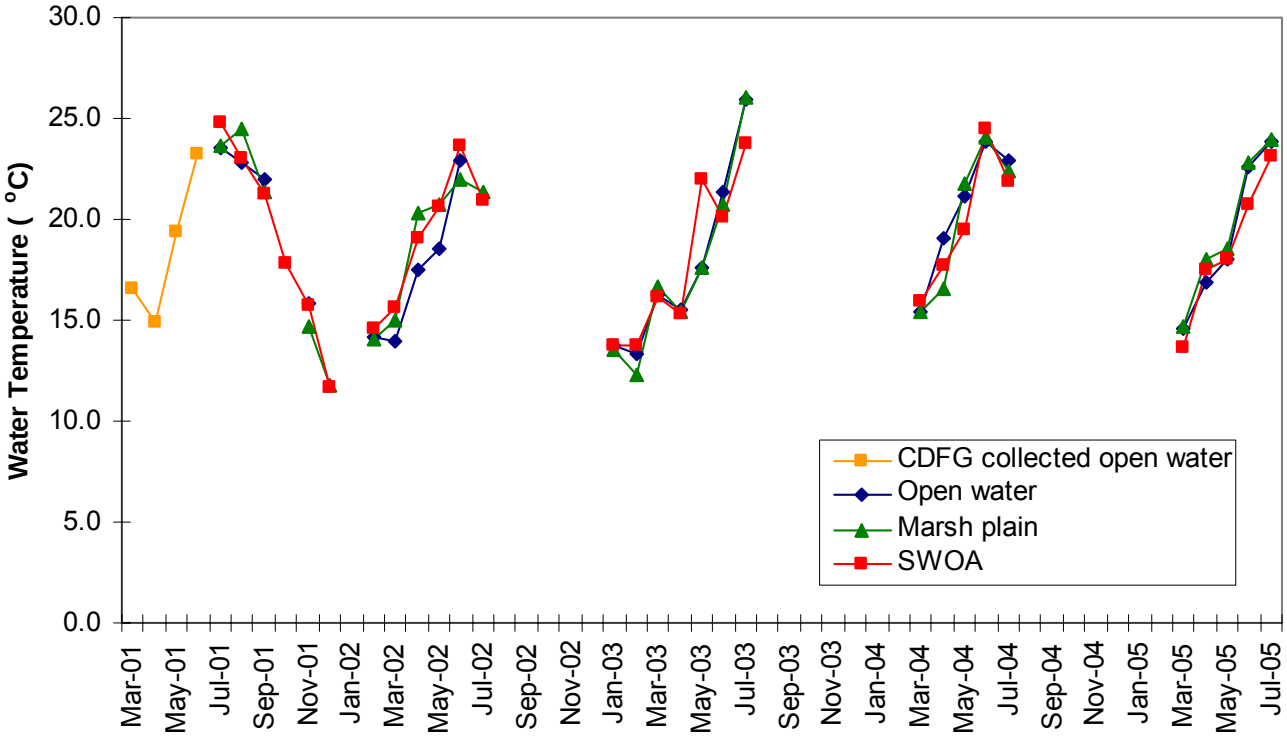


Figure A-7. Average water temperature in SWOA, marsh plain, and open water habitats in the Napa River Project area, at the time of sampling in 2001–2005.

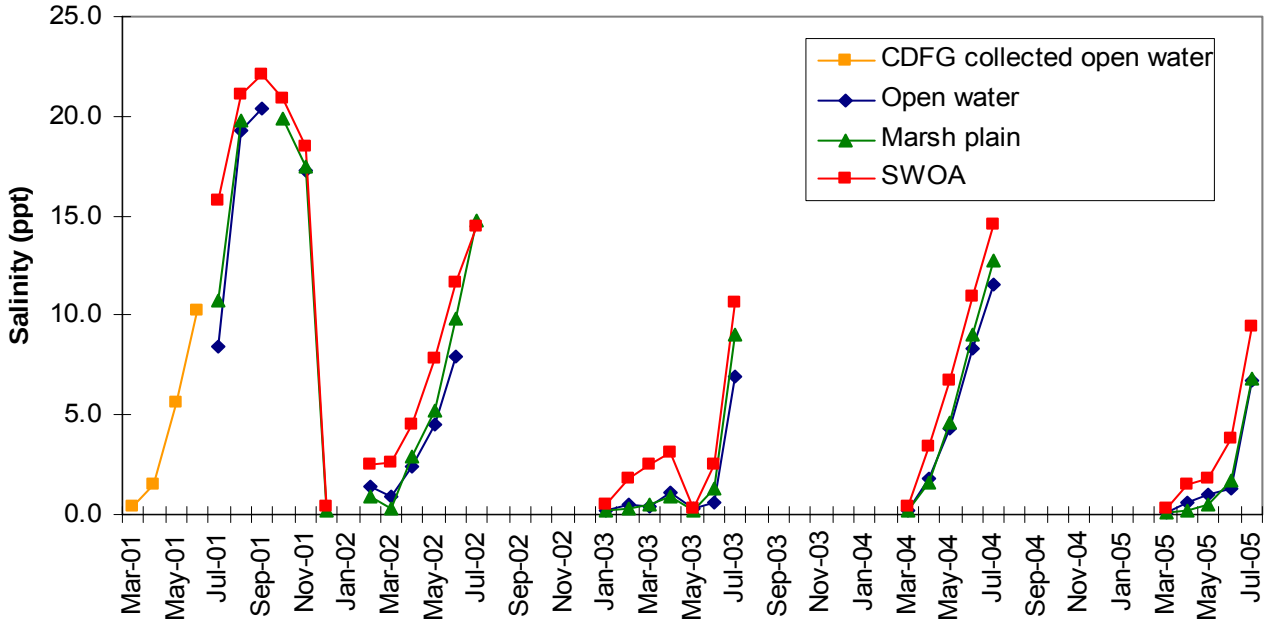


Figure A-8. Average salinity in SWOA, marsh plain, and open water habitats in the Napa River Project area, at the time of sampling in 2001–2005.

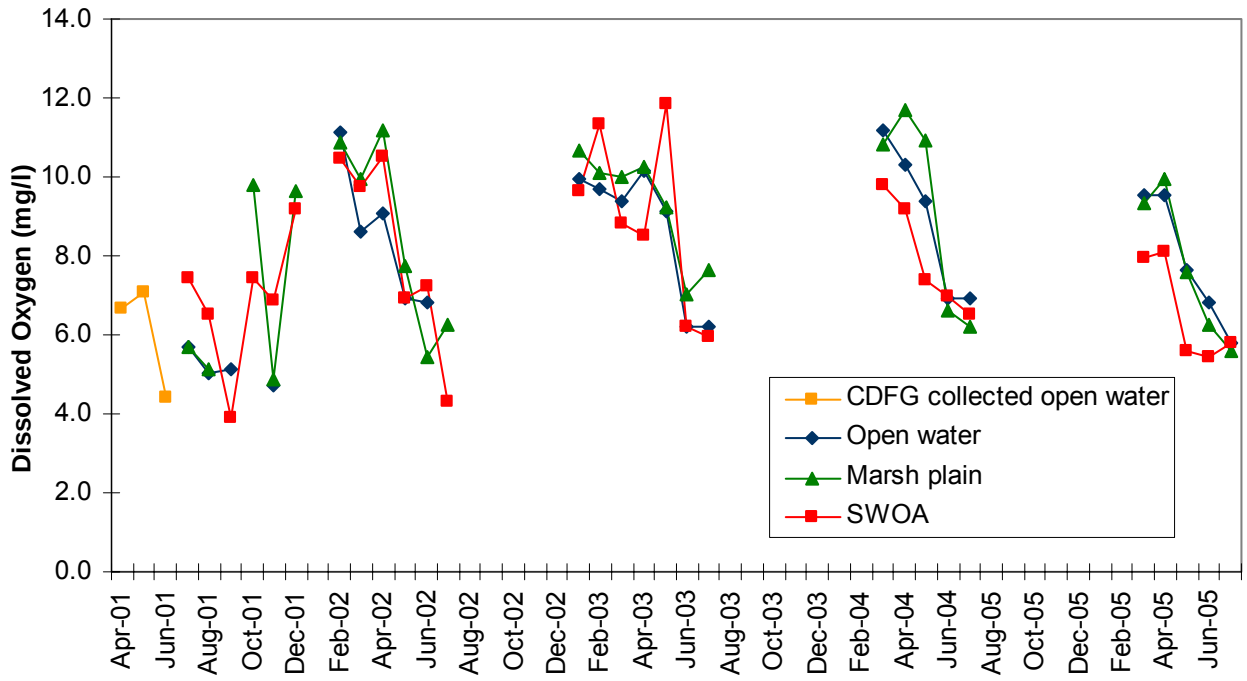


Figure A-9. Average dissolved oxygen in SWOA, marsh plain, and open water habitats in the Napa River Project area, at the time of sampling in 2001–2005.

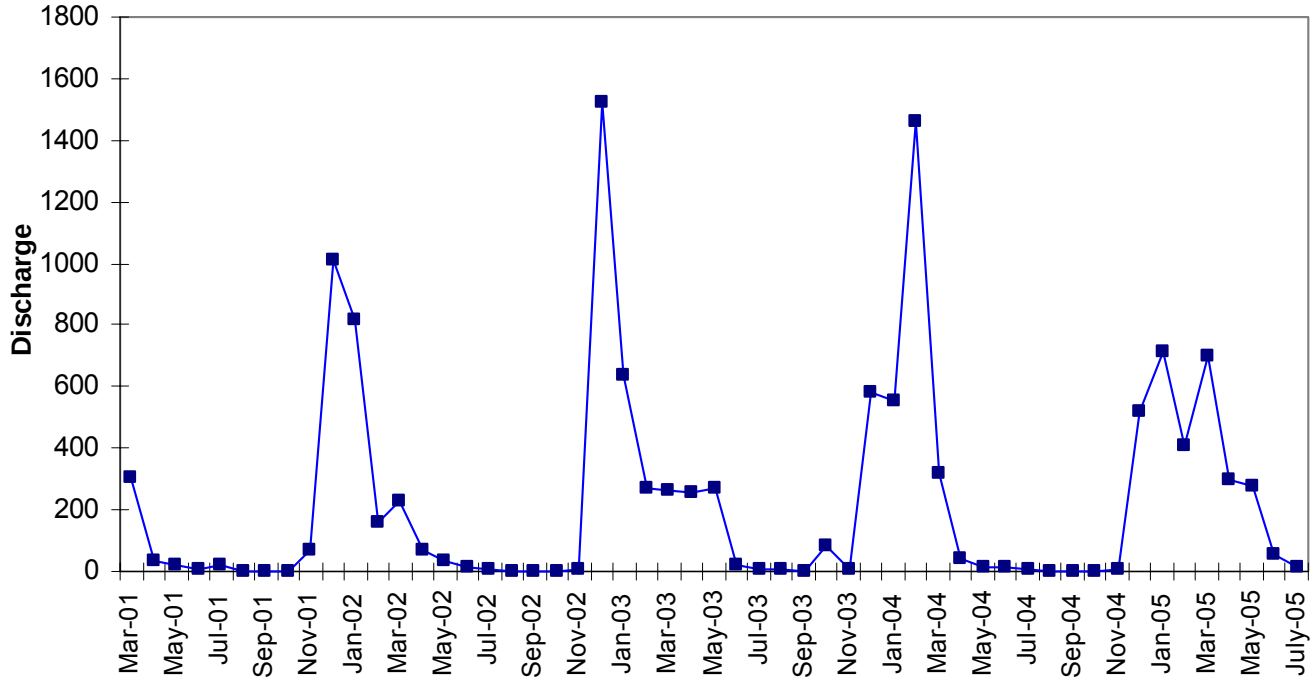
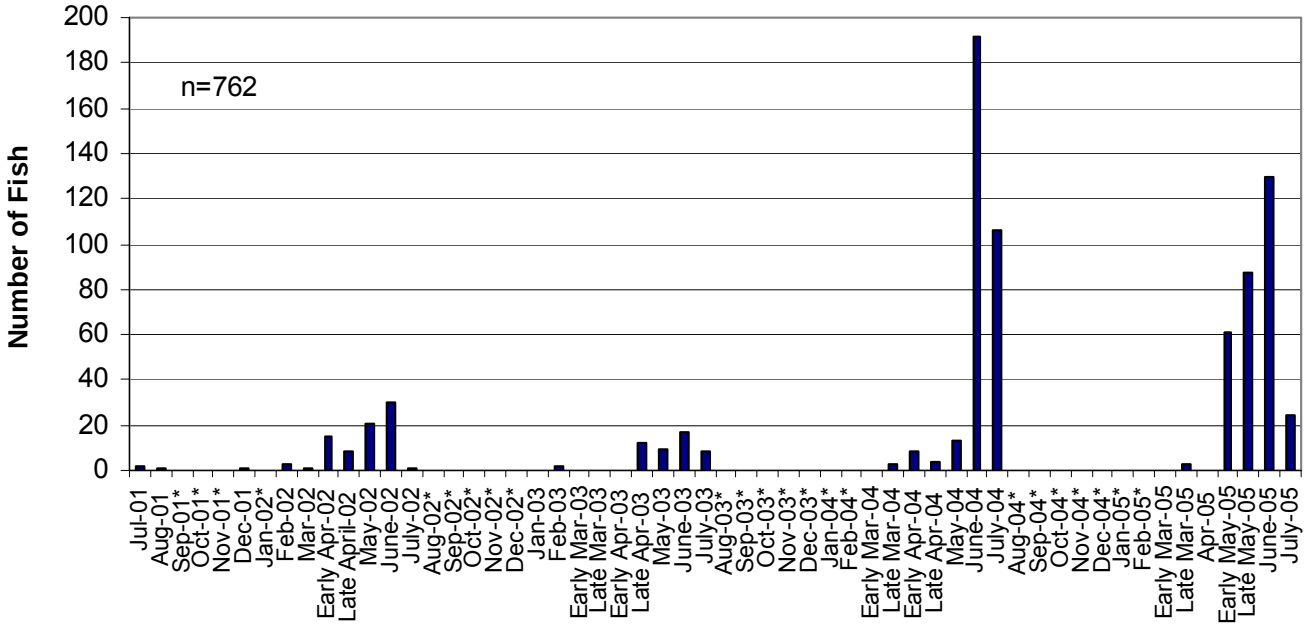
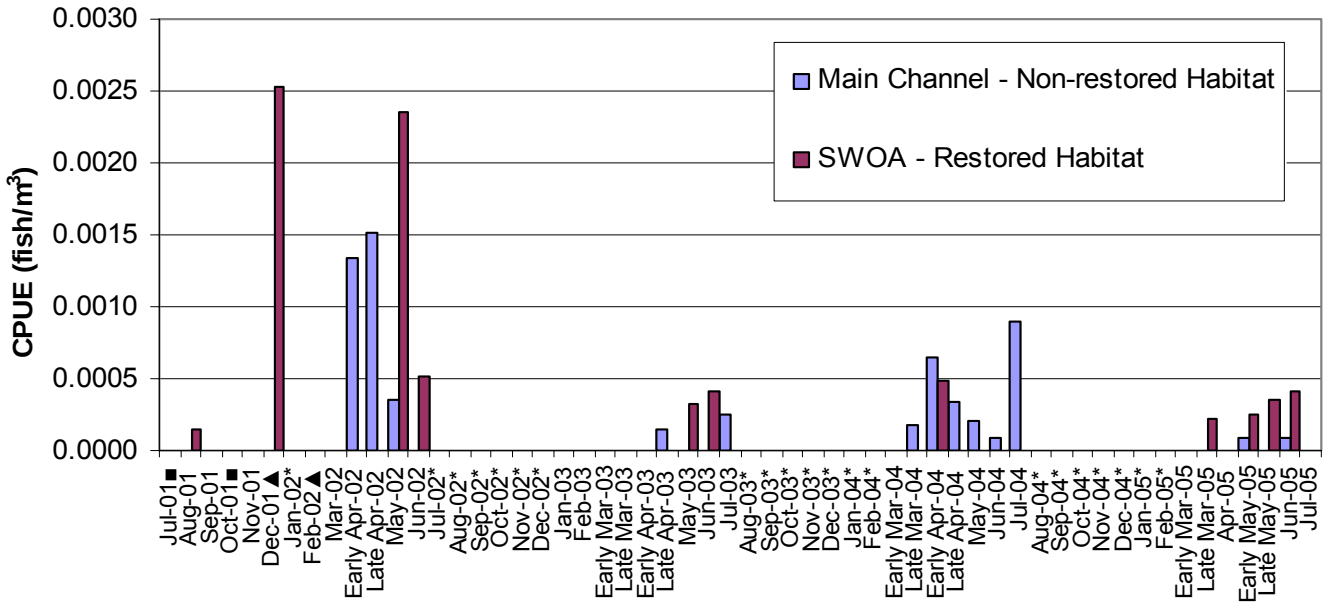


Figure A-10. Average monthly discharge in the Napa River (USGS gage #11458000), upstream of the project area, between March 2001 and July 2005.



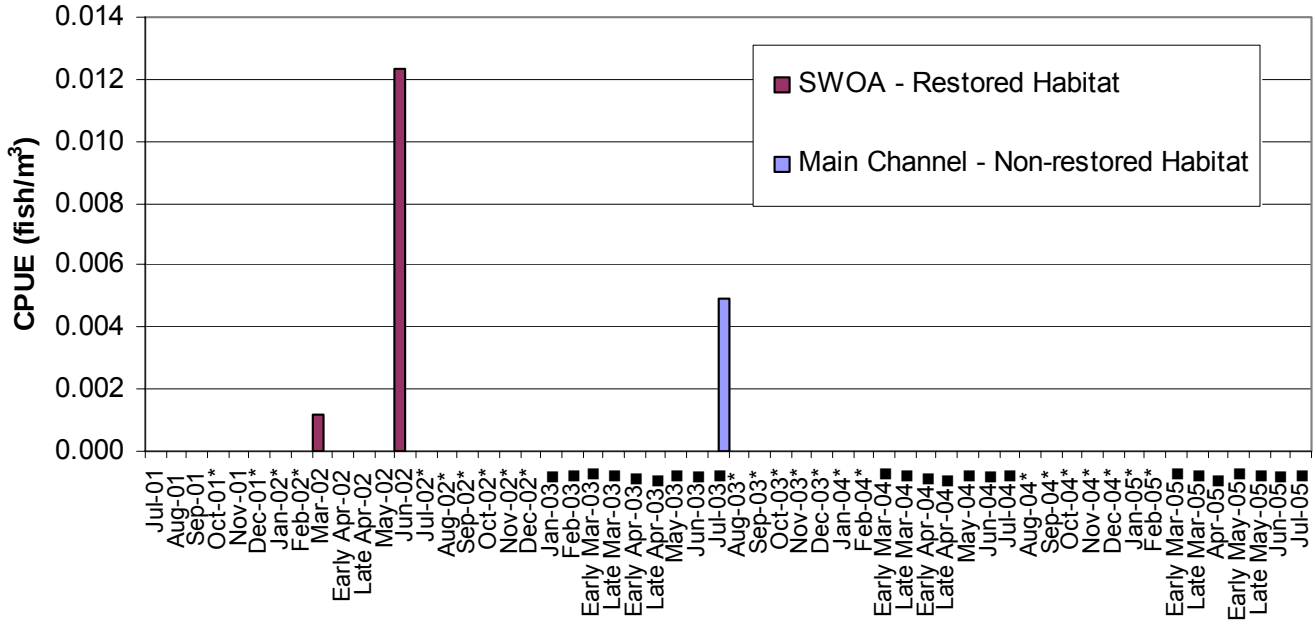
* No sampling occurred on this date.

Figure A-11. Total number of Sacramento splittail captured in the Napa River Project area, 2001–2005.



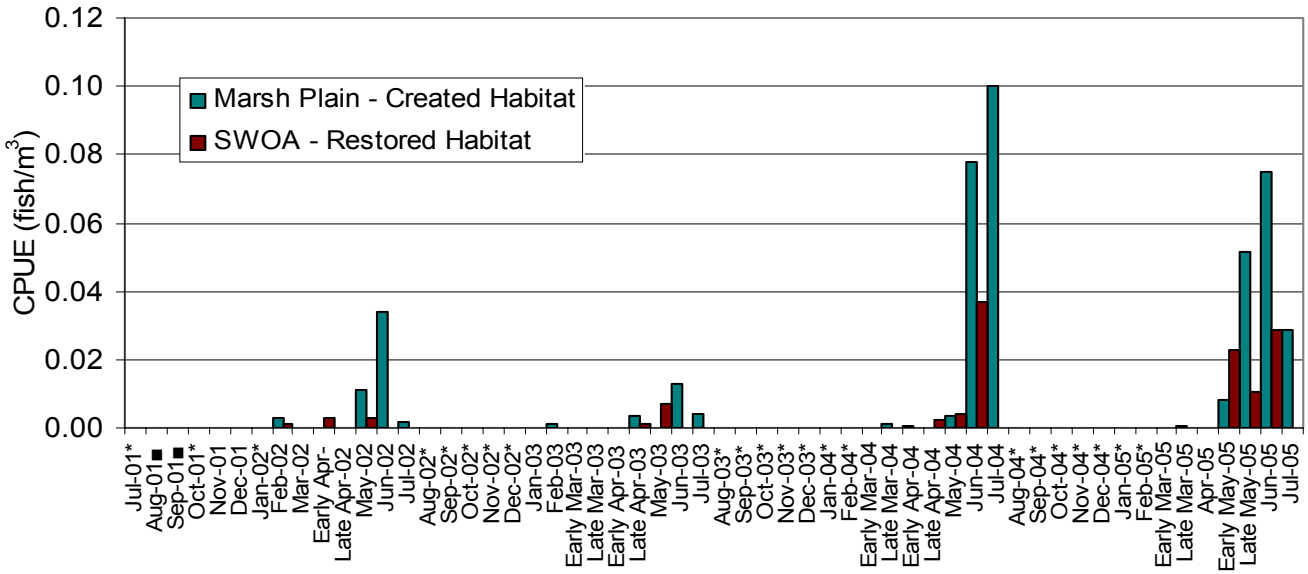
* No otter trawling occurred on this date.
■ Otter trawls were only deployed in the main channel on this date.
▲ Otter trawls were only deployed in the SWOA on this date.

Figure A-12. Catch per unit effort (CPUE) of Sacramento splittail captured in the otter trawl for main channel and SWOA habitats, 2001–2005.



* No purse seining occurred on this date.
■ Purse seines were only deployed in the open water on this date.

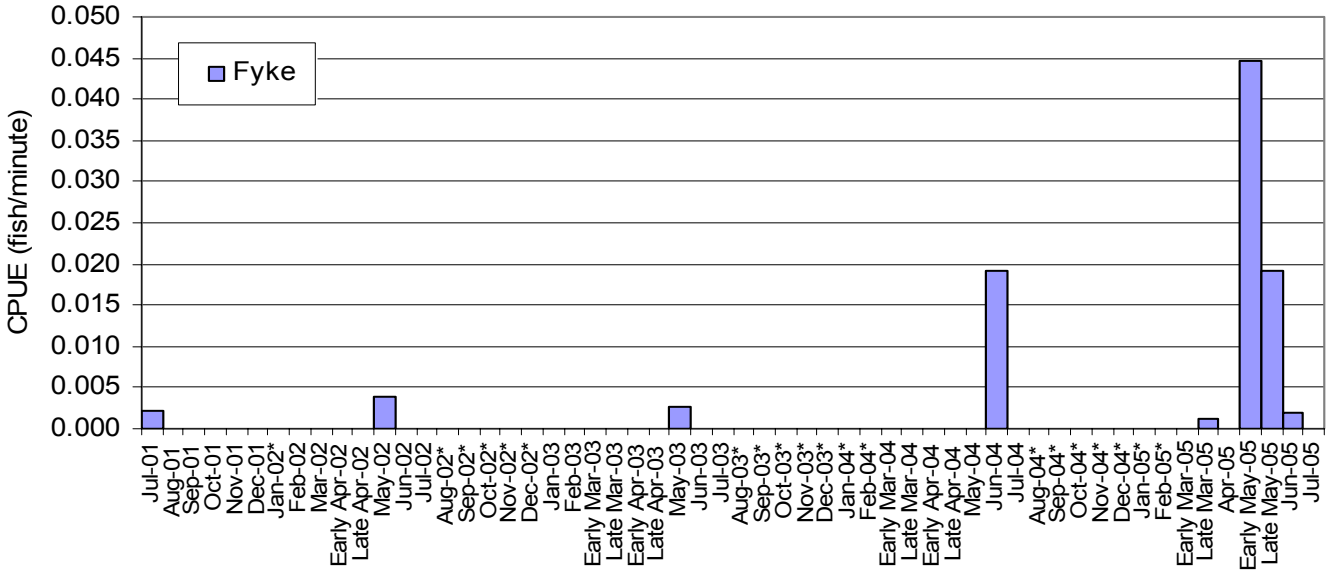
Figure A-13. Catch per unit effort (CPUE) of Sacramento splittail in the purse seine for main channel and SWOA habitats, 2001–2005.



* No beach seining occurred on this date.

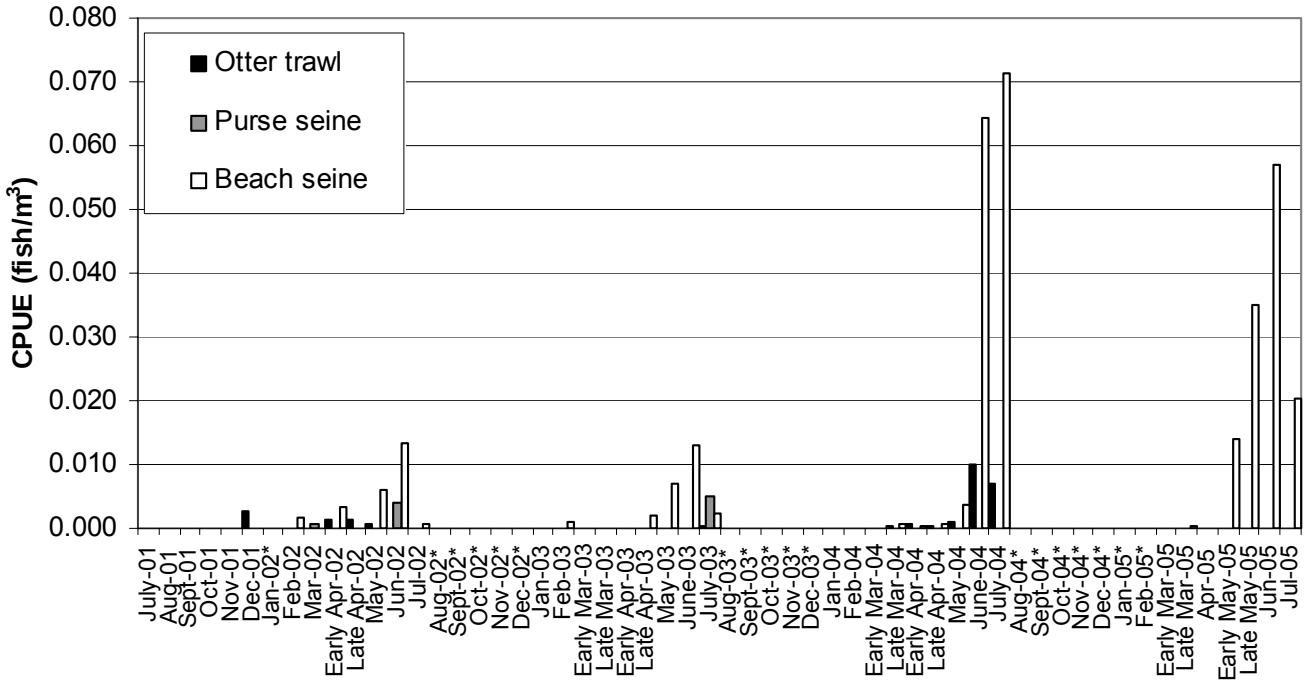
■ Beach seines were only deployed at the SWOA on this date.

Figure A-14. Catch per unit effort (CPUE) of Sacramento splittail captured in the beach seine for marsh plain and SWOA habitats, 2001–2005.



* No sampling occurred on this date.
Two larval splittail were captured by a CDFG tow net in May 2001.

Figure A-15. Catch per unit effort (CPUE) (fish/minute) of Sacramento splittail captured in fyke nets in the Napa River Project area, 2001–2005.



* No sampling occurred on this date.

Figure A-16. Catch per unit effort (CPUE) (fish/m³) of Sacramento splittail by gear type in the Napa River Project area, 2001–2005.

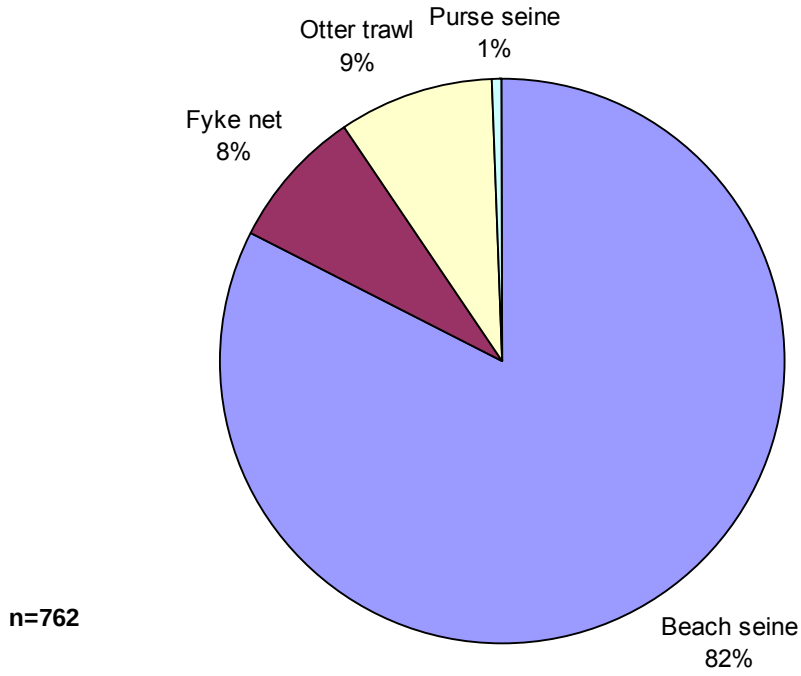


Figure A-17. Sacramento splittail captured by gear type in the Napa River Project area between July 2001–July 2002, January 2003–July 2003, March 2004–July 2004, and March 2005–July 2005.

Appendix B

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 07-16-01																																				
1A-2 Otter Trawl 1 of 2												1					1																			2
1A-9 Purse Seine 1 of 2																																				0
1A-9 Purse Seine 2 of 2																																				0
3-1 Otter Trawl 1 of 1																	1																			1
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2																																				0
Date: 07-17-01																																				
1A-3 Fyke Net 1of 1																																				0
1A-5 Fyke Net 1 of 1																																				0
1A-6 Fyke Net 1 of 1							29																													29
1A-7 Fyke Net 1of 1							20										1																			21
1A-8 Fyke Net 1 of 1							81										3																			84
1A-10 Fyke Net 1 of 1							2																							2						4
July 2001 Subtotal	0	0	0	0	0	0	132	0	0	0	0	1	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	141
Date: 08-14-01																																				
1A-3 Fyke Net 1 of 1																																				0
1A-4 Beach Seine 1 of 2							48				0										2															50
1A-4 Beach Seine 2 of 2							24				1										1															26
1A-5 Fyke Net 1 of 1																																				0
1A-6 Fyke Net 1 of 1							21																													21
1A-7 Fyke Net 1 of 1							1										1																			2
1A-8 Fyke Net 1 of 1							33																													33
1A-10 Fyke Net 1 of 1																																				0
Date: 08-15-01																																				
1A-1 Otter Trawl 1 of 2												6											1									1			0	8
1A-1 Otter Trawl 2 of 2												10																				2			1	13
1A-2 Otter Trawl 1 of 2												2					5																		1	8
1A-2 Otter Trawl 2 of 2																	3																			3
1A-9 Purse Seine 1 of 2							146																													146
1A-9 Purse Seine 2 of 2																																				0
1B-1 Otter Trawl 1 of 2												15																				2			1	18
1B-1 Otter Trawl 2 of 2											1	26					1															1			1	30
2-1 Otter Trawl 1 of 2												5					1				1															7
2-1 Otter Trawl 2 of 2												14									3		1							1					1	20
3-1 Purse Seine 1 of 2							4																													4
3-1 Purse Seine 2 of 2							4																													4
August 2001 Subtotal	0	0	0	0	0	0	281	0	0	0	2	78	0	0	0	0	11	0	0	0	7	0	2	0	0	0	0	0	0	1	0	6	0	0	5	393
Date: 09-11-01																																				
1A-1 Otter Trawl 1 of 2												12												1		1						2				16
1A-1 Otter Trawl 2 of 2																																				0
1A-2 Otter Trawl 1 of 1											3																									3
1A-4 Beach Seine 1 of 2							49																													49
1A-4 Beach Seine 2 of 2							11				1																									12
1A-9 Purse Seine 1 of 2							1																													1
1A-9 Purse Seine 2 of 2																																				0
1B-1 Otter Trawl 1 of 2											1	46																							6	53
1B-1 Otter Trawl 2 of 2											4	1																								5
2-1 Otter Trawl 1 of 2												14																								14
2-1 Otter Trawl 2 of 2											1	16					1						1													19
3-1 Purse Seine 1 of 2							47																													47
3-1 Purse Seine 2 of 2	1						20																													21
September 2001 Subtotal	1	0	0	0	0	0	128	0	0	0	10	89	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	2	0	0	6	240

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 10-11-01																																				
1A-3 Beach Seine 1 of 1							266																													266
1A-4 Beach Seine 1 of 3									5																											5
1A-4 Beach Seine 2 of 3							24		1																											25
1A-4 Beach Seine 3 of 3							94																													94
October 2001 Subtotal	0	0	0	0	0	0	384	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	390
Date: 11-08-01																																				
1A-1 Otter Trawl 1 of 2												4																							2	6
1A-1 Otter Trawl 2 of 2												2															2									4
1A-2 Otter Trawl 1 of 2												1																								1
1A-2 Otter Trawl 2 of 2												2																								2
1A-9 Purse Seine 1 of 2	3																																			3
1A-9 Purse Seine 2 of 2	1																																			1
1B-1 Otter Trawl 1 of 2												1																							6	7
1B-1 Otter Trawl 2 of 2												3																								3
2-1 Otter Trawl 1 of 3												5																							1	6
2-1 Otter Trawl 2 of 3	2											7		1																						1	11
2-1 Otter Trawl 3 of 3	1											7	1																						4	13
3-1 Purse Seine 1 of 2							180																													180
3-1 Purse Seine 2 of 2							88																													88
Date: 11-09-01																																				
1A-3 Fyke Net 1 of 1																																				0
1A-3 Beach Seine 1 of 1							621		1																											622
1A-4 Beach Seine 1 of 2							43																													43
1A-4 Beach Seine 2 of 2							26																													26
1A-5 Fyke Net 1 of 1																																				0
1A-6 Fyke Net 1 of 1	2						26				5																									33
1A-7 Fyke Net 1 of 1																																				0
1A-8 Fyke Net 1 of 1	1						4																													5
1A-10 Fyke Net 1 of 1							1				1																									2
November 2001 Subtotal	10	0	0	0	0	0	989	0	1	0	6	32	1	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	14	1,056
Date: 12-10-01																																				
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2											1	4																		1						6
1A-3 Beach Seine 1 of 1							225																													225
1A-4 (South End) Beach Seine 1 of 2				1			86															1														88
1A-4 (South End) Beach Seine 2 of 2							4																													4
1A-4 (North End) Beach Seine 1 of 2							5																													5
1A-4 (North End) Beach Seine 2 of 2							2																													2
December 2001 Subtotal	0	0	0	1	0	0	322		0	0	1	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	330
July-December 2001 subtotal of juvenile and adult fish	11	0	0	1	0	0	2,236	0	7	0	19	204	1	1	0	0	18	0	0	0	7	1	3	0	1	0	3	0	0	4	0	8	0	0	25	2,550
Date: 02-25-02																																				
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2											4	1																								5
1A-3 Beach Seine 1 of 1							2																							1						3
1A-4 (South End) Beach Seine 1 of 2							1										5													1						7
1A-4 (South End) Beach Seine 2 of 2							7																													7
1A-4 (North End) Beach Seine 1 of 2							2																													2
1A-4 (North End) Beach Seine 2 of 2							6		1		2																			1						10
1B-1 Otter Trawl 1 of 1											1	3																								4
2-1 Otter Trawl 1 of 1																																				0
February 2002 Subtotal	0	0	0	0	0	0	18	0	1	0	7	4	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	38

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																		
Date: 03-25-02																																				
1A-1 Otter Trawl 1of 1																																				0
1A-2 Otter Trawl 1 of 2											2	2									1															5
1A-2 Otter Trawl 2 of 2											5	1																								6
1A-3 Beach Seine 1 of 1											2																18									20
1A-4 (South End) Beach Seine 1 of 2							5																				3									8
1A-4 (South End) Beach Seine 2 of 2				3			2				3	1	1											43			4									57
1A-4 (North End) Beach Seine 1 of 2											2																2							4		8
1A-4 (North End) Beach Seine 2 of 2							2																													2
1A-6 Fyke Net 1 of 1							1				1													14			1									17
1A-7 Fyke Net 1 of 1											1									1				2												4
1A-8 Fyke Net 1 of 1																					1			3										1		5
Date: 03-26-02																																				
1A-1 Otter Trawl 1 of 2					1						1	4																								6
1A-1 Otter Trawl 2 of 2																																				0
1A-9 Purse Seine 1 of 6							3						4											1			4									12
1A-9 Purse Seine 2 of 6																								1			2			1						4
1A-9 Purse Seine 3 of 6							2						2														2									6
1A-9 Purse Seine 4 of 6																																				0
1A-9 Purse Seine 5 of 6																																				0
1A-9 Purse Seine 6 of 6							1																													1
1A-10 Fyke Net 1 of 1																								59												59
1B-1 Otter Trawl 1 of 2																											3									3
1B-1 Otter Trawl 2 of 2											2	4									1						2									9
2-1 Otter Trawl 1 of 2																																			1	1
2-1 Otter Trawl 2 of 2		1										5																							1	7
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
March 2002 Subtotal	0	1	0	3	1	0	16	0	0	0	19	17	7	0	0	0	0	0	0	1	3	0	0	123	0	0	41	0	0	1	0	0	0	5	2	240
Date: 04-08-02																																				
1A-1 Otter Trawl 1 of 2											2	1															1			1						5
1A-1 Otter Trawl 2 of 2												1																		1						2
1A-4 (South End) Beach Seine 1 of 1							12																	92			1			3				2		110
1A-4 (North End) Beach Seine 1 of 3							7					2					1										30									40
1A-4 (North End) Beach Seine 2 of 3							6				1	2					2										37									48
1A-4 (North End) Beach Seine 3 of 3							5																	8			37			1						51
1A-6 Fyke Net 1 of 1							1																	11										2		14
1A-7 Fyke Net 1 of 1											1													294			1									296
1A-8 Fyke Net 1 of 1																																				0
1A-10 Fyke Net 1 of 1																								1,100												1,100
2-1 Otter Trawl 1 of 1											1													2												3
Date: 04-09-02																																				
1A-8 Fyke Net 1 of 1																								8												8
1A-9 Purse Seine 1 of 2																								23			1									24
1A-9 Purse Seine 2 of 2																																				0
1B-1 Otter Trawl 1 of 2											2	8															1			4						15
1B-1 Otter Trawl 2 of 2											8	6															1			4						19
2-1 Otter Trawl 1 of 3												4															1									5
2-1 Otter Trawl 2 of 3												3																								3
2-1 Otter Trawl 3 of 3											3	2																		1						6
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																		
Date: 04-22-02																																				
1A-3 Beach Seine 1 of 2							2										1							2			49								54
1A-3 Beach Seine 2 of 2							2																				18							2	22
1A-4 (South End) Beach Seine 1 of 2							11				1							1						1			3							10	27
1A-4 (South End) Beach Seine 2 of 2							17										2							3			11							24	57
1A-4 (North End) Beach Seine 1 of 2							1																	6			6							1	14
1A-4 (North End) Beach Seine 2 of 2							1				2													2			8							1	14
1A-6 Fyke Net 1 of 1							1																				5							1	7
1A-7 Fyke Net 1 of 1																								7			8								15
1A-8 Fyke Net 1 of 1																								150			19								169
Date: 04-23-02																																				
1A-1 Otter Trawl 1 of 1												3															4								7
1A-2 Otter Trawl 1 of 1											2	2																							4
1A-9 Purse Seine 1 of 2																																			0
1A-9 Purse Seine 2 of 2																								5			5								10
1A-10 Fyke Net 1 of 1																								1,491											1,491
1B-1 Otter Trawl 1 of 2											2	8															1			2					13
1B-1 Otter Trawl 2 of 2											2	18					1										1			3					25
2-1 Otter Trawl 1 of 2											1	8																		2					11
2-1 Otter Trawl 2 of 2	1																													1					2
3-1 Purse Seine 1 of 3																																			0
3-1 Purse Seine 2 of 3													2																						2
3-1 Purse Seine 3 of 3																																			0
April 2002 Subtotal	1	0	0	0	0	0	66	0	0	0	28	68	2	0	0	0	7	1	0	0	0	0	0	3,205	0	0	249	0	0	23	0	0	0	43	0	3,693
Date: 05-22-02																																				
1A-1 Otter Trawl 1 of 2																														1						1
1A-1 Otter Trawl 2 of 2																																				0
1A-2 Otter Trawl 1 of 2												2																		2					4
1A-2 Otter Trawl 2 of 2				1								1																		1					3
1A-6 Fyke Net 1 of 1																																				0
1A-7 Fyke Net 1 of 1							6										6																	3		15
1A-8 Fyke Net 1 of 1							34										1									1	2			1						39
1A-10 Fyke Net 1 of 1							5				1	1					2							10			1			2						22
1B-1 Otter Trawl 1 of 2											1	2															2									5
1B-1 Otter Trawl 2 of 2											1	5													1		1									8
2-1 Otter Trawl 1 of 3																									3		1									4
2-1 Otter Trawl 2 of 3												2																								2
2-1 Otter Trawl 3 of 3																														1						1
Date: 05-23-02																																				
1A-3 Beach Seine 1 of 2							1				3																9			8						21
1A-3 Beach Seine 2 of 2							5				1						8										59			1				1		75
1A-4 (South End) Beach Seine 1 of 3																																				0
1A-4 (South End) Beach Seine 2 of 3																														3						3
1A-4 (South End) Beach Seine 3 of 3							1																				1									2
1A-4 (North End) Beach Seine 1 of 3											1						2									3										6
1A-4 (North End) Beach Seine 2 of 3											1						5									4	2									12
1A-4 (North End) Beach Seine 3 of 3											2						5													1						8
1A-9 Purse Seine 1 of 2												1																								1
1A-9 Purse Seine 2 of 2							2																													2
3-1 Purse Seine 1 of 3													2																					1		3
3-1 Purse Seine 2 of 3							1																													1
3-1 Purse Seine 3 of 3							6						3					1																1		11
May 2002 Subtotal	0	0	0	1	0	0	61	0	0	0	11	14	5	0	0	0	29	1	0	0	0	0	0	10	4	8	78	0	0	21	0	0	1	4	1	249

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 06-20-02																																				
1A-3 Beach Seine 1 of 3											12						2													3						17
1A-3 Beach Seine 2 of 3						1					11						8										1			19					2	42
1A-3 Beach Seine 3 of 3						1	4				2						4										1			5				2		19
1A-4 (South End) Beach Seine 1 of 2							1				1																									2
1A-4 (South End) Beach Seine 2 of 2																	1																			1
1A-4 (North End) Beach Seine 1 of 2							5																													5
1A-4 (North End) Beach Seine 2 of 2							4				2																									6
1A-4 (West Side) Beach Seine 1 of 1							6				2						2																			10
1A-6 Fyke Net 1 of 1																											1									1
1A-7 Fyke Net 1 of 1							3				2						2																			7
1A-8 Fyke Net 1 of 1							11				1						1																			13
1A-10 Fyke Net 1 of 1							8										1																			9
Date: 06-21-02																																				
1A-1 Otter Trawl 1of 2																																				0
1A-1 Otter Trawl 2 of 2												1																								1
1A-2 Otter Trawl 1 of 2												1																			1					2
1A-2 Otter Trawl 2 of 2											1																									1
1A-9 Purse Seine 1 of 3																														2						2
1A-9 Purse Seine 2 of 3																																				0
1A-9 Purse Seine 3 of 3																																				0
1B-1 Otter Trawl 1 of 2																																				0
1B-1 Otter Trawl 2 of 2																																				0
2-1 Otter Trawl 1 of 2												5																								5
2-1 Otter Trawl 2 of 2												6																								6
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3													2																								2
3-1 Purse Seine 3 of 3							3						1																								4
June 2002 Subtotal	0	0	0	0	0	2	45	0	0	0	34	13	3	0	0	0	21	0	0	0	0	0	0	0	0	0	3	0	0	30	0	0	0	2	2	155
Date: 07-19-02																																				
1A-3 Beach Seine 1 of 2							6				3						16																			25
1A-3 Beach Seine 2 of 2							5				20						10										1			1						37
1A-4 (South End) Beach Seine 1 of 2							1				1																									2
1A-4 (South End) Beach Seine 2 of 2							4																													4
1A-4 (North End) Beach Seine 1 of 2																																				0
1A-4 (North End) Beach Seine 2 of 2																																				0
July 2002 Subtotal	0	0	0	0	0	0	16	0	0	0	24	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	68
February-July 2002 subtotal of juvenile and adult fish	1	1	0	4	1	2	222	0	1	0	123	116	17	0	0	0	88	2	0	1	3	0	0	3,338	4	8	372	0	0	79	0	0	1	54	5	4,443

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 01-29-03																																				
1A-4 (North End) Beach Seine 1 of 5																																				0
1A-4 (North End) Beach Seine 2 of 5																																				0
1A-4 (North End) Beach Seine 3 of 5																																				0
1A-4 (South End) Beach Seine 4 of 5							1																													1
1A-4 (South End) Beach Seine 5 of 5																																				0
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2																																				0
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2																																				0
1B-1 Otter Trawl 1 of 3																																				0
1B-1 Otter Trawl 2 of 3																																				0
1B-1 Otter Trawl 3 of 3																																				0
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2												1																								1
1A-2 Otter Trawl 1 of 2											1																									1
1A-2 Otter Trawl 2 of 2											9																									9
Date: 01-31-03																																				
1A-3 Beach Seine 1 of 3							1				1																				1					3
1A-3 Beach Seine 2 of 3							20	1																							3					24
1A-3 Beach Seine 3 of 3							7																													7
2-2 Beach Seine 1 of 3																																				0
2-2 Beach Seine 2 of 3																																				0
2-2 Beach Seine 3 of 3																																				0
January 2003 Subtotal	0	0	0	0	0	0	29	1	0	0	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	46
Date: 02-26-03																																				
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2																																				0
1B-1 Otter Trawl 1 of 2																															1					1
1B-1 Otter Trawl 2 of 2																																				0
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2													1																								1
1A-2 Otter Trawl 1 of 2											5																										5
1A-2 Otter Trawl 2 of 2											1																										1
Date: 02-27-03																																				
1A-4 (North End) Beach Seine 1 of 4																																				0
1A-4 (North End) Beach Seine 2 of 4																																				0
1A-4 (South End) Beach Seine 3 of 4																																				0
1A-4 (South End) Beach Seine 4 of 4																																				0
1A-3 Beach Seine 1 of 3																															1	1				2
1A-3 Beach Seine 2 of 3																												1			1					2
1A-3 Beach Seine 3 of 3																												1								1
2-2 Beach Seine 1 of 3							8																													8
2-2 Beach Seine 2 of 3																																				0
2-2 Beach Seine 3 of 3							129																													129
February 2003 Subtotal	0	0	0	0	0	0	137	0	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	0	0	0	150

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 03-13-03																																				
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2																																				0
2-1 Otter Trawl 1 of 2												2																								2
2-1 Otter Trawl 2 of 2																																			4	4
1B-1 Otter Trawl 1 of 2																															1	1			1	3
1B-1 Otter Trawl 2 of 2												1																								1
1A-1 Otter Trawl 1 of 2											2				1																	2				5
1A-1 Otter Trawl 2 of 2										1	4						2															4				11
1A-2 Otter Trawl 1 of 2													2															2							1	5
1A-2 Otter Trawl 2 of 2											1		1															1								3
1A-4 (North End) Beach Seine 1 of 6							4																													4
1A-4 (North End) Beach Seine 2 of 6							5																													5
1A-4 (North End) Beach Seine 3 of 6							2				1																							1		4
1A-4 (South End) Beach Seine 4 of 6							1																													1
1A-4 (South End) Beach Seine 5 of 6							1																													1
1A-4 (South End) Beach Seine 6 of 6							1																													1
1A-3 Beach Seine 1 of 2							6																													6
1A-3 Beach Seine 2 of 2							2																								2					4
1A-6 Fyke net																																				0
1A-7 Fyke net							6				2																									8
1A-10 Fyke net																																				0
Date: 03-27-03																																				
1A-3 Beach Seine 1 of 2							2																													2
1A-3 Beach Seine 2 of 2							23				2																	1			1					27
1A-4 (North End) Beach Seine 1 of 4							4				10						1											5								20
1A-4 (North End) Beach Seine 2 of 4							4																													4
1A-4 (South End) Beach Seine 3 of 4							20																													20
1A-4 (South End) Beach Seine 4 of 4							1																													1
1A-6 Fyke net																																				0
1A-7 Fyke net																												1								1
1A-10 Fyke net																																				0
Date: 03-28-03																																				
3-1 Purse Seine 1 of 2																												1								1
3-1 Purse Seine 2 of 2																																				0
2-1 Otter Trawl 1 of 2				1							2		2																						2	7
2-1 Otter Trawl 2 of 2											2																								1	3
1B-1 Otter Trawl 1 of 2																																				0
1B-1 Otter Trawl 2 of 2											1																									1
1A-1 Otter Trawl 1 of 2													1										1													2
1A-1 Otter Trawl 2 of 2			1								2																								2	5
1A-2 Otter Trawl 1 of 2																																				0
1A-2 Otter Trawl 2 of 2											1																									1
March 2003 Subtotal	0	0	1	1	0	0	82	0	0	1	30	3	6	0	1	0	3	0	0	0	0	0	0	1	0	0	0	11	0	0	4	7	0	1	11	163

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 04-10-03																																				
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2																																				0
2-1 Otter Trawl 1 of 3																												1								1
2-1 Otter Trawl 2 of 3											1		2															1								4
2-1 Otter Trawl 3 of 3																																				0
1B-1 Otter Trawl 1 of 2											1													27												28
1B-1 Otter Trawl 2 of 2	1										1													114								1				117
1A-1 Otter Trawl 1 of 2																								1												1
1A-1 Otter Trawl 2 of 2																																				0
1A-2 Otter Trawl 1 of 2											1																	19								20
1A-2 Otter Trawl 2 of 2											2																	4								6
Date: 04-11-03																																				
1A-3 Beach Seine 1 of 2							4																					2			1					7
1A-3 Beach Seine 2 of 2							1																													1
1A-4 (North End) Beach Seine 1 of 4							5				6																									11
1A-4 (North End) Beach Seine 2 of 4							1				5																	1								7
1A-4 (South End) Beach Seine 3 of 4							6																													6
1A-4 (South End) Beach Seine 4 of 4							5			1														3										1		10
1A-6 Fyke net										1																		2								3
1A-7 Fyke net																																				0
1A-10 Fyke net																																		1		1
Date: 04-24-03																																				
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
2-1 Otter Trawl 1 of 2											3		3															5								11
2-1 Otter Trawl 2 of 2											2																					1				3
1B-1 Otter Trawl 1 of 2											1																	1				1				3
1B-1 Otter Trawl 2 of 2											1																				1					2
1A-1 Otter Trawl 1 of 2																														1						1
1A-1 Otter Trawl 2 of 2																								10						1						11
1A-2 Otter Trawl 1 of 2																								6				1								7
1A-2 Otter Trawl 2 of 2												1												21				3								25
Date: 04-25-03																																				
1A-3 Beach Seine 1 of 4							1																	2												3
1A-3 Beach Seine 2 of 4							3																					1		3						7
1A-3 Beach Seine 3 of 4							11																					2		2						15
1A-3 Beach Seine 4 of 4							5																							3	1					9
1A-4 Beach Seine 1 of 5											1													2						1						4
1A-4 Beach Seine 2 of 5																								13						1						14
1A-4 Beach Seine 3 of 5											1																									1
1A-4 Beach Seine 4 of 5																								6												6
1A-4 Beach Seine 5 of 5							1																	6												7
1A-6 Fyke net																								294												294
1A-7 Fyke net																								125												125
1A-10 Fyke net																								16												16
April 2003 subtotal	1	0	0	0	0	0	43	0	0	2	26	1	5	0	0	0	0	0	0	0	0	0	0	646	0	0	0	43	0	12	3	3	0	2	0	787

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 05-13-03																																				
1A-3 Beach Seine 1 of 2											8																	3			1	6				18
1A-3 Beach Seine 2 of 2							2				11						1											16		4		8			1	43
1A-4 Beach Seine 1 of 4							1				4						5											3								13
1A-4 Beach Seine 2 of 4											7																	1								8
1A-4 Beach Seine 3 of 4																												1		2						3
1A-4 Beach Seine 4 of 4							1				5		2																		1					9
1A-6 Fyke net											2																	1								3
1A-7 Fyke net											1							1												1						3
1A-10 Fyke net											1																	1								2
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2							13																													13
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2																																				0
Date: 05-14-03																																				
1B-1 Otter Trawl 1 of 2																																1				1
1B-1 Otter Trawl 2 of 2																																				0
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																				0
1A-2 Otter Trawl 1 of 2																														1						1
1A-2 Otter Trawl 2 of 2																	3													1						4
May 2003 subtotal	0	0	0	0	0	0	17	0	0	0	39	0	2	0	0	0	9	1	0	0	0	0	0	0	0	0	0	26	0	9	2	15	0	0	1	121
Date: 06-07-03																																				
1A-4 Beach Seine 1 of 4							2				5						3											3								13
1A-4 Beach Seine 2 of 4							6				13						7											3								29
1A-4 Beach Seine 3 of 4				1			15				2																									18
1A-4 Beach Seine 4 of 4							1																													1
1A-6 Fyke net																	2											1								3
1A-7 Fyke net							2																													2
1A-10 Fyke net							1																													1
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2																																				0
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2																																				0
Date: 06-08-03																																				
1B-1 Otter Trawl 1 of 2																												1								1
1B-1 Otter Trawl 2 of 2																																				0
1A-1 Otter Trawl 1 of 2																																1				1
1A-1 Otter Trawl 2 of 2																												1								1
1A-2 Otter Trawl 1 of 2				1																										2						3
1A-2 Otter Trawl 2 of 2				1							3	2					2											1		1						10
2-1 Otter Trawl 1 of 2												6																								6
2-1 Otter Trawl 2 of 2												4																								4
1A-3 Beach Seine 1 of 2												1																1		11	2	6		2	2	25
1A-3 Beach Seine 2 of 2							2				11						9											1		3	3	14				43
June 2003 subtotal	0	0	0	3	0	0	29	0	0	0	34	13	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0	12	0	17	5	21	0	2	2	161

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 07-23-03																																				
1A-4 Beach Seine 1 of 4							2				3																									5
1A-4 Beach Seine 2 of 4							2				6																									8
1A-4 Beach Seine 3 of 4							5				19						3																			27
1A-4 Beach Seine 4 of 4							9				62	2	3				3																			79
1A-3 Beach Seine 1 of 2											30	5					4											1				3		1		44
1A-3 Beach Seine 2 of 2									1		12	27	579				2													3		2		8		634
1A-6 Fyke net											5						1																			6
1A-7 Fyke net							40				6	1	1				7																		1	56
1A-10 Fyke net							8				11	4					6																		1	30
3-1 Purse Seine 1 of 2							1						33																	1					4	39
3-1 Purse Seine 2 of 2							2						14																						1	17
1A-2 Otter Trawl 1 of 2				1							21		9																							31
1A-2 Otter Trawl 2 of 2											17	1	1																							19
2-1 Otter Trawl 1 of 1		3									1	1	10															1							1	17
Date: 07-24-03																																				
1B-1 Otter Trawl 1 of 2		21									1	36	43											1						2						104
1B-1 Otter Trawl 2 of 2		7									1	27	1															1		1						38
1A-1 Otter Trawl 1 of 2		1																										1								2
1A-1 Otter Trawl 2 of 2																	1													1						2
2-1 Otter Trawl 1 of 2		53										163	84																						4	304
2-1 Otter Trawl 2 of 2		16										5	11																							32
July 2003 subtotal	0	101	0	1	0	0	69	0	1	0	195	272	789	0	0	0	27	0	0	0	0	0	0	1	0	0	0	4	0	8	0	5	0	9	12	1,494
Total juvenile and adult fish in 2003	1	101	1	5	0	0	406	1	1	3	341	290	803	0	1	0	62	1	0	0	0	0	0	648	0	0	0	98	0	48	20	51	0	14	26	2,922
Date: 03-3-04																																				
1A-3 Beach Seine 1 of 3											1																									1
1A-3 Beach Seine 2 of 3							1				1																									2
1A-3 Beach Seine 3 of 3																																				0
1A-6 Fyke net																																				0
1A-7 Fyke net																																				0
1A-10 Fyke net																																				0
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2																																				0
2-2 Beach Seine 1 of 2							8																								1					9
2-2 Beach Seine 2 of 2							20																													20
Date: 03-4-04																																				
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																1				1
1A-2 Otter Trawl 1 of 2	2										1																									3
1A-2 Otter Trawl 2 of 2											1																									1
2-1 Otter Trawl 1 of 3																																			1	1
2-1 Otter Trawl 2 of 3																																				0
2-1 Otter Trawl 3 of 3																																				0
1B-1 Otter Trawl 1 of 2																																				0
1B-1 Otter Trawl 2 of 2																																				0
1B-2 Beach Seine 1 of 3																																				0
1B-2 Beach Seine 2 of 3							6																													6
1B-2 Beach Seine 3 of 3							22																													22
1A-4 Beach Seine 1 of 4							1																													1
1A-4 Beach Seine 2 of 4																																				0
1A-4 Beach Seine 3 of 4							1																													1
1A-4 Beach Seine 4 of 4							1																													1

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 03-17-04																																				
1A-4 Beach Seine 1 of 4							2				2																									4
1A-4 Beach Seine 2 of 4				1			2																													3
1A-4 Beach Seine 3 of 4							2				2		3																							7
1A-4 Beach Seine 4 of 4							20												1																	21
1A-6 Fyke net							2				1		1																							4
1A-7 Fyke net																																				0
1A-10 Fyke net							2											1															1			4
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
1B-2 Beach Seine 1 of 2							6				2																									8
1B-2 Beach Seine 2 of 2							30																													30
Date: 03-18-04																																				
1A-1 Otter Trawl 1 of 2												2																		1		4			1	8
1A-1 Otter Trawl 2 of 2																																				0
1A-2 Otter Trawl 1 of 2											2	4																								6
1A-2 Otter Trawl 2 of 2				1							5	1																								7
2-1 Otter Trawl 1 of 2																																			1	1
2-1 Otter Trawl 2 of 2												1																							1	2
1B-1 Otter Trawl 1 of 2												1																			2	3			1	7
1B-1 Otter Trawl 2 of 2																																1			1	2
2-2 Beach Seine 1 of 2							9																													9
2-2 Beach Seine 2 of 2							33																								1			1		35
1A-3 Beach Seine 1 of 2							23																													23
1A-3 Beach Seine 2 of 2							1						2																	2					1	6
March 2004 subtotal	2	0	0	2	0	0	192	0	0	0	18	9	6	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3	4	9	1	1	7	256
Date: 04-15-04																																				
1A-1 Otter Trawl 1 of 2																							2									1				3
1A-1 Otter Trawl 2 of 2											1	4														3				1		3			1	13
1A-2 Otter Trawl 1 of 2	1			2							2	7																								12
1A-2 Otter Trawl 2 of 2	1			6							2	1																		1						11
1B-1 Otter Trawl 1 of 2												1												1						2						4
1B-1 Otter Trawl 2 of 2																																				0
3-1 Purse Seine 1 of 2							1												4														1			6
3-1 Purse Seine 2 of 2																			2																	2
2-2 Beach Seine 1 of 2							48																													48
2-2 Beach Seine 2 of 2							364																													364
2-1 Otter Trawl 1 of 3	1			1								5	1																		1		2		5	16
2-1 Otter Trawl 2 of 3												3																				1			1	5
2-1 Otter Trawl 3 of 3	1											2	1																		2				2	8
Date: 04-16-04																																				
1B-2 Beach Seine 1 of 2							40						7																		1					48
1B-2 Beach Seine 2 of 2							46						17																							63
1A-4 Beach Seine 1 of 5							101																													101
1A-4 Beach Seine 2 of 5							10																											1		11
1A-4 Beach Seine 3 of 5							8																													8
1A-4 Beach Seine 4 of 5							4					1	3												1											9
1A-4 Beach Seine 5 of 5											1																									1
1A-6 Fyke net	1						4			1	1													4												11
1A-7 Fyke net							25																	1												26
1A-10 Fyke net							6																	3										2		11
1A-3 Beach Seine 1 of 2							2						9																							11
1A-3 Beach Seine 2 of 2							9						26																							35

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 04-29-04																																				
1A-4 Beach Seine 1 of 4							7			2	1													1											11
1A-4 Beach Seine 2 of 4							15																												15
1A-4 Beach Seine 3 of 4							7				3	1																							11
1A-4 Beach Seine 4 of 4							8			3							2													1					14
1A-6 Fyke net							1												1																2
1A-7 Fyke net				1			9																										1		11
1A-10 Fyke net																																	1		1
2-2 Beach Seine 1 of 2							62																											1	63
2-2 Beach Seine 2 of 2							83				1																							2	86
1B-2 Beach Seine 1 of 2							36				1																						1		38
1B-2 Beach Seine 2 of 2							43																												43
1A-3 Beach Seine 1 of 2							16						3														1							2	22
1A-3 Beach Seine 2 of 2							10						1														1								12
Date: 04-30-04																																				
1A-1 Otter Trawl 1 of 2												2																				2			4
1A-1 Otter Trawl 2 of 2																								1											1
1A-2 Otter Trawl 1 of 2											1	7																							8
1A-2 Otter Trawl 2 of 2				1								2																							3
2-1 Otter Trawl 1 of 2											1																								1
2-1 Otter Trawl 2 of 2	1										3	6																				2			12
1B-1 Otter Trawl 1 of 2		1										2												1						3		1			8
1B-1 Otter Trawl 2 of 2												1																							1
3-1 Purse Seine 1 of 2							6																												6
3-1 Purse Seine 2 of 2							16																												16
April 2004 subtotal	6	1	0	11	0	0	987	0	0	6	18	45	68	0	0	0	2	0	7	0	0	0	0	11	4	0	5	0	0	12	1	11	1	6	14	1,216
Date: 05-13-04																																				
1A-4 Beach Seine 1 of 4				1			2				1																			1					5
1A-4 Beach Seine 2 of 4							4																												4
1A-4 Beach Seine 3 of 4							5				1																			1					7
1A-4 Beach Seine 4 of 4										1																				2					3
1A-6 Fyke net							1																	10											11
1A-7 Fyke net							1																	1											2
1A-10 Fyke net							2			1																									3
1A-1 Otter Trawl 1 of 2												1												7						2					10
1A-1 Otter Trawl 2 of 2																																1			1
1A-3 Beach Seine 1 of 2							3					1	1				1										11			1		3		1	22
1A-3 Beach Seine 2 of 2							23																				1			1		1			26
1A-2 Otter Trawl 1 of 2																																			0
1A-2 Otter Trawl 2 of 2				1								5												1											7
Date: 05-14-04																																				
2-2 Beach Seine 1 of 2							105				4		1				2													1	2				23	138
2-2 Beach Seine 2 of 2						1	98						1																					3	103
2-1 Otter Trawl 1 of 2		1										1	1																						3
2-1 Otter Trawl 2 of 2		3										5	1																						9
1B-1 Otter Trawl 1 of 2				1								4																			1				6
1B-1 Otter Trawl 2 of 2				2								5																							7
3-1 Purse Seine 1 of 3	9												3																						12
3-1 Purse Seine 2 of 3	5												2																						7
3-1 Purse Seine 3 of 3	5												2																						7
1B-2 Beach Seine 1 of 2							13				1		45																	1	3			1		64
1B-2 Beach Seine 2 of 2							93				2		29																						124
May 2004 subtotal	19	4	0	5	0	1	350	0	0	2	9	22	86	0	0	0	3	0	0	0	0	0	0	19	0	0	12	0	2	13	1	5	0	0	28	581

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 06-15-04																																				
1A-4 Beach Seine 1 of 3							9				14						2													30						55
1A-4 Beach Seine 2 of 3							2																													2
1A-4 Beach Seine 3 of 3							3																							3						6
1A-6 Fyke net											3						1																			4
1A-7 Fyke net							26																							2						28
1A-10 Fyke net							2				3						3													15						23
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																				0
1B-1 Otter Trawl 1 of 3							1																													1
1B-1 Otter Trawl 2 of 3				1																																1
1B-1 Otter Trawl 3 of 3																																				0
1A-2 Otter Trawl 1 of 2												3																								3
1A-2 Otter Trawl 2 of 2												2																								2
2-1 Otter Trawl 1 of 3												1																			1						2
2-1 Otter Trawl 2 of 3	2																																			2
2-1 Otter Trawl 3 of 3													2																							2
Date: 06-16-04																																				
1A-3 Beach Seine 1 of 2							17	1		1	5	1					1										1			63		1			2	93
1A-3 Beach Seine 2 of 2							31										1													4						36
2-2 Beach Seine 1 of 2				1			12					14	1				4													19					10	61
2-2 Beach Seine 2 of 2				8			23					8																		13				1	5	58
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3							3																													3
3-1 Purse Seine 3 of 3	3						4																													7
1B-2 Beach Seine 1 of 2							6				4	1					15										1			30					3	60
1B-2 Beach Seine 2 of 2				1			3	1					4				11													12					3	35
June 2004 subtotal	5	0	0	11	0	0	142	2	0	1	29	30	7	0	0	0	38	0	0	0	0	0	0	0	0	0	2	0	0	192	0	1	0	1	23	484
Date: 07-12-04																																				
1A-4 Beach Seine 1 of 4							4																													4
1A-4 Beach Seine 2 of 4											6						1																			7
1A-4 Beach Seine 3 of 4																																				0
1A-4 Beach Seine 4 of 4							3			2																										5
1A-6 Fyke net											2						1																			3
1A-7 Fyke net							133																													133
1A-10 Fyke net							1				4						7																			12
1A-1 Otter Trawl 1 of 2												4																								4
1A-1 Otter Trawl 2 of 2																																				0
1B-1 Otter Trawl 1 of 2	1																																			1
1B-1 Otter Trawl 2 of 2												2																							1	3
1A-2 Otter Trawl 1 of 2												4																								4
1A-2 Otter Trawl 2 of 2												1																								1
2-1 Otter Trawl 1 of 2																														6						6
2-1 Otter Trawl 2 of 2												5	1																	3					1	10
1A-3 Beach Seine 1 of 2							1	1			4						5													38						49
1A-3 Beach Seine 2 of 2							2										9													13						24
Date: 07-13-04																																				
2-2 Beach Seine 1 of 2							2					2					3													1						8
2-2 Beach Seine 2 of 2							5				1	4																		8						18
3-1 Purse Seine 1 of 3													5																1							6
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
1B-2 Beach Seine 1 of 2																														3						3
1B-2 Beach Seine 2 of 2							3										1													34						38
July 2004 subtotal	1	0	0	0	0	0	154	1	0	2	17	22	6	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0	1	106	0	0	0	0	2	339
Total juvenile and adult fish in 2004	33	5	0	29	0	1	1,825	3	0	11	91	128	173	0	0	0	70	1	8	0	0	0	0	30	4	0	19	0	3	326	6	26	2	8	74	2,876

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 03-9-05																																				
1A-4 Beach Seine 1 of 4																																				0
1A-4 Beach Seine 2 of 4											3																1									4
1A-4 Beach Seine 3 of 4																																				0
1A-4 Beach Seine 4 of 4																																		1		1
1A-6 Fyke net																																				0
1A-7 Fyke net																																				0
1A-10 Fyke net										1																	1									2
1A-1 Otter Trawl 1 of 2											1																									1
1A-1 Otter Trawl 2 of 2																																				0
1B-2 Beach Seine 1 of 2			1				9																													10
1B-2 Beach Seine 2 of 2							13																													13
1A-2 Otter Trawl 1 of 3				3								1	1																							5
1A-2 Otter Trawl 2 of 3																																				0
1A-2 Otter Trawl 3 of 3											2		7																							9
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2																																				0
2-2 Beach Seine 1 of 2							3																													3
2-2 Beach Seine 2 of 2							45																													45
1A-3 Beach Seine 1 of 3													3						1								1									5
1A-3 Beach Seine 2 of 3																																				0
1A-3 Beach Seine 3 of 3																																				0
Date: 03-10-05																																				
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
1B-1 Beach Seine 1 of 2																																				0
1B-1 Beach Seine 2 of 2																																				0
Date: 03-23-05																																				
1A-4 Beach Seine 1 of 4													1														1									2
1A-4 Beach Seine 2 of 4																																				0
1A-4 Beach Seine 3 of 4							8												1																	9
1A-4 Beach Seine 4 of 4			1				2																													3
1A-6 Fyke net																				1													1			2
1A-7 Fyke net																																				0
1A-10 Fyke net							5												1											1						7
1A-1 Otter Trawl 1 of 3																																				0
1A-1 Otter Trawl 2 of 3																																				0
1A-1 Otter Trawl 3 of 3																																				0
1B-2 Beach Seine 1 of 2											1																									1
1B-2 Beach Seine 2 of 2							2				2																									4
1A-2 Otter Trawl 1 of 2																																				0
1A-2 Otter Trawl 2 of 2											3		1																	1						5
1B-1 Beach Seine 1 of 2																																				0
1B-1 Beach Seine 2 of 2											1																									1
1A-3 Beach Seine 1 of 3							3						1						2																	6
1A-3 Beach Seine 2 of 3							4						6						1																	11
1A-3 Beach Seine 3 of 3							2																							1						3
Date: 03-24-05																																				
3-1 Purse Seine 1 of 3																			1																	1
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2																																				0
2-2 Beach Seine 1 of 2							29				4								3																	36
2-2 Beach Seine 2 of 2							9				3								1																	13
March 2005 subtotal	0	0	2	3	0	0	134	0	0	1	20	1	20	0	0	0	0	0	11	0	1	0	0	0	0	0	4	0	0	3	0	0	1	1	0	202

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 04-20-05																																				
1A-6 Fyke net																																				0
1A-7 Fyke net																																		1		1
1A-10 Fyke net			2																1																	3
1A-4 Beach Seine 1 of 4																																				0
1A-4 Beach Seine 2 of 4																																				0
1A-4 Beach Seine 3 of 4				1			1			1																										3
1A-4 Beach Seine 4 of 4				1			2																													3
1A-3 Beach Seine 1 of 2							19																				2									21
1A-3 Beach Seine 2 of 2							1				1																1									3
2-2 Beach Seine 1 of 2							66												1								1				1					69
2-2 Beach Seine 2 of 2				3			227												2																	232
1A-2 Otter Trawl 1 of 2												1																								1
1A-2 Otter Trawl 2 of 2												1																								1
2-1 Otter Trawl 1 of 2											1																									1
2-1 Otter Trawl 2 of 2																																				0
3-1 Purse Seine 1 of 3																																				0
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
Date: 04-21-05																																				0
1B-2 Beach Seine 1 of 3																			1																	1
1B-2 Beach Seine 2 of 3							8																													8
1B-2 Beach Seine 3 of 3			1				41												2																	44
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																				0
1B-1 Beach Seine 1 of 2																																				0
1B-1 Beach Seine 2 of 2																																				0
April 2005 subtotal	0	0	3	5	0	0	365	0	0	1	2	2	0	0	0	0	0	0	7	0	0	0	0	0	0	0	4	0	0	0	1	0	0	1	0	391

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 05-05-05																																				
1A-6 Fyke net																														3						3
1A-7 Fyke net							6																							23						29
1A-10 Fyke net																																		1		1
1A-4 Beach Seine 1 of 4							1										1																			2
1A-4 Beach Seine 2 of 4							3																													3
1A-4 Beach Seine 3 of 4							5			12																				22				1		40
1A-4 Beach Seine 4 of 4				1																																1
1A-3 Beach Seine 1 of 3										1							2													1							4
1A-3 Beach Seine 2 of 3													1						3											3							7
1A-3 Beach Seine 3 of 3																	1										2			1							4
2-2 Beach Seine 1 of 2							25																				1								1	27
2-2 Beach Seine 2 of 2							15												2														1				18
1A-2 Otter Trawl 1 of 2				1								3																		1						5
1A-2 Otter Trawl 2 of 2				1							1	1																								3
1B-2 Beach Seine 1 of 2			1				29						15																						5	50
1B-2 Beach Seine 2 of 2							5																							6						11
3-1 Purse Seine 1 of 2																																				0
3-1 Purse Seine 2 of 2																																				0
Date: 05-06-05																																				
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2												1																				2				3
1B-1 Beach Seine 1 of 2																														1						1
1B-1 Beach Seine 2 of 2																																				0
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2	1																1																		1	3
Date: 05-18-05																																				
1A-6 Fyke net										1									1											2							4
1A-7 Fyke net							4																							8							12
1A-10 Fyke net																														2				1		3
1A-4 Beach Seine 1 of 5							5																													5
1A-4 Beach Seine 2 of 5							5			1																											6
1A-4 Beach Seine 3 of 5							1			2			1						1																		5
1A-4 Beach Seine 4 of 5							1			2																				5				1		9
1A-4 Beach Seine 5 of 5							2																							4						6
1A-2 Otter Trawl 1 of 2										1														1						1						3
1A-2 Otter Trawl 2 of 2											1	1					1										3									6
1B-1 Beach Seine 1 of 2																																				0
1B-1 Beach Seine 2 of 2																																				0
3-1 Purse Seine 1 of 3																																	1			1
3-1 Purse Seine 2 of 3																																				0
3-1 Purse Seine 3 of 3																																				0
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																				0
Date: 05-19-05																																				
1B-2 Otter Trawl 1 of 3			1				3																												1	5
1B-2 Otter Trawl 2 of 3							7						1				1													9					2	20
1B-2 Otter Trawl 3 of 3							8										1													11				1	2	23
1A-3 Beach Seine 1 of 2							6						8						5											15				1		35
1A-3 Beach Seine 2 of 2							6			1	3		1				2		1								1			28	1				4	48
2-2 Beach Seine 1 of 2							25						1																						2	28
2-2 Beach Seine 2 of 2							22						1																	2					6	31
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2												1																								1
May 2005 subtotal	1	0	2	3	0	0	184	0	0	21	5	7	29	0	0	0	10	0	13	0	0	0	0	0	1	0	7	0	0	148	1	2	4	4	24	466

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 06-29-05																																				
1A-6 Fyke net							2					2																								4
1A-7 Fyke net							2					4																		1						7
1A-10 Fyke net																																		1		1
1A-4 Beach Seine 1 of 4							3				4	3					2													7						19
1A-4 Beach Seine 2 of 4							1																							3						4
1A-4 Beach Seine 3 of 4							7					1																		15						23
1A-4 Beach Seine 4 of 4							4			1																										5
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																				0
1A-2 Otter Trawl 1 of 2												2													2						1					5
1A-2 Otter Trawl 2 of 2				3								18																		1	1					23
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																				0
Date: 06-30-05																																				
1B-2 Beach Seine 1 of 2							18					24	1				1								1		1			26	1				1	74
1B-2 Beach Seine 2 of 2							27					58	7				6													18	1				10	127
3-1 Purse Seine 1 of 3	2						1																													3
3-1 Purse Seine 2 of 3													5																							5
3-1 Purse Seine 3 of 3							1						35																							36
1B-1 Beach Seine 1 of 2												4																		1	2					7
1B-1 Beach Seine 2 of 2												4																								4
1A-3 Beach Seine 1 of 2							4			1	6	6	4																	18	1					40
1A-3 Beach Seine 2 of 2							26				3	43					3													21					6	102
2-1 Otter Trawl 1 of 2																																				0
2-1 Otter Trawl 2 of 2												1															1					1			2	5
2-2 Beach Seine 1 of 2							25					12					4													19	8				7	75
2-2 Beach Seine 2 of 2							12					2	7				3														1					25
June 2005 subtotal	2	0	0	3	0	0	133	0	0	2	13	184	59	0	0	0	19	0	0	0	0	0	0	0	3	0	2	0	0	130	16	1	0	1	26	594

Table B-1. Juvenile and adult sampling results for the Napa River Fish Monitoring, July 2001–July 2002, January–July 2003, March–July 2004, and March–July 2005.

Location Code/ Gear Type/ Replicate Number	American shad	Black crappie	Bluegill	Carp	Channel catfish	Golden shiner	Inland silverside	Largemouth bass	Mosquitofish	Rainwater killifish	Shimofuri goby	Striped bass	Threadfin shad	Wakasagi	White catfish	White crappie	Yellowfin goby	Chinook salmon	Chum salmon	Delta smelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Speckled sanddab	Staghorn sculpin	Prickly/Staghorn sculpin	Sacramento pikeminnow	Sacramento splittail	Sacramento sucker	Starry flounder	Steelhead	Threespine stickleback	Tule perch	Total
	Introduced																	Native																			
Date: 07-28-05																																				
1A-6 Fyke net							2										12										1									15
1A-7 Fyke net							3						2																							5
1A-10 Fyke net																																				0
1A-4 Beach Seine 1 of 4							12				1		6																							19
1A-4 Beach Seine 2 of 4																																				0
1A-4 Beach Seine 3 of 4											1																									1
1A-4 Beach Seine 4 of 4										1							1																			2
1A-1 Otter Trawl 1 of 2																																				0
1A-1 Otter Trawl 2 of 2																																				0
1A-2 Otter Trawl 1 of 2																																				0
1A-2 Otter Trawl 2 of 2				1								10	13											4												28
1A-1 Otter Trawl 1 of 2																								1											1	2
1A-1 Otter Trawl 2 of 2																																				0
1A-3 Beach Seine 1 of 2							1						8				1										3			16						29
1A-3 Beach Seine 2 of 2							3				1																			1						5
1B-2 Beach Seine 1 of 2							1						9																							10
1B-2 Beach Seine 2 of 2							4						1																							5
2-2 Beach Seine 1 of 2													52				1																			53
2-2 Beach Seine 2 of 2							1				2		19																	7						29
Date: 07-29-05																																				
1B-2 Beach Seine 1 of 2																																				0
1B-2 Beach Seine 2 of 2																																				0
3-1 Purse Seine 1 of 2							2						4											3												9
3-1 Purse Seine 2 of 2							15						17											8												40
1B-1 Beach Seine 1 of 2				1								2																							1	4
1B-1 Beach Seine 2 of 2												6	3			1									1											11
2-1 Otter Trawl 1 of 2												56	32			4																			2	94
2-1 Otter Trawl 2 of 2												57	64			5	2								2		3							23	156
July 2005 subtotal	0	0	0	2	0	0	44	0	0	1	5	131	230	0	0	10	17	0	0	0	0	0	0	16	3	0	7	0	0	24	0	0	0	0	27	517
March-July 2005 subtotal of juvenile and adult fish	3	0	7	16	0	0	860	0	0	26	45	325	338	0	0	10	46	0	31	0	1	0	0	16	7	0	24	0	0	305	18	3	5	7	77	2,170
Total juvenile and adult fish, 2001, 2002, 2003, 2004, and 2005	49	107	8	55	1	3	5,549	4	9	40	619	1,063	1,332	1	1	10	284	4	39	1	11	1	3	4,032	16	8	418	98	3	762	44	88	8	83	207	14,961

Table B-2. Larval Fish Sampling Results for Napa River Fish Monitoring, March 2001–July 2002, January 2003–July 2003, March 2004–July 2004, and March 2005–July 2005.

Location Code/ Gear Type/ Replicate Number	Inland silverside	Shimofuri goby	Striped bass	Threadfin shad	Yellowfin goby	Arrow goby	Bay goby	Delta smelt	Jacksmelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Sacramento splittail	Sacramento sucker	Starry flounder	Threespine stickleback	Tule perch	Tridentiger spp. (Gobidae spp.)	Unidentified smelt	Unidentified centrarchid	Unidentified damaged	Total
	Introduced					Native																		
Date: 3-24-01																								
1A-1 CDFG 20-mm tow-net 1 of 3											2,917		15	12										2,944
1A-1 CDFG 20-mm tow-net 2 of 3		1			2			3			4,663		22	33										4,724
1A-1 CDFG 20-mm tow-net 3 of 3		9									3,974		7	8										3,998
1B-1 CDFG 20-mm tow-net 1 of 3								9			900		4	32										945
1B-1 CDFG 20-mm tow-net 2 of 3					3			19			955			89										1,066
1B-1 CDFG 20-mm tow-netl 3 of 3								12			494			31										537
2-1 CDFG 20-mm tow-net 1 of 3								4			98			35										137
2-1 CDFG 20-mm tow-net 2 of 3								8			78			67										153
2-1 CDFG 20-mm tow-net 3 of 3								4			74			67										145
March 2001Subtotal	0	10	0	0	5	0	0	59	0	0	14,153	0	48	374	0	0	0	0	0	0	0	0	0	14,649
Date: 4-7-01																								
1A-1 CDFG 20-mm tow-net 1 of 3					59			253			3,383		221	3										3,919
1A-1 CDFG 20-mm tow-net 2 of 3	1				23		3	259			3,453		432	12								1		4,183
1A-1 CDFG 20-mm tow-net 3 of 3		3			29		4	275			2,812		458	10										3,591
1B-1 CDFG 20-mm tow-net 1 of 3					14			439			673		92	39							1	1		1,258
1B-1 CDFG 20-mm tow-net 2 of 3					20			515			563		58	32										1,188
1B-1 CDFG 20-mm tow-netl 3 of 3					7			788			503		126	39										1,463
2-1 CDFG 20-mm tow-net 1 of 3					3			289			145		8	208										653
2-1 CDFG 20-mm tow-net 2 of 3					2			194			140		8	175								1		519
2-1 CDFG 20-mm tow-net 3 of 3					3			263			103		8	84										461
April 2001 Subtotal	1	3	0	0	160	0	7	3,275	0	0	11,775	0	1,411	602	0	0	0	0	0	0	1	3	0	17,235
Date: 5-5-01																								
1A-1 CDFG 20-mm tow-net 1 of 3		798		1	461		478	20		3	616	19	81											2,477
1A-1 CDFG 20-mm tow-net 2 of 3		822			646		1130	21	1	6	1,473	25	105		1									4,230
1A-1 CDFG 20-mm tow-net 3 of 3		457	676			9	104	17	1	2	652		79											1,997
1B-1 CDFG 20-mm tow-net 1 of 3		962			266		61	87		9	251	2	37	1								1		1,676
1B-1 CDFG 20-mm tow-net 2 of 3		1071			328		85	92		10	314		34											1,934
1B-1 CDFG 20-mm tow-netl 3 of 3		1004			491		102	75		6	331	3	39		1									2,052
2-1 CDFG 20-mm tow-net 1 of 3		573	1		276		2	50		10	134					1		1						1,048
2-1 CDFG 20-mm tow-net 2 of 3		537	1		587		13	68		16	171		2									1		1,395
2-1 CDFG 20-mm tow-net 3 of 3		1658			64		13	132		18	232		15											2,132
May 2001 Subtotal	0	7,882	678	1	3,119	9	1,988	562	2	80	4,174	49	392	1	2	1	0	1	0	0	0	2	0	18,941

Location Code/ Gear Type/ Replicate Number	Inland silverside	Shimofuri goby	Striped bass	Threadfin shad	Yellowfin goby	Arrow goby	Bay goby	Delta smelt	Jacksmelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Sacramento splittail	Sacramento sucker	Starry flounder	Threespine stickleback	Tule perch	Tridentiger spp. (Gobidae spp.)	Unidentified smelt	Unidentified centrarchid	Unidentified damaged	Total
	Introduced					Native																		
Date: 6-4-01																								
1A-1 CDFG 20-mm tow-net 1 of 3		399			1							7												407
1A-1 CDFG 20-mm tow-net 2 of 3		237										4												241
1A-1 CDFG 20-mm tow-net 3 of 3		432									1	2												435
1B-1 CDFG 20-mm tow-net 1 of 3		1										1												2
1B-1 CDFG 20-mm tow-net 2 of 3		739										1												740
1B-1 CDFG 20-mm tow-netl 3 of 3		806										1												807
2-1 CDFG 20-mm tow-net 1 of 3		493		1				1																495
2-1 CDFG 20-mm tow-net 2 of 3		426																						426
2-1 CDFG 20-mm tow-net 3 of 3	1	185											1											187
June 2001 Subtotal	1	3,718	0	1	1	0	0	1	0	0	1	16	1	0	0	0	0	0	0	0	0	0	0	3,740
2001 Subtotal of larval fish	2	11,613	678	2	3,285	9	1,995	3,897	2	80	30,103	65	1,852	977	2	1	0	1	0	0	1	5	0	54,565
Date: 3/25/02																								
1A-6 Fyke												2	2										6	10
1A-7 Fyke																								0
1A-4 Beach Seine (North End) 1 of 2													1											1
1A-4 Beach Seine (South End) 2 of 2													11											11
1A-2 Otter Trawl 1 of 2					1							3	2										34	40
1A-2 Otter Trawl 2 of 2																							1	1
Date: 3/26/02																								
1B-1 Otter Trawl 1 of 2																								0
1B-1 Otter Trawl 2 of 2																				1				1
1A-1 Otter Trawl 1 of 2																							2	2
1A-10 Fyke																								0
March 2002 Subtotal	0	0	0	0	1	0	0	0	0	0	0	5	16	0	0	0	0	0	0	1	0	0	43	66
Date: 4/8/02																								
1A-1 Otter Trawl 1 of 2					1								1											2
1A-1 Otter Trawl 2 of 2					1																			1
2-1 Otter Trawl 1 of 1					3								2											5
1A-4 (North End) Beach Seine 1 of 4													3											3
1A-4 (North End) Beach Seine 2 of 4	2												1									5		8
1A-10 Fyke											5		6											11
Date: 4/9/02																								
2-1 Otter Trawl 1 of 3					10																		2	12
2-1 Otter Trawl 2 of 3					2																			2
1B-1 Otter Trawl 1 of 2																								0
1B-1 Otter Trawl 2 of 2					2																			2

Location Code/ Gear Type/ Replicate Number	Inland silverside	Shimofuri goby	Striped bass	Threadfin shad	Yellowfin goby	Arrow goby	Bay goby	Delta smelt	Jacksmelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Sacramento splittail	Sacramento sucker	Starry flounder	Threespine stickleback	Tule perch	Tridentiger spp. (Gobidae spp.)	Unidentified smelt	Unidentified centrarchid	Unidentified damaged	Total
	Introduced					Native																		
Date: 4/22/02																								
1A-4 Beach Seine 1 of 2													1											1
Date: 4/23/02																								
1A-1 Otter Trawl 1 of 1																								0
1B-1 Otter Trawl 1 of 2					9																		2	11
1B-1 Otter Trawl 2 of 2					1																			1
April 2002 Subtotal	2	0	0	0	29	0	0	0	0	0	5	0	14	0	0	0	0	0	0	0	0	5	4	59
Date: 5/22/02																								
2-1 Otter Trawl 1 of 3		61																						61
2-1 Otter Trawl 3 of 3		73			1																			74
1B-1 Otter Trawl 1 of 2		13																						13
May 2002 Subtotal	0	147	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148
Date: 6/21/02																								
1A-2 Otter Trawl 1 of 2		9																						9
1A-2 Otter Trawl 2 of 2		40																						40
2-1 Otter Trawl 2 of 2		63																						63
June 2002 Subtotal	0	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112
2002 Subtotal of larval fish	2	259	0	0	31	0	0	0	0	0	5	5	30	0	0	0	0	0	0	1	0	5	47	385
Date: 2/26/03																								
1A-1 Otter Trawl 1 of 2											4												2	6
1A-1 Otter Trawl 2 of 2											12												3	15
1A-2 Otter Trawl 1 of 2											41													41
February 2003 Subtotal	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0	0	0	0	0	0	0	5	62
Date: 3/13/03																								
1B-1 Otter Trawl 1 of 2											12												5	17
1B-1 Otter Trawl 2 of 2											74												9	83
2-1 Otter Trawl 1 of 2											152												38	190
2-1 Otter Trawl 2 of 2											1,262												47	1,309
1A-1 Otter Trawl 1 of 2											292												22	314
1A-1 Otter Trawl 2 of 2					2						586												45	633
1A-2 Otter Trawl 1 of 2					2						166												2	170
1A-2 Otter Trawl 2 of 2					1						155		1											157
Date: 3/27/03																								
1A-6 Fyke	1												2											3
1A-7 Fyke											3		1											4
Date:3/28/03																								
1A-1 Otter Trawl 1 of 2		1									147			1									6	155
1A-1 Otter Trawl 2 of 2											59			2									3	64
March 2003 Subtotal	1	1	0	0	5	0	0	0	0	0	2,908	0	4	3	0	0	0	0	0	0	0	0	177	3,099

Location Code/ Gear Type/ Replicate Number	Inland silverside	Shimofuri goby	Striped bass	Threadfin shad	Yellowfin goby	Arrow goby	Bay goby	Delta smelt	Jacksmelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Sacramento splittail	Sacramento sucker	Starry flounder	Threespine stickleback	Tule perch	Tridentiger spp. (Gobidae spp.)	Unidentified smelt	Unidentified centrarchid	Unidentified damaged	Total
	Introduced					Native																		
Date: 4/10/03																								
1A-1 Otter Trawl 1 of 2											2													2
1A-1 Otter Trawl 2 of 2											8													8
1B-1 Otter Trawl 1 of 2											53		1										1	55
1B-1 Otter Trawl 2 of 2											14												4	18
2-1 Otter Trawl 1 of 2											2													2
1A-2 Otter Trawl 1 of 2					5						246						1						3	255
1A-2 Otter Trawl 2 of 2											202			1			1							204
Date: 4/11/03																								
1A-6 Fyke											21													21
Date: 4/24/03																								
1A-1 Otter Trawl 1 of 2											2		1											3
1A-1 Otter Trawl 2 of 2											3													3
1A-2 Otter Trawl 1 of 2											11													11
1A-2 Otter Trawl 2 of 2		1									15													16
Date: 4/25/03																								
1A-6 Fyke											1													1
1A-7 Fyke		1									2		5											8
April 2003 Subtotal	0	2	0	0	5	0	0	0	0	0	582	0	7	1	0	0	2	0	0	0	0	0	8	607
Date: 6/7/03																								
1A-6 Fyke			4																					4
1A-7 Fyke			1																					1
2-1 Otter Trawl 1 of 2			73																					73
2-1 Otter Trawl 2 of 2			21																					21
1A-4 Beach Seine 1 of 4			11																					11
Date: 6/8/03																								
1A-1 Otter Trawl 1 of 2			3																					3
1A-1 Otter Trawl 2 of 2			9																					9
2-1 Otter Trawl 1 of 2			27																					27
1B-1 Otter Trawl 1 of 2			30																					30
1B-1 Otter Trawl 2 of 2			33																					33
1A-2 Otter Trawl 1 of 2			13																					13
1A-2 Otter Trawl 2 of 2			5																					5
1A-3 Beach Seine 1 of 2			2																					2
1A-3 Beach Seine 2 of 2			5																					5
June 2003 Subtotal	0	0	237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	237
Date: 7/24/03																								
2-1 Otter Trawl 1 of 2			1																					1
1B-1 Otter Trawl 1 of 2			1																					1
July 2003 Subtotal	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2003 Subtotal of larval fish	1	3	239	0	10	0	0	0	0	0	3,547	0	11	4	0	0	2	0	0	0	0	0	190	4,007

Location Code/ Gear Type/ Replicate Number	Inland silverside	Shimofuri goby	Striped bass	Threadfin shad	Yellowfin goby	Arrow goby	Bay goby	Delta smelt	Jacksmelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Sacramento splittail	Sacramento sucker	Starry flounder	Threespine stickleback	Tule perch	Tridentiger spp. (Gobidae spp.)	Unidentified smelt	Unidentified centrarchid	Unidentified damaged	Total
	Introduced					Native																		
Date: 4/15/04																								
2-1 Otter Trawl 1of 3																			10					10
1A-2 Otter Trawl 2 of 2													1										2	3
Date: 4/16/04																								
1A-6 Fyke											16		9											25
1A-10 Fyke													6											6
Date: 4/30/04																								
2-1 Otter Trawl 2 of 2					2								1										1	4
1A-2 Otter Trawl 1 of 2											1													1
1A-2 Otter Trawl 2 of 2											3												1	4
April 2004 Subtotal	0	0	0	0	2	0	0	0	0	0	20	0	17	0	0	0	0	0	10	0	0	0	4	53
Date: 05/14/04																								
2-1 Otter Trawl 1 of 2		1																						1
2-1 Otter Trawl 2 of 2		10																						10
Date: 05/13/04																								
1A-1 Otter Trawl 1 of 2																				12				12
May 2004 Subtotal	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	23
Date: 6/15/04																								
2-1 Otter Trawl 1 of 2		23																					2	25
June 2004 Subtotal	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	25
2004 Subtotal of larval fish	0	34	0	0	2	0	0	0	0	0	20	0	17	0	0	0	0	0	10	12	0	0	6	101
Date: 4/20/05																								
1A-2 Otter Trawl 2 of 2		2																						2
1A-6 Fyke Net		1									1													2
April 2005 Subtotal	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4

Location Code/ Gear Type/ Replicate Number	Inland silverside	Shimofuri goby	Striped bass	Threadfin shad	Yellowfin goby	Arrow goby	Bay goby	Delta smelt	Jacksmelt	Long-jawed mudsucker	Longfin smelt	Northern anchovy	Pacific herring	Prickly sculpin	Sacramento splittail	Sacramento sucker	Starry flounder	Threespine stickleback	Tule perch	Tridentiger spp. (Gobidae spp.)	Unidentified smelt	Unidentified centrarchid	Unidentified damaged	Total
	Introduced					Native																		
Date: 5/5/05																								
1A-6 Fyke													1											1
1A-2 Otter Trawl 1 of 2					2																			2
1B-1 Beach Seine 1 of 2		1																						1
Date: 5/18/05																								
1A-1 Otter Trawl 1 of 2											1													1
1A-2 Otter Trawl 1 of 2					1						1													2
1A-2 Otter Trawl 2 of 2		1			2						3													6
1B-1 Beach Seine 2 of 2		1																						1
1A-7 Fyke Net		1																						1
May 2005 Subtotal	0	4	0	0	5	0	0	0	0	0	5	0	1	0	0	0	0	0	0	0	0	0	0	15
Date: 6/29/05																								
1A-1 Otter Trawl 1 of 2		41	2																					43
2-1 Otter Trawl 2 of 2			4	1									5											10
Date: 6/30/05																								
1A-3 Beach Seine 1 of 3																							1	1
1A-3 Beach Seine 3 of 3		2											3											5
1B-2 Beach Seine 1 of 2				1									1											2
1B-1 Otter Trawl 1 of 2		89	1																				5	95
1B-1 Otter Trawl 2 of 2		275	9		1								1							40			7	333
2-1 Otter Trawl 1 of 2		82	3																				7	92
2-1 Otter Trawl 2 of 2		263	6	2	1								5							15				292
June 2005 Subtotal	0	752	25	4	2	0	0	0	0	0	0	0	15	0	0	0	0	0	0	55	0	0	20	873
Date: 7/29/05																								
2-1 Otter Trawl 1 of 2		8																					4	12
2-1 Otter Trawl 2 of 2		23																						23
1B-1 Otter Trawl 2 of 2		1																						1
July 2005 Subtotal	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	36
2005 Subtotal of larval fish	0	791	25	4	7	0	0	0	0	0	6	0	16	0	0	0	0	0	0	55	0	0	24	928
Total larval fish, 2001, 2002, 2003, 2004, and 2005	5	12,700	942	6	3,335	9	1,995	3,897	2	80	33,681	70	1,926	981	2	1	2	1	10	68	1	10	267	59,991

Appendix C

Table C-1. Napa River Fisheries Monitoring Program environmental conditions during juvenile and adult fish sampling, 2001–2005.

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
7/16/2001	1A-9	21.7	21.7	17.4	15.6	0.6	5.8	-	2.5	Clear	1.6
7/16/2001	3-1	24	23.1	7.6	9.3	0.6	6.4	5.0	4.5	Clear	1.0
7/16/2001	1A-2	20.8	20.8	17.1	17.3	0.6	4.3	0.0	6.0	Clear	1.5
7/16/2001	3-1	24	23.1	7.6	9.3	0.6	6.4	5.0	4.5	Clear	1.0
7/17/2001	1A-8	25.6	25.6	13.9	14.3	0.9	9.9	10.8	0.6	Clear	1.2
7/17/2001	1A-5	23.8	23.8	10.1	12.9	0.6	5.9	5.7	0.6	Clear	1.5
7/17/2001	1A-6	26.9	26.9	17.2	18.1	0.9	8.9	9.9	1.5	Clear	1.2
7/17/2001	1A-3	23.5	23.6	10.0	9.8	0.6	5.5	5.6	0.3	Clear	1.7
7/17/2001	1A-7	26.8	26.7	10.4	11.7	0.9	8.7	8.6	0.6	Clear	1.5
7/17/2001	1A-10	26.9	26.5	18.2	18.2	0.8	6.0	6.0	1.0	Clear	1.5
8/14/2001	1A-4	19.2	19.2	20.7	20.7	0.3	2.7	2.7	0.3	Overcast	1.7
8/14/2001	1A-4	19.2	19.2	20.7	20.7	0.3	2.7	2.7	0.3	Clear	1.6
8/14/2001	1A-10	23.6	23.6	20.6	20.6	0.6	7.4	7.4	1.3	Overcast	1.1
8/14/2001	1A-8	24.8	24.9	20.5	20.6	0.6	9.6	9.9	0.4	Clear	1.1
8/14/2001	1A-7	26.9	26.9	20.6	26.9	-	10.7	10.7	0.3	Clear	1.2
8/14/2001	1A-6	25.8	25.7	20.9	20.9	0.6	9.1	9.5	1.2	Clear	1.3
8/14/2001	1A-3	25.2	25.4	19.6	19.5	1.8	5.3	5.4	0.6	Clear	1.3
8/14/2001	1A-5	23.9	23.6	20.1	20.1	0.3	5.1	4.8	0.6	Clear	0.4
8/15/2001	2-1	23.6	22.5	19.3	19.4	0.5	5.8	3.0	7.0	Clear	0.5
8/15/2001	1B-1	23.3	21.8	19.3	20.8	0.3	6.8	4.1	5.0	Clear	0.5
8/15/2001	1A-9	21	21.5	20.7	20.3	0.4	3.5	3.8	3.0	Overcast	0.7
8/15/2001	3-1	23.3	23.4	17.1	17.4	0.5	5.6	5.4	5.1	Clear	1.1
8/15/2001	1A-1	22.8	21.6	20.3	20.6	0.6	5.9	3.6	6.0	Clear	1.5
8/15/2001	1A-2	23.8	23.5	20.9	20.8	0.5	6.5	6.0	1.5	Overcast	1.4
9/11/2001	1A-4	20.1	20.1	21.6	21.9	0.5	3.1	0.1	1.0	Clear	1.3
9/11/2001	1A-4	20.1	20.1	21.6	21.9	0.5	3.1	0.1	1.0	Clear	1.3

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
9/11/2001	1A-9	20.4	20.7	22.2	22.2	0.6	3.9	3.6	3.3	Clear	0.7
9/11/2001	1A-9	20.4	20.7	22.2	22.2	0.6	3.9	3.6	3.3	Clear	0.7
9/11/2001	3-1	22.6	21.9	18.0	19.4	0.5	5.7	4.1	3.3	Clear	1.1
9/11/2001	3-1	22.6	21.9	18.0	19.4	0.5	5.7	4.1	3.3	Clear	1.4
9/11/2001	2-1	22.6	21.6	20.3	21.3	0.4	7.0	3.4	3.4	Clear	1.2
9/11/2001	1B-1	22.6	21.2	21.3	21.8	0.5	7.8	4.0	5.1	Clear	1.0
9/11/2001	1A-1	22.7	20.6	22.2	22.0	0.5	6.2	3.5	5.5	Clear	1.0
9/11/2001	1A-2	24.6	24.3	22.7	22.7	0.6	7.8	8.1	1.4	Clear	1.2
10/11/2001	1A-3	21.4	21.4	19.9	19.9	0.5	9.8	9.8	0.3	Overcast	1.5
10/11/2001	1A-4	17.8	17.8	20.9	20.9	0.5	7.4	7.4	0.2	Overcast	1.8
11/8/2001	1A-10	16.2	16.2	18.4	18.4	-	9.4	10.1	0.8	Clear	1.3
11/8/2001	1A-9	15.1	15.1	18.5	18.5	0.7	5.2	1.2	2.3	Clear	1.9
11/8/2001	1A-6	15.4	15.2	18.5	18.5	0.8	5.6	4.7	1.5	Clear	0.9
11/8/2001	3-1	15.4	15.6	15.0	15.8	0.6	4.5	3.9	7.3	Clear	1.5
11/8/2001	2-1	16.1	15.8	16.9	17.5	0.8	4.9	4.0	5.0	Clear	1.5
11/8/2001	1B-1	16.1	15.7	17.6	17.7	0.8	4.9	4.5	5.2	Clear	1.5
11/8/2001	1A-3	16.1	15.7	17.6	17.7	0.8	4.9	4.5	5.2	Clear	1.0
11/8/2001	1A-1	16	15.7	17.9	17.9	0.7	5.5	5.9	5.4	Clear	0.9
11/8/2001	1A-3	16.1	15.7	17.6	17.7	0.8	4.9	4.5	5.2	Clear	1.0
11/9/2001	1A-6	17.7	17.7	18.3	18.3	0.6	14.6	14.7	1.8	Clear	1.9
11/9/2001	1A-3	14.7	14.4	17.9	17.8	0.6	4.6	4.5	0.6	Clear	1.8
11/9/2001	1A-5	15.1	15.1	18.4	18.3	0.6	5.7	5.3	0.6	Clear	1.8
11/9/2001	1A-7	15.2	15.2	18.6	18.6	0.6	5.2	5.6	0.7	Clear	1.9
11/9/2001	1A-8	15.2	15.2	18.6	18.6	0.0	5.1	4.4	0.9	Clear	1.9
11/9/2001	1A-4	15.4	15.3	18.6	18.6	0.0	5.4	5.4	0.6	Clear	2.1
11/9/2001	1A-3	14.7	14.4	14.9	17.8	0.6	4.6	4.5	0.6	Overcast	1.8
12/10/2001	1A-1	11.6	11.5	0.3	0.3	0.2	9.5	9.5	6.3	Clear	0.9
12/10/2001	1A-3	11.9	12.0	0.2	0.2	0.2	9.8	9.8	0.6	Clear	1.8
12/10/2001	1A-4	11.7	11.7	0.5	0.5	0.2	8.8	8.8	0.6	Clear	1.8

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
12/10/2001	1A-4	11.6	11.6	0.4	0.4	0.3	9.5	9.5	0.6	Clear	2.4
2/25/2002	1A-1	14.9	14.4	3.3	3.6	0.3	11.2	10.4	8.0	Clear	2.1
2/25/2002	1A-3	14.2	13.9	0.9	0.9	0.2	10.7	11.0	0.5	Clear	2.4
2/25/2002	1A-3	14.2	13.9	0.9	0.9	0.2	10.7	11.0	0.5	Clear	2.4
2/25/2002	1A-4	14.4	14.4	2.2	2.1	0.2	10.7	10.3	0.5	Clear	2.1
2/25/2002	1A-4	14.4	14.4	2.2	2.1	0.2	10.7	10.3	0.5	Clear	2.1
2/25/2002	1A-4	14.8	14.8	2.4	2.5	0.1	10.8	9.9	0.5	Clear	2.1
2/25/2002	1A-4	14.7	14.7	3.2	2.9	0.2	10.8	10.4	0.5	Clear	2.2
2/25/2002	1B-1	14.3	13.6	0.3	0.7	0.4	11.3	11.1	7.0	Clear	2.1
3/25/2002	1A-2	15.4	14.5	2.9	3.2	0.3	9.4	8.7	2.0	Overcast	2.1
3/25/2002	1A-3	15.2	14.8	0.3	0.3	0.5	10.0	9.9	0.5	Clear	1.4
3/25/2002	1A-4	14.5	14.4	2.5	2.5	0.2	8.5	8.0	0.5	Overcast	2.1
3/25/2002	1A-4	15.3	15.2	2.6	2.6	0.2	9.6	9.6	0.6	Overcast	2.1
3/25/2002	1A-6	15.3	15.2	2.6	2.6	0.2	9.6	9.6	0.6	Overcast	2.2
3/25/2002	1A-7	17.0	16.9	2.3	2.3	0.2	11.4	11.2	0.6	Overcast	2.2
3/25/2002	1A-7	17.0	16.9	2.3	2.3	0.2	11.4	11.2	0.6	Overcast	2.2
3/25/2002	1A-8	16.8	16.9	1.6	1.6	0.2	15.1	15.1	0.6	Overcast	2.2
3/26/2002	1A-1	15.4	14.2	1.3	5.4	0.4	9.9	2.0	8.0	Clear	2.1
3/26/2002	1A-10	16.5	16.3	3.4	3.4	0.3	9.8	9.7	1.2	Clear	2.2
3/26/2002	1A-9	14.6	14.7	2.3	3.2	0.2	9.0	1.8	1.5	Clear	2.2
3/26/2002	1A-9	14.6	14.7	2.3	3.2	0.2	9.0	1.8	1.5	Clear	2.2
3/26/2002	1B-1	14.5	14.0	0.7	0.7	0.4	9.6	9.0	7.0	Clear	2.1
3/26/2002	2-1	13.9	13.4	0.2	0.2	0.5	9.4	9.4	4.5	Clear	1.8
4/8/2002	1A-1	17.5	17.2	2.3	3.7	0.2	8.7	6.9	6.6	Overcast	1.5
4/8/2002	1A-1	17.5	17.2	2.3	3.7	0.2	8.7	6.9	6.6	Overcast	1.5
4/8/2002	1A-10	19.1	19.2	3.3	3.3	0.2	13.2	13.9	0.9	Overcast	1.9
4/8/2002	1A-4	17.2	17.0	0.9	1.7	0.3	8.0	8.5	0.6	Overcast	1.8
4/8/2002	1A-4	17.2	17.2	3.5	3.4	0.2	7.2	8.0	0.5	Overcast	2.0
4/8/2002	1A-4	17.3	17.3	4.2	4.2	0.2	7.2	6.9	0.6	Overcast	1.9

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
4/8/2002	1A-6	19.2	19.2	3.4	3.5	0.2	12.6	12.3	0.7	Overcast	1.9
4/8/2002	1A-7	19.2	19.2	3.4	3.5	0.2	12.6	12.3	0.7	Overcast	1.9
4/8/2002	2-1	17.3	17.3	4.3	4.3	0.2	7.6	7.2	20.0	Overcast	1.8
4/9/2002	1A-8	17.0	17.0	4.3	4.3	0.3	7.7	7.7	1.0	Overcast	1.9
4/9/2002	1A-9	17.0	17.1	4.2	4.1	0.2	8.2	8.2	1.5	Overcast	1.5
4/9/2002	1B-1	16.8	16.7	1.5	2.0	0.2	8.8	8.2	4.4	Overcast	1.8
4/9/2002	1B-1	16.8	16.7	1.5	2.0	0.2	8.8	8.2	4.4	Overcast	1.8
4/9/2002	2-1	16.4	16.3	0.5	0.6	0.5	9.5	8.7	5.3	Overcast	1.9
4/9/2002	2-1	16.4	16.3	0.5	0.6	0.5	9.5	8.7	5.3	Overcast	1.9
4/22/2002	1A-3	20.8	19.8	2.8	3.1	0.5	10.6	11.8	0.6	Clear	1.6
4/22/2002	1A-4	17.5	17.4	6.3	6.3	0.0	8.1	7.6	0.4	Clear	1.7
4/22/2002	1A-4	17.5	17.4	6.3	6.3	0.0	8.1	7.6	0.4	Clear	1.7
4/22/2002	1A-4	17.0	17.0	6.1	6.1	0.0	8.3	8.5	0.5	Clear	2.0
4/22/2002	1A-6	26.2	26.2	5.6	5.6	0.2	19.1	19.1	0.3	Clear	2.0
4/22/2002	1A-7	22.5	22.2	5.3	5.4	0.2	15.5	14.9	0.3	Clear	2.0
4/22/2002	1A-8	22.5	22.2	5.3	5.4	0.2	15.5	14.9	0.0	Clear	2.0
4/23/2002	1A-1	18.8	18.0	5.0	6.8	0.4	10.0	7.7	4.3	Clear	2.0
4/23/2002	1A-10	17.7	16.8	4.5	5.3	0.4	8.1	7.3	1.3	Clear	2.0
4/23/2002	1A-2	21.8	19.2	6.2	6.5	0.5	9.3	5.4	2.4	Clear	1.9
4/23/2002	1A-9	19.0	18.8	4.9	6.4	0.3	8.5	7.0	1.1	Clear	1.6
4/23/2002	1B-1	20.1	18.3	2.6	4.1	0.6	11.5	8.8	6.4	Clear	2.0
4/23/2002	1B-1	20.1	18.3	2.6	4.1	0.6	11.5	8.8	6.4	Clear	2.0
4/23/2002	1B-1	20.1	18.3	2.6	4.1	0.6	11.5	8.8	6.4	Clear	2.0
4/23/2002	1B-1	20.1	18.3	2.6	4.1	0.6	11.5	8.8	6.4	Clear	2.0
4/23/2002	2-1	19.1	18.3	1.8	2.4	0.5	11.0	8.3	5.3	Clear	2.0
4/23/2002	2-1	19.1	18.3	1.8	2.4	0.5	11.0	8.3	5.3	Clear	2.0
4/23/2002	3-1	17.2	17.3	0.2	0.3	0.8	10.7	9.6	8.0	Clear	1.9
5/22/2002	1A-1	19.7	18.5	6.7	6.8	0.3	7.9	6.7	5.7	Clear	4.5
5/22/2002	1A-10	20.2	20.1	8.0	8.0	0.3	6.7	6.9	0.8	Clear	1.8

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
5/22/2002	1A-2	20.7	18.6	8.1	8.3	0.2	7.1	6.2	1.7	Clear	1.5
5/22/2002	1A-7	20.5	19.2	8.2	8.3	0.3	6.9	6.4	0.2	Clear	1.8
5/22/2002	1A-8	20.2	19.3	8.1	8.2	0.2	7.0	4.0	0.4	Clear	1.8
5/22/2002	1B-1	18.4	17.8	6.0	6.4	0.2	7.4	6.4	5.7	Clear	5.7
5/22/2002	2-1	18.8	18.7	3.4	4.2	0.3	8.4	6.1	5.6	Clear	1.7
5/22/2002	2-1	18.8	18.7	3.4	4.2	0.3	8.4	6.1	5.6	Clear	1.7
5/23/2002	1A-3	20.8	20.7	5.2	5.2	0.2	7.8	7.7	0.6	Clear	1.4
5/23/2002	1A-4	19.6	19.2	8.4	8.4	0.2	6.0	5.6	0.4	Clear	1.8
5/23/2002	1A-4	20.8	20.6	8.4	8.5	0.2	7.4	5.3	0.5	Clear	1.7
5/23/2002	1A-9	25.0	24.6	1.5	7.6	0.2	9.5	9.1	1.2	Clear	1.1
5/23/2002	3-1	18.4	18.2	1.2	1.5	0.3	6.6	6.1	6.9	Clear	1.5
5/23/2002	3-1	18.4	18.2	1.2	1.5	0.3	6.6	6.1	6.9	Clear	1.5
5/23/2002	3-1	18.4	18.2	1.2	1.5	0.3	6.6	6.1	6.9	Clear	1.5
6/20/2002	1A-10	23.2	22.8	11.6	11.8	0.4	6.9	6.1	0.9	Clear	1.6
6/20/2002	1A-3	21.9	22.0	9.8	9.9	0.5	5.5	5.4	0.8	Clear	1.6
6/20/2002	1A-4	23.9	24.1	11.6	11.6	0.3	7.7	7.7	0.5	Clear	1.6
6/20/2002	1A-4	26.2	26.2	11.3	11.3	0.2	9.5	9.5	0.2	Clear	1.6
6/20/2002	1A-4	25.7	25.0	11.3	11.4	0.3	10.1	9.0	0.5	Clear	1.5
6/20/2002	1A-6	23.9	24.1	11.6	11.6	0.3	7.7	7.7	0.2	Clear	1.6
6/20/2002	1A-7	22.8	22.9	11.8	11.8	0.3	5.7	5.8	0.4	Clear	1.6
6/20/2002	1A-8	22.7	22.7	11.8	11.8	0.4	5.5	5.4	0.5	Clear	1.6
6/21/2002	1A-1	22.7	21.9	10.3	10.4	0.3	7.0	6.0	5.7	Clear	1.4
6/21/2002	1A-2	22.6	22.6	12.0	12.0	0.4	6.2	6.4	1.7	Clear	1.7
6/21/2002	1A-9	22.3	22.5	12.0	11.9	0.3	8.1	5.8	0.9	Clear	1.8
6/21/2002	2-1	24.3	23.1	8.3	8.5	0.4	6.5	5.8	6.4	Clear	1.7
6/21/2002	3-1	22.2	23.4	5.5	5.5	0.5	6.7	4.9	5.6	Overcast	1.4
6/21/2002	3-1	22.2	23.4	5.5	5.5	0.5	6.7	4.9	5.6	Overcast	1.4
7/19/2002	1A-3	20.3	22.5	14.7	14.8	0.4	6.2	6.4	1.8	Clear	1.7
7/19/2002	1A-3	20.3	22.5	14.7	14.8	0.4	6.2	6.4	1.8	Clear	1.7

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
7/19/2002	1A-3	20.3	22.5	14.7	14.8	0.4	6.2	6.4	1.8	Clear	1.7
7/19/2002	1A-4	21.5	21.5	15.9	15.9	0.3	4.9	4.9	0.5	Clear	1.5
7/19/2002	1A-4	21.5	21.5	15.9	15.9	0.3	4.9	4.9	0.5	Clear	1.5
1/29/2003	1A-4	13.0	13.2	0.3	0.3	0.4	10.7	10.1	0.4	Clear	2.4
1/29/2003	1A-2	14.5	14.4	0.7	0.7	0.3	9.1	8.7	1.2	Clear	2.1
1/29/2003	3-1	13.3	13.3	0.1	0.1	1.2	10.4	11.6	6.9	Clear	2.2
1/29/2003	2-1	13.6	13.3	0.1	0.2	1.0	9.5	9.6	4.9	Overcast	1.4
1/29/2003	1B-1	13.9	13.6	0.2	0.2	0.8	9.0	9.4	1.0	Overcast	1.2
1/29/2003	1A-1	14.7	14.7	0.3	0.3	0.4	10.3	9.7	5.7	Overcast	0.9
1/31/2003	1A-3	14.2	13.7	0.3	0.3	0.4	12.2	10.3	0.6	Overcast	2.4
1/31/2003	2-2	13.2	13.1	0.2	0.2	0.7	9.8	10.3	0.7	Overcast	2.4
2/26/2003	3-1	12.9	13.0	0.2	0.2	1.8	9.6	9.0	3.1	Overcast	2.3
2/26/2003	2-1	13.2	13.1	0.2	0.2	1.1	9.9	9.7	5.6	Overcast	2.2
2/26/2003	1B-1	13.2	13.3	0.2	0.2	0.7	10.3	10.8	4.4	Overcast	1.3
2/26/2003	1A-2	13.9	13.9	1.8	1.9	0.3	9.8	7.6	1.5	Overcast	1.9
2/26/2003	1A-1	13.9	13.9	1.5	1.5	0.5	9.1	9.1	6.7	Overcast	1.6
2/27/2003	1A-4	13.6	13.6	0.0	0.0	0.3	14.0	14.0	0.3	Clear	2.3
2/27/2003	1A-3	12.9	12.8	0.5	0.5	0.5	10.2	10.2	1.1	Clear	2.1
2/27/2003	2-2	11.3	12.2	0.2	0.2	0.6	10.5	9.5	0.6	Clear	1.7
3/13/2003	1A-3	16.1	16.0	0.9	0.9	0.7	11.2	11.0	1.2	Overcast	1.2
3/13/2003	1A-4	15.3	15.2	3.8	3.8	0.3	9.2	9.5	0.5	Overcast	2.0
3/13/2003	1A-10	16.8	16.8	4.0	4.0	0.4	10.1	10.2	0.8	Clear	1.4
3/13/2003	1A-6	15.4	15.3	4.9	4.8	0.4	8.6	8.4	1.3	Overcast	2.1
3/13/2003	1A-7	15.3	15.3	4.6	4.6	0.3	8.7	8.7	0.7	Overcast	2.1
3/13/2003	3-1	16.6	16.8	0.2	0.2	1.4	10.1	9.8	1.7	Overcast	0.9
3/13/2003	2-1	16.3	16.3	0.2	0.3	0.6	13.1	9.5	1.4	Overcast	0.7
3/13/2003	1B-1	16.2	16.1	0.4	0.4	0.9	12.2	11.6	3.5	Light rain	0.3
3/13/2003	1A-2	16.2	16.1	4.3	4.3	0.4	9.6	9.6	1.8	Overcast	1.8
3/13/2003	1A-1	15.8	15.8	1.2	1.2	0.6	10.4	10.5	4.5	Overcast	0.1

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
3/27/2003	1A-3	17.2	17.2	0.2	0.2	0.4	9.3	8.4	0.6	Clear	1.8
3/27/2003	1A-4	16.4	16.6	0.7	0.7	0.3	10.0	8.2	0.3	Clear	2.1
3/27/2003	1A-10	16.3	16.5	0.6	0.7	0.3	8.7	6.1	1.0	Clear	2.1
3/27/2003	1A-6	16.4	16.5	0.7	0.7	0.3	8.5	8.2	0.6	Clear	2.1
3/27/2003	1A-7	16.4	16.6	0.7	0.7	0.3	8.3	8.0	0.9	Clear	2.1
3/27/2003	3-1	15.9	15.7	0.1	0.1	0.3	9.1	9.0	2.3	Clear	1.5
3/28/2003	2-1	16.0	15.9	0.2	0.2	0.7	9.8	1.8	6.4	Clear	1.7
3/28/2003	1B-1	16.4	16.3	0.3	0.3	0.5	10.3	8.9	8.2	Clear	1.9
3/28/2003	1A-2	17.1	17.0	0.9	1.0	0.2	9.4	9.1	1.6	Clear	1.8
3/28/2003	1A-1	16.7	16.6	0.5	0.5	0.4	10.2	3.8	6.5	Clear	1.8
4/10/2003	2-1	16.7	15.7	0.2	2.5	1.0	10.4	6.7	4.4	Overcast	1.7
4/10/2003	1B-1	16.6	15.7	0.6	3.2	0.9	11.1	7.8	4.5	Overcast	1.2
4/10/2003	1A-2	15.1	15.5	3.0	4.3	0.5	10.3	8.3	1.9	Overcast	1.7
4/10/2003	1A-1	16.5	15.6	1.7	3.7	0.4	10.2	7.6	6.4	Overcast	1.0
4/10/2003	3-1	16.1	16.1	0.2	0.2	2.2	14.2	14.2	6.0	Overcast	1.4
4/11/2003	1A-4	15.8	15.8	3.9	4.0	0.5	7.9	7.8	0.5	Clear	1.9
4/11/2003	1A-3	16.6	16.6	1.3	1.3	0.7	11.5	9.8	1.1	Clear	1.6
4/11/2003	1A-10	15.6	15.7	4.2	4.3	0.3	8.2	7.4	1.0	Clear	1.8
4/11/2003	1A-6	15.8	15.8	4.3	4.1	0.4	8.2	7.9	1.3	Clear	1.8
4/11/2003	1A-7	15.7	15.7	4.1	4.1	0.5	9.4	8.2	0.6	Clear	1.8
4/24/2003	2-1	14.8	14.9	0.2	0.2	0.7	10.1	9.4	7.1	Light rain	1.9
4/24/2003	1B-1	15.3	15.5	0.3	0.5	0.5	9.5	9.6	5.0	Light rain	1.7
4/24/2003	1A-2	15.6	15.7	2.6	2.6	0.4	8.4	8.5	2.7	Overcast	1.7
4/24/2003	1A-1	15.3	15.6	1.9	2.1	0.4	9.4	8.9	5.9	Overcast	1.2
4/24/2003	3-1	14.2	14.2	0.2	0.2	1.5	11.8	11.3	7.6	Light rain	1.6
4/25/2003	1A-3	14.3	14.3	0.5	0.5	0.3	9.9	9.7	0.8	rain	1.7
4/25/2003	1A-4	15.0	15.2	2.4	2.4	0.3	8.5	8.3	0.6	rain	1.9
4/25/2003	1A-10	13.5	14.1	1.5	1.6	0.3	9.6	9.5	0.6	Light rain	1.9
4/25/2003	1A-6	15.0	15.2	2.4	2.4	0.3	8.5	8.3	0.6	rain	1.9

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
4/25/2003	1A-7	14.9	15.0	2.0	2.1	0.2	8.8	8.7	0.9	rain	1.8
5/13/2003	3-1	17.2	17.3	0.2	0.1	2.1	9.0	9.3	6.4	Clear	1.7
5/13/2003	1A-3	17.7	17.6	0.2	0.2	0.5	9.5	9.0	0.3	Clear	1.3
5/13/2003	1A-4	18.7	18.4	0.3	0.3	0.2	9.6	6.5	0.2	Clear	1.4
5/13/2003	1A-10	24.1	24.1	0.3	0.3	0.2	11.1	9.6	0.7	Clear	1.1
5/13/2003	1A-6	23.5	23.3	0.3	0.3	0.3	16.0	14.5	0.3	Clear	1.1
5/13/2003	1A-7	25.4	25.2	0.3	0.3	0.2	16.5	17.5	1.2	Clear	1.1
5/13/2003	2-1	17.4	17.4	0.2	0.2	0.8	9.7	10.0	6.8	Clear	1.5
5/14/2003	1B-1	17.5	17.6	0.2	0.2	0.4	9.4	9.2	4.1	Overcast	0.9
5/14/2003	1A-2	18.8	18.7	0.5	0.5	0.3	8.8	8.6	1.9	Overcast	1.3
5/14/2003	1A-1	18.4	18.4	0.5	0.5	0.3	8.2	8.2	5.9	Overcast	1.1
6/7/2003	1A-4	20.0	20.1	2.6	2.6	0.4	6.4	5.5	0.3	Overcast	1.7
6/7/2003	1A-6	20.3	20.4	2.9	2.9	0.4	5.0	5.8	0.8	Overcast	1.8
6/7/2003	1A-7	20.1	20.2	2.8	2.8	0.4	6.1	6.8	0.3	Overcast	1.7
6/7/2003	1A-10	20.2	20.3	2.7	0.9	0.4	6.0	5.1	1.4	Overcast	1.8
6/7/2003	2-1	21.7	21.8	0.2	0.2	0.4	5.6	5.2	3.9	Overcast	1.1
6/7/2003	3-1	20.9	20.9	0.2	0.2	0.8	7.4	6.0	2.3	Overcast	1.2
6/8/2003	1A-1	20.5	20.1	1.7	2.2	0.4	6.6	6.4	5.1	Overcast	1.2
6/8/2003	1A-2	19.9	19.8	2.6	2.6	0.4	7.8	7.5	1.7	Overcast	1.4
6/8/2003	1A-3	20.7	20.7	1.3	1.3	0.3	7.1	7.0	0.8	Overcast	1.7
6/8/2003	1B-1	22.0	21.9	0.7	0.7	0.3	6.9	6.9	4.4	Overcast	1.0
6/8/2003	2-1	22.0	21.6	0.2	0.2	0.4	6.4	5.1	4.0	Clear	0.7
7/23/2003	3-1	26.0	26.1	4.3	5.0	0.4	7.2	5.8	1.7	Overcast	1.4
7/23/2003	1A-3	26.1	26.0	9.1	9.0	0.4	7.6	7.6	2.8	Overcast	1.4
7/23/2003	1A-7	23.8	24.0	9.1	10.8	0.4	10.5	5.1	1.0	Clear	1.3
7/23/2003	1A-10	24.1	24.1	10.7	10.7	0.4	5.7	5.8	0.8	Clear	1.2
7/23/2003	1A-6	23.8	23.7	10.4	10.5	0.4	4.6	4.7	0.9	Clear	1.6
7/23/2003	2-1	26.0	25.3	7.1	8.7	0.4	9.0	3.6	5.6	Overcast	1.1
7/23/2003	1A-4	24.5	24.4	11.4	11.4	0.6	6.3	6.2	1.9	Clear	1.6

Sample Date	USACE / Stillwater Site	Water Temperature Surface (°C)	Water Temperature Bottom (°C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
7/23/2003	1A-2	22.8	22.3	10.7	10.7	0.5	4.9	5.7	1.0	Clear	1.4
7/24/2003	2-1	26.9	24.9	7.9	8.6	0.6	7.5	4.3	4.3	Clear	1.4
7/24/2003	1B-1	-	-	-	-	0.3	-	-	6.1	Clear	1.6
7/24/2003	1A-1	-	-	-	-	0.4	-	-	5.9	Clear	1.2
3/3/2004	1A-6	12.6	12.6	0.2	0.2	0.3	11.0	11.5	1.0	Clear	2.1
3/3/2004	1A-7	12.6	12.6	0.2	0.2	0.3	10.0	11.1	0.7	Clear	2.1
3/3/2004	1A-10	12.5	12.3	0.2	0.2	0.3	11.5	11.0	2.3	Clear	1.9
3/3/2004	1A-3	12.2	12.3	0.1	0.1	0.5	11.5	11.7	0.8	Overcast	2.1
3/3/2004	2-2	12.2	12.2	0.1	0.1	0.6	11.0	10.7	0.7	Overcast	1.9
3/3/2004	3-1	12.1	12.0	0.1	0.1	0.6	12.7	11.8	2.5	Light rain	1.4
3/4/2004	1A-1	13.5	13.4	0.2	0.2	0.4	11.4	11.7	6.3	Clear	1.1
3/4/2004	1A-2	12.7	12.5	0.2	0.2	0.4	10.6	10.4	0.7	Clear	2.1
3/4/2004	1B-1	12.6	12.3	0.1	0.1	0.4	11.6	10.9	4.2	Clear	1.3
3/4/2004	2-1	13.2	12.0	0.1	0.1	0.8	10.6	10.9	5.3	Clear	1.7
3/4/2004	1A-4	11.9	12.0	0.2	0.2	0.4	10.4	9.5	0.5	Clear	1.8
3/4/2004	1B-2	13.4	13.0	0.1	0.1	0.4	11.6	10.3	0.6	Clear	2.0
3/17/2004	1A-6	18.8	18.8	0.4	0.4	0.3	9.4	9.3	0.4	Clear	1.7
3/17/2004	1A-7	18.9	18.9	0.4	0.4	0.3	8.7	9.0	0.4	Clear	1.8
3/17/2004	1A-10	18.8	18.7	0.4	0.4	0.4	9.2	9.0	0.6	Clear	1.7
3/17/2004	1A-4	19.0	18.9	0.4	0.4	0.3	9.4	9.0	0.5	Clear	1.9
3/17/2004	1B-2	18.3	18.2	0.2	0.2	1.0	10.7	9.4	1.2	Clear	1.5
3/17/2004	3-1	16.9	16.7	0.1	0.1	1.8	10.2	10.1	3.3	Clear	1.7
3/18/2004	1A-1	18.4	18.3	0.2	0.2	0.6	11.3	11.0	9.2	Clear	0.8
3/18/2004	1A-2	21.1	20.8	0.9	0.9	0.7	8.6	8.3	2.9	Clear	1.9
3/18/2004	1B-1	20.1	17.7	0.2	0.2	0.7	12.3	10.4	4.6	Clear	1.5
3/18/2004	2-1	19.3	18.1	0.2	0.2	0.8	12.0	10.9	5.7	Clear	2.2
3/18/2004	1A-3	18.6	18.6	0.3	0.3	0.4	10.1	9.6	0.7	Clear	1.6
3/18/2004	2-2	17.7	17.7	0.2	0.2	1.2	12.0	11.4	0.6	Clear	1.9
4/15/2004	1A-2	19.6	19.5	4.0	4.0	0.3	18.8	18.2	0.4	Overcast	1.2

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
4/15/2004	2-1	17.3	17.4	0.8	1.1	0.6	11.7	10.8	5.4	Clear	1.3
4/15/2004	1B-1	17.3	17.0	2.5	2.7	0.4	10.9	8.7	6.5	Overcast	1.7
4/15/2004	3-1	16.4	16.0	0.2	0.2	1.0	12.5	11.0	4.2	Overcast	1.8
4/15/2004	2-2	18.1	18.0	0.5	0.5	0.4	13.6	10.8	0.6	Overcast	1.8
4/15/2004	1A-1	18.0	17.6	2.2	2.4	0.4	12.3	7.9	4.9	Overcast	1.3
4/16/2004	1A-7	15.0	15.0	3.0	3.0	0.4	9.2	9.3	1.3	Clear	0.5
4/16/2004	1A-10	16.5	16.4	2.9	3.0	0.4	10.8	8.4	0.7	Clear	1.2
4/16/2004	1A-6	14.2	14.0	3.2	3.3	0.5	9.8	6.3	0.6	Clear	0.9
4/16/2004	1A-3	17.6	17.4	2.6	2.6	0.4	12.5	11.2	0.7	Light rain	1.9
4/16/2004	1A-4	15.0	15.0	3.0	3.0	0.4	9.2	9.3	1.3	Clear	1.5
4/16/2004	1B-2	18.5	18.5	1.8	1.8	0.1	12.3	11.5	0.5	Overcast	1.9
4/29/2004	1A-6	18.9	18.8	3.2	3.2	0.3	6.7	6.1	1.3	Clear	1.5
4/29/2004	1A-7	19.1	19.0	3.2	3.2	0.5	9.0	7.0	0.6	Clear	1.5
4/29/2004	1A-10	20.1	20.1	3.5	3.5	0.5	7.8	7.8	1.2	Clear	1.4
4/29/2004	2-2	21.5	21.5	0.8	0.8	0.5	11.5	9.4	0.4	Clear	1.6
4/29/2004	1B-2	21.6	21.5	1.5	1.5	0.5	13.5	12.5	1.1	Clear	1.2
4/29/2004	1A-3	20.7	20.8	2.2	2.2	0.3	10.6	10.8	0.3	Clear	1.7
4/29/2004	1A-4	18.6	18.5	3.2	3.2	0.4	7.1	6.6	1.0	Clear	1.5
4/30/2004	1A-1	20.3	20.2	4.0	4.3	0.5	8.1	8.2	5.8	Clear	1.4
4/30/2004	1A-2	20.3	20.3	4.2	4.2	0.4	7.8	8.2	2.0	Clear	1.7
4/30/2004	2-1	21.8	21.0	1.7	1.8	0.4	11.9	10.4	5.8	Clear	1.7
4/30/2004	1B-1	21.6	21.4	2.2	2.3	0.4	10.4	10.1	4.7	Clear	1.3
4/30/2004	3-1	21.0	20.7	0.3	0.3	0.8	10.2	9.5	2.8	Clear	1.8
5/13/2004	1A-6	19.3	19.3	6.4	6.4	0.3	7.1	7.4	0.7	Clear	1.5
5/13/2004	1A-7	19.5	19.5	6.5	6.5	0.4	7.5	6.6	0.4	Clear	1.5
5/13/2004	1A-10	19.6	19.6	6.8	6.9	0.4	7.4	7.8	0.6	Clear	1.4
5/13/2004	1A-3	21.6	22.0	4.9	5.0	0.4	11.7	11.0	0.9	Clear	1.6
5/13/2004	1A-4	19.0	18.6	6.4	6.4	0.4	7.0	6.5	0.6	Clear	0.6
5/13/2004	1A-3	21.6	20.2	5.4	6.4	0.4	10.4	8.6	5.7	Clear	0.8

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
5/13/2004	1A-2	20.5	20.3	7.4	7.5	0.5	8.7	8.2	1.3	Clear	1.7
5/13/2004	1A-1	21.6	20.2	5.4	6.4	0.4	10.4	8.6	5.7	Clear	0.8
5/14/2004	1B-2	22.6	22.4	4.3	4.4	0.5	12.1	12.3	0.6	Overcast	1.3
5/14/2004	1B-1	21.1	20.8	5.3	5.4	0.4	8.6	8.2	4.3	Clear	1.2
5/14/2004	2-1	21.9	21.1	4.4	4.8	0.5	10.9	8.7	5.2	Clear	1.5
5/14/2004	2-2	22.5	21.2	2.4	4.1	0.5	12.1	8.7	2.1	Clear	1.7
5/14/2004	3-1	21.1	21.3	0.9	1.4	0.4	9.8	10.2	4.1	Overcast	1.1
6/15/2004	1A-6	23.6	23.5	11.3	11.3	0.7	6.4	5.9	1.2	Clear	1.1
6/15/2004	1A-7	23.7	23.3	11.1	11.2	0.6	7.0	6.7	1.2	Clear	1.1
6/15/2004	1A-10	29.4	29.3	10.5	10.6	0.3	10.3	9.7	0.6	Clear	1.1
6/15/2004	1A-4	22.7	22.6	10.3	10.3	0.4	5.6	5.5	0.5	Clear	1.3
6/15/2004	1B-1	23.7	23.2	8.2	8.3	0.4	6.5	6.5	6.5	Clear	1.1
6/15/2004	2-1	24.8	23.5	7.2	8.0	0.3	7.5	6.3	5.0	Clear	1.3
6/15/2004	1A-2	23.6	23.3	11.3	11.3	0.5	6.8	6.5	1.7	Clear	1.0
6/15/2004	1A-1	23.9	22.8	10.8	11.5	0.6	7.5	6.0	6.2	Clear	0.9
6/16/2004	1A-3	23.6	23.5	9.9	9.9	0.4	5.5	4.2	0.4	Clear	1.3
6/16/2004	1B-2	24.3	24.2	8.9	8.5	0.4	7.8	7.7	0.7	Clear	1.3
6/16/2004	2-2	24.4	24.4	8.4	8.4	0.5	7.5	7.2	1.6	Clear	1.1
6/16/2004	3-1	25.2	24.4	6.1	6.4	0.4	8.7	6.4	2.9	Clear	1.1
7/12/2004	1A-3	21.7	21.6	13.6	13.7	0.6	5.7	5.6	0.6	Clear	1.2
7/12/2004	1A-6	22.7	22.1	14.8	14.8	0.4	7.0	7.9	0.5	Clear	1.0
7/12/2004	1A-7	21.6	21.6	14.8	14.8	0.9	5.6	5.9	0.6	Clear	1.0
7/12/2004	1A-10	23.3	23.1	14.9	14.8	0.9	8.8	8.0	0.7	Clear	1.1
7/12/2004	1A-4	21.6	21.6	14.8	14.8	0.9	5.6	5.9	0.6	Clear	1.1
7/12/2004	1B-1	23.6	21.6	12.8	13.7	0.5	8.3	6.0	4.8	Clear	0.9
7/12/2004	2-1	23.9	22.1	12.1	13.1	0.1	7.8	6.0	5.3	Clear	0.9
7/12/2004	1A-2	21.7	21.5	14.8	14.8	0.9	6.3	5.8	1.9	Clear	1.2
7/12/2004	1A-4	21.4	21.2	13.5	13.3	0.9	6.1	5.6	6.0	Overcast	1.2
7/13/2004	1B-2	22.4	22.4	13.0	13.0	0.3	6.1	6.1	0.3	Clear	1.3

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
7/13/2004	2-2	23.2	23.1	11.5	11.7	0.9	7.5	6.5	1.0	Clear	1.3
7/13/2004	3-1	23.0	23.1	8.6	8.9	0.5	7.2	6.2	6.4	Overcast	1.2
3/9/2005	1A-3	15.6	15.4	0.2	0.2	0.5	9.0	9.8	0.9	Clear	2.1
3/9/2005	1A-4	15.7	15.7	0.3	0.3	0.4	9.2	6.6	0.4	Clear	2.0
3/9/2005	1A-6	14.8	14.8	0.4	0.4	0.3	6.8	6.3	0.6	Overcast	1.5
3/9/2005	1A-7	14.9	14.9	0.4	0.4	0.3	7.2	6.9	0.5	Overcast	1.6
3/9/2005	1B-2	17.8	16.9	0.2	0.2	0.6	10.0	9.9	0.9	Clear	2.0
3/9/2005	2-2	16.6	15.8	0.1	0.1	1.0	9.2	10.0	0.5	Clear	1.5
3/9/2005	1A-1	17.1	16.9	0.3	0.3	0.4	9.9	9.7	6.2	Clear	1.0
3/9/2005	1A-2	15.4	15.3	0.2	0.2	0.5	8.8	9.3	1.4	Overcast	1.2
3/9/2005	2-1	15.7	15.2	0.1	0.1	1.0	9.1	9.3	5.9	Clear	1.5
3/10/2005	1B-1	15.7	15.6	0.2	0.2	0.7	9.6	9.3	6.1	Clear	1.4
3/10/2005	3-1	16.6	15.8	0.1	0.1	1.4	9.1	8.9	3.0	Clear	1.9
3/23/2005	1A-6	12.0	12.0	0.3	0.3	0.2	7.8	6.7	0.7	Light rain	1.1
3/23/2005	1A-7	12.0	12.0	0.3	0.3	0.2	7.7	7.1	0.4	Light rain	1.1
3/23/2005	1A-10	12.4	12.5	0.2	0.2	0.2	8.0	8.2	0.8	Light rain	1.0
3/23/2005	1A-2	12.0	12.0	0.3	0.3	0.2	7.7	7.1	0.4	Light rain	1.2
3/23/2005	1A-1	13.4	13.3	0.1	0.1	0.2	9.5	9.4	6.5	Overcast	1.8
3/23/2005	1B-1	13.5	13.5	0.1	0.1	0.2	9.9	9.6	2.6	Overcast	1.3
3/23/2005	1A-3	13.4	13.3	0.1	0.1	0.2	9.2	8.5	0.5	Overcast	1.8
3/23/2005	1A-4	13.9	13.9	0.1	0.1	0.2	12.3	9.7	2.7	Overcast	2.0
3/23/2005	1B-2	12.9	12.9	0.1	0.1	0.1	9.7	9.7	0.5	Overcast	1.6
3/24/2005	2-1	13.6	12.7	0.1	0.1	0.4	10.0	10.0	5.5	Clear	1.9
3/24/2005	2-2	12.7	12.7	0.1	0.1	0.3	9.8	9.6	0.5	Clear	1.5
3/24/2005	3-1	12.5	12.4	0.1	0.1	0.5	9.8	9.8	1.7	Clear	1.7
4/20/2005	1A-6	17.2	17.2	1.7	1.7	0.4	8.3	7.5	1.0	Clear	1.7
4/20/2005	1A-7	17.5	17.5	1.5	1.5	0.5	8.1	8.2	0.7	Clear	1.7
4/20/2005	1A-10	17.4	17.2	1.4	1.7	0.5	8.7	7.3	1.4	Clear	1.7
4/20/2005	1A-2	18.1	17.8	1.5	1.6	0.4	8.7	8.4	2.2	Clear	1.6

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
4/20/2005	2-1	15.8	15.8	0.2	0.2	1.1	9.9	9.6	4.8	Overcast	0.9
4/20/2005	3-1	15.6	15.7	0.2	0.2	1.9	9.6	11.3	2.7	Overcast	1.2
4/20/2005	1A-4	17.6	17.5	1.3	1.3	0.4	8.2	7.5	0.4	Clear	1.7
4/20/2005	1A-3	18.9	18.5	0.3	0.3	0.5	10.5	9.0	0.5	Clear	1.3
4/20/2005	2-2	16.2	16.2	0.2	0.2	1.1	10.6	10.6	0.4	Overcast	1.4
4/21/2005	1A-1	18.6	17.8	1.3	1.7	0.3	8.5	8.1	6.7	Clear	1.6
4/21/2005	1B-1	18.0	17.5	0.4	0.4	0.6	9.6	9.7	5.1	Clear	1.5
4/21/2005	1B-2	19.6	18.9	0.2	0.2	0.5	10.2	12.7	0.5	Clear	1.7
5/5/2005	1A-6	17.1	17.1	2.8	2.8	0.3	3.9	4.0	1.2	Overcast	0.9
5/5/2005	1A-7	17.1	17.1	2.8	2.8	0.4	4.8	5.2	1.4	Overcast	0.9
5/5/2005	1A-10	18.0	17.8	2.2	2.3	0.5	6.1	5.3	0.3	Overcast	0.8
5/5/2005	1A-4	18.5	18.5	2.1	2.1	0.4	6.5	6.5	0.2	Overcast	1.2
5/5/2005	1A-3	19.6	19.5	2.0	2.0	0.4	7.6	6.9	0.6	Overcast	1.8
5/5/2005	2-2	21.1	21.1	0.2	0.2	0.4	10.4	11.0	0.5	Overcast	1.5
5/5/2005	1A-2	17.1	17.1	2.8	2.8	0.4	4.8	5.2	1.4	Overcast	0.9
5/5/2005	1B-2	20.1	20.0	0.7	0.7	0.5	10.2	10.2	0.4	Overcast	1.6
5/5/2005	3-1	17.8	17.8	0.2	0.2	1.4	8.6	5.8	1.9	Clear	1.0
5/6/2005	2-1	18.8	18.7	0.8	0.8	0.4	8.5	8.3	6.5	Overcast	1.2
5/6/2005	1A-1	18.9	19.0	4.0	4.1	0.5	7.2	6.6	3.2	Overcast	1.7
5/6/2005	1B-1	18.9	18.8	1.9	1.9	0.5	7.8	7.5	1.5	Overcast	1.5
5/18/2005	3-1	16.4	16.0	0.1	0.1	0.2	8.4	8.3	3.3	Overcast	0.9
5/18/2005	1B-1	18.5	18.6	0.2	0.2	0.3	7.8	7.9	4.8	Heavy rain	1.2
5/18/2005	1A-1	18.3	18.4	0.7	0.6	0.4	7.0	6.9	4.6	Heavy rain	1.1
5/18/2005	1A-2	18.4	18.5	1.4	1.4	0.3	6.6	6.2	5.5	rain	1.4
5/18/2005	1A-4	18.3	18.3	0.9	0.9	0.3	6.0	6.0	0.3	rain	1.5
5/18/2005	1A-10	18.5	18.5	1.2	1.2	0.3	2.4	6.0	2.1	Light rain	1.4
5/18/2005	1A-7	18.4	18.4	1.1	1.1	0.2	6.1	6.1	0.3	rain	1.5
5/18/2005	1A-6	18.4	18.5	1.1	1.1	0.3	5.9	6.0	1.7	rain	1.4
5/19/2005	1A-3	17.5	17.2	0.1	0.1	0.1	7.8	7.5	0.4	Overcast	1.6

Sample Date	USACE / Stillwater Site	Water Temperature Surface (^{o}C)	Water Temperature Bottom (^{o}C)	Water Salinity Surface (ppt)	Water Salinity Bottom (ppt)	Water Turbidity (m)	Dissolved Oxygen Surface (mg/l)	Dissolved Oxygen Bottom (mg/l)	Water Depth (m)	Weather Condition	Tide Elevation (m)
5/19/2005	2-2	17.4	17.0	0.1	0.1	0.1	7.9	7.7	0.4	Overcast	1.5
5/19/2005	1B-2	15.9	15.8	0.1	0.1	0.1	7.2	7.3	0.4	Overcast	1.3
5/19/2005	2-1	16.8	16.2	0.1	0.1	0.2	8.2	7.9	4.5	Overcast	1.0
6/29/2005	1A-10	20.1	20.1	4.0	4.0	0.4	5.2	4.8	1.2	Overcast	1.5
6/29/2005	1A-6	20.0	20.1	3.9	3.9	0.4	5.2	5.2	1.4	Overcast	1.5
6/29/2005	1A-7	20.1	20.1	3.9	3.9	0.4	5.0	5.2	0.4	Overcast	1.5
6/29/2005	1A-1	22.2	21.4	2.1	2.2	0.3	6.2	6.6	4.0	Clear	0.7
6/29/2005	1A-4	20.0	20.0	3.7	3.7	0.2	5.2	5.2	0.6	Overcast	1.6
6/29/2005	1A-2	23.1	23.6	3.5	3.6	0.2	6.7	6.2	1.4	Clear	1.0
6/30/2005	1A-3	21.7	21.7	2.6	2.6	0.2	5.2	5.2	0.3	Clear	1.6
6/30/2005	1B-1	21.7	21.8	1.9	2.0	0.3	5.8	6.4	5.3	Clear	1.0
6/30/2005	1B-2	23.0	22.8	1.7	1.8	0.4	6.5	7.0	0.5	Clear	1.5
6/30/2005	2-1	24.7	22.9	0.5	1.0	0.3	8.3	7.7	4.7	Clear	1.0
6/30/2005	2-2	23.8	23.6	0.7	0.7	0.2	7.8	8.4	0.5	Clear	1.5
6/30/2005	3-1	23.1	22.7	0.2	0.2	0.4	6.3	7.3	3.9	Clear	1.2
7/28/2005	1A-10	22.7	22.8	9.6	9.7	0.8	4.8	3.7	1.0	Overcast	1.5
7/28/2005	1A-6	22.6	22.7	9.5	9.6	0.2	5.7	4.3	1.0	Clear	1.5
7/28/2005	1A-7	22.5	22.6	9.4	9.4	0.5	6.0	5.1	0.6	Clear	1.5
7/28/2005	1A-4	22.3	22.5	9.3	9.3	0.5	6.0	5.2	0.5	Clear	1.5
7/28/2005	1A-2	25.5	25.2	9.5	9.5	0.4	6.9	7.0	1.0	Clear	0.8
7/28/2005	1A-1	24.7	23.4	7.2	8.3	0.6	6.2	5.8	4.9	Clear	0.7
7/28/2005	1A-3	23.3	23.3	8.0	8.0	0.4	5.8	5.3	0.4	Clear	1.5
7/28/2005	2-2	24.7	24.6	4.8	6.3	0.5	6.2	6.3	0.6	Clear	1.1
7/28/2005	1B-2	24.1	23.9	6.7	7.0	0.5	6.5	6.0	0.7	Clear	1.3
7/29/2005	2-1	23.6	23.9	6.0	7.0	0.6	6.3	5.8	4.6	Clear	1.3
7/29/2005	3-1	24.6	24.2	3.9	4.8	0.5	5.6	4.5	2.2	Clear	1.5
7/29/2005	1B-1	23.9	22.9	8.2	8.5	0.6	6.7	5.6	4.8	Clear	2.4