Assessment of Predator Abundance and Distribution in Mine Pit Habitat in the San Joaquin River Restoration Area

August 2013

2013 Predator Population Assessment (Preliminary Data Report)

Introduction

The San Joaquin River has been impacted historically by in channel and floodplain sand and gravel mining leaving both off channel mine pits and captured mine pits in the channel. Many off channel pits have been breached and allow the river to run through them. Based on available data about 33 river miles have been directly impacted by mining actions (FWUA/NRDC 2002). Studies on the Tuolumne River have shown instream and captured gravel pits and the lentic habitat they create favor largemouth bass and that predation losses in these habitats may be significant enough to affect populations of salmonids (TID/MID 1992 as cited in Stillwater 2003). Largemouth bass are adapted to high water temperatures and are commonly found in captured mine pits in the San Joaquin basin (FMWG 2009a, CDFG 2007).

Predation is recognized as a limiting factor for juvenile salmonids to be addressed during restoration actions in the San Joaquin River Restoration Program. The Restoration Area is known to harbor a number of likely predators on juvenile salmonids including largemouth bass (*Micropterus salmoides*), spotted bass (*M. punctulatus*), Sacramento pikeminnow (*Ptychocheilus grandis*), green sunfish (*Lepomis cyanellus*), black crappie (*Pomoxis nigromaculatus*) and striped bass (*Morone saxitalis*). Predation risk below small dams, such as Sack Dam in the Restoration Area, has been well documented in other locales in the Central Valley, such as Woodbridge Irrigation District Dam (Workman 2006). Actions identified to address predation as a limiting factor include filling the 'highest priority' mining pits, and reducing the number of predatory non-native fish (FMWG 2009b). Aassessment and management of predator populations are necessary actions toward achieving the population objectives outlined in the FMP (FMWG 2009b). This study is intended to fill data gaps on predator populations and habitat conditions in captured mine pits for Phase II settlement actions of prioritizing mine pits for restoration (NRDC v. USBR 2006).

Fishery and aquatic resource assessments have been conducted by the California Department of Fish and Game (now Fish and Wildlife) from 2003-2005 as the first step in pre-restoration monitoring (2007). Predator presence data, by reach, is available from these studies.

Methods

1. **Study Area Delineation.** Figure 1 shows the general area of the mine pit reaches in the Restoration Area (RM 230-261). Within this stretch of river 6 groupings of captured mine pits were identified, each containing a number of mine pits with varying degrees of connectivity and variable depth and overall acreage.

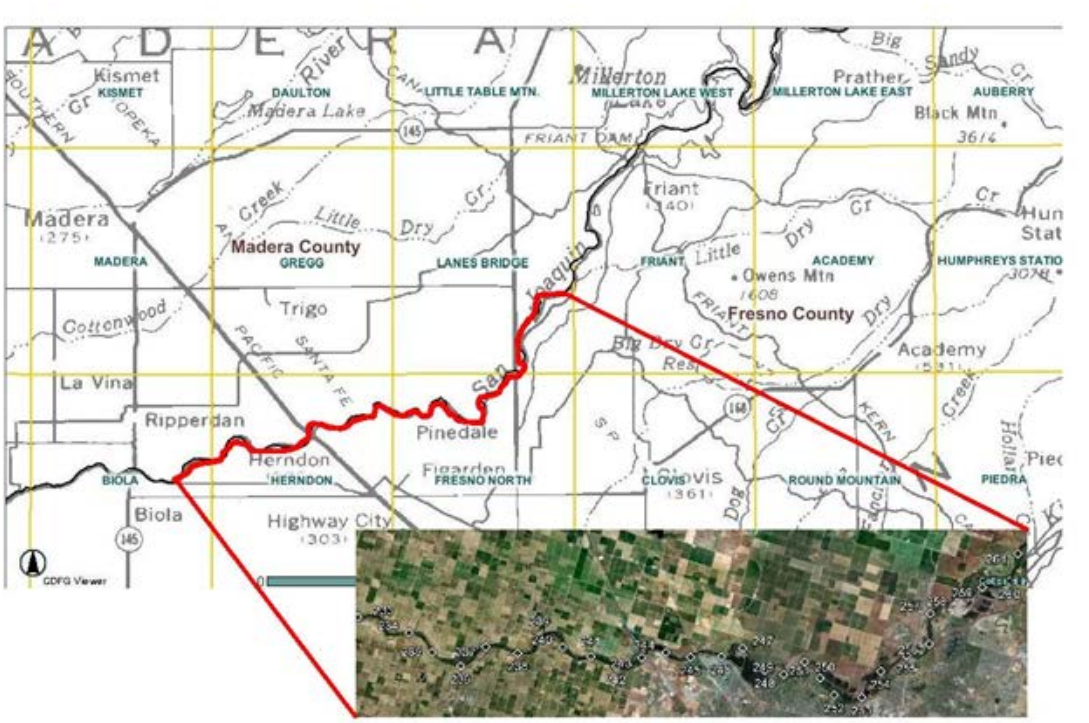

Figure 1. Detailed Map Showing the Mine Pit Reach of the San Joaquin River Restoration Area

2. **Fish Sampling.** Monthly sampling was conducted from February through June of 2013. Thirty four mine pits were sampled by United States Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW) staff using boat electroshockers. Each pit was sampled by electrofishing the shoreline habitat. Including the shorelines of any islands within the pits, and any brush piles or other structure within the pits. Sampling also included gill netting in deeper water habitats in twenty- two of the pits. Fish captured were identified to genus and species, weighed to the nearest 0.1 kilogram, and measured to the nearest millimeter. All adult predators were tagged with a uniquely numbered floy tag and released in the mine pit where they were captured. A subsample of each predator species encountered was subjected to gastric lavage to assess diet composition (samples have not been analyzed). If the fish was retrieved dead from the gill nets the stomach sample was taken by excising the stomach. Stomach samples will be analyzed by California State University, Fresno along with water samples and fin clips and scales from predators to assess diet, site fidelity and prey site fidelity.

Data Summary. Data collected were entered into Excel. Standard information regarding water temperature, dissolved oxygen, clarity (NTUs) and weather condition were recorded. Catch per unit effort (CPUE) was calculated as number of adult predator fish /100 seconds of electrofishing time, and for gillnets the number of adult predators/ hour set time. The species captured this year are listed in Table 1, and the species richness per pit is listed in Table 2. The number of fish tagged, recaptured and stomach sampled are listed by mine pit complex in Table 3. In Table 4 the tagged fish and stomach samples are listed by species. The CPUE for gill nets and electroshocking are displayed in Figures 2 and 3.

Table 1. Species Captured in 2013 sampling

Predator species (Adult Size in mm)		Non-Predator species
Black Bullhead	(200)	Bigscale logperch
Black Crappie	(240)	Carp
Bluegill	(90)	Chinook salmon
Brown Bullhead	(250)	Fathead Minnow
Channel Catfish	(250)	Golden Shiner
Green Sunfish	(140)	Goldfish
Largemouth Bass	(290)	Kern Brook Lamprey
Pumpkinseed	(90)	Pacific Lamprey
Rainbow Trout	(380)	Prickly Sculpin
Redear Sunfish	(190)	Sacramento Sucker
Sacramento Pikeminnow	(190)	Threadfin Shad
Spotted Bass	(190)	Threespine Stickleback
Striped Bass	(500)	Western Mosquitofish
Warmouth	(90)	
White Catfish	(170)	

Table 2. Species Richness

SITE	Predator Species	Non-predator Species	Species Total
All sites	**15**	**13**	**28**
Ft. Wash 002	4	3	7
Ft. Wash 003/004	6	4	10
Ft. Wash 005	3	5	8
Ft. Wash 006	8	5	13
Ft. Wash 007	5	6	11
Ft. Wash 008	7	3	10
Sycamore Island 11	9	5	14
Sycamore Island 12	8	4	12
Sycamore Island 13	1	4	5
Sycamore Island 14	2	3	5
Sycamore Island 15	9	3	12
Sycamore Island 17	9	7	16
Sycamore Island 18	7	8	15
Sycamore Island 19	4	10	14
Sycamore Island 20	9	6	15
Sycamore Island 21	9	5	14
Sycamore Island 22	8	8	16
Sycamore Island 23	8	5	13
Sycamore Island 24	3	5	8
Sycamore Island 25	5	5	10
Sycamore Island 26	7	5	12
Millburn 27	5	5	10
Millburn 28	10	6	16
Millburn 29	9	7	16
Pashayan 36	7	6	13
Pashayan 37	5	3	8
Pashayan 38	9	3	12
Pashayan 39	5	6	11
Pashayan 40	5	2	7
Skaggs 54	9	7	16
Skaggs 55	7	5	12
Skaggs 56	8	4	12
Skaggs 57	7	1	8

Table 3.

# of Predators Tagged by Month

SITE	February	March	April	May	June	Total Tagged
Ft. Washington	22	17	30	33	21	123
Milburn	45	54	67	30	32	228
Pashayan	13	11	11	6	6	47
Sycamore Island	87	104	130	100	72	493
Skaggs	14	23	37	14	24	112
Total	181	209	275	183	155	**1,003**

# of Stomach Samples by Month

SITE	February	March	April	May	June	Total Stomach samples
Ft. Washington	11	9	13	17	13	63
Milburn	13	18	25	15	16	87
Pashayan	10	6	8	5	5	34
Sycamore Island	45	38	56	41	36	216
Skaggs	7	8	19	9	16	59
Total	86	79	121	87	86	**459**

# of Recaptures by Month

SITE	February	March	April	May	June	Total Recaps
Ft. Washington	0	0	1	2	0	3
Milburn	0	1	5	1	0	7
Pashayan	0	0	1	0	0	1
Sycamore Island	0	4	13	0	6	23
Skaggs	0	0	2	0	0	2
Total	0	5	22	3	6	**36**

Table 4. Total Tagged and Stomach Sample by Species

Species	Tagged	Stomach Sample
Brown Bullhead	34	24
Black Crappie	40	23
Bluegill	40	18
Channel Catfish	26	17
Green Sunfish	20	18
Largemouth Bass	667	265
Pikeminnow	4	3
Rainbow Trout	1	3
Redear Sunfish	45	30
Spotted Bass	104	56
Striper	1	3
White Catfish	7	7

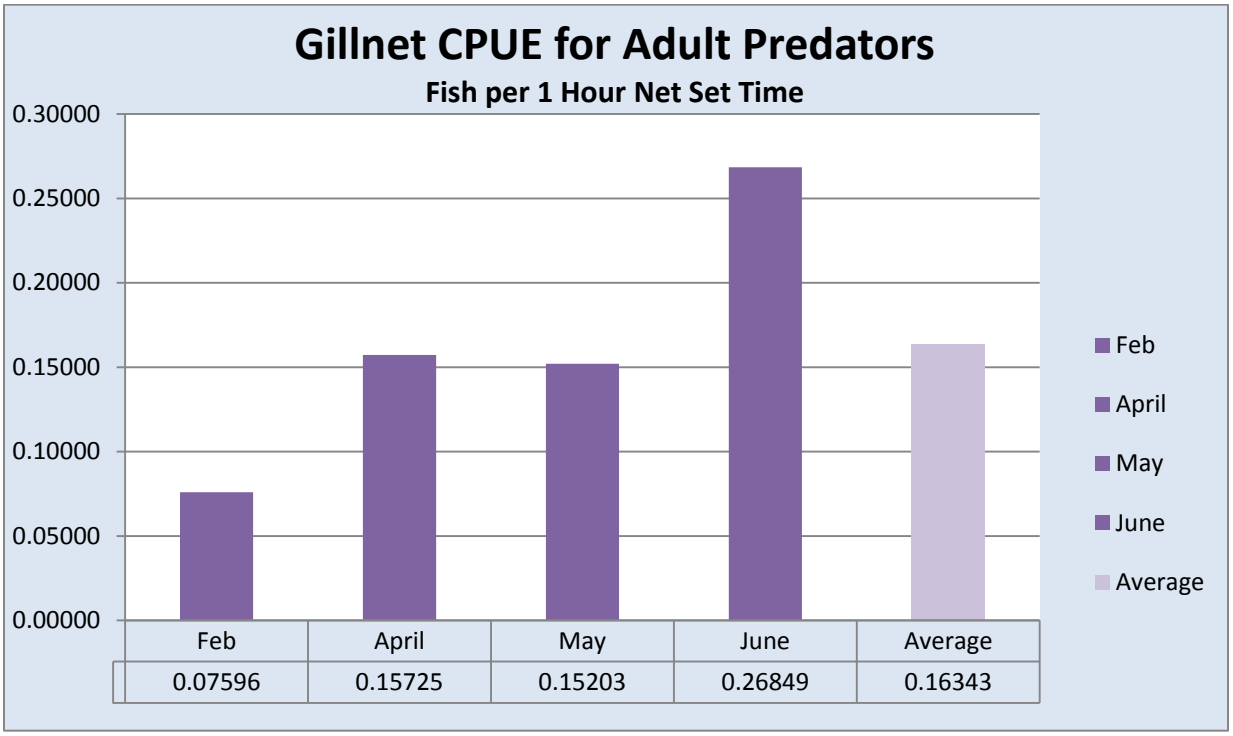

Figure 2. Catch per unit effort for gill net sampling in the Reach 1 mine pit habitat in the San Joaquin River Restoration Area for February-June 2013.

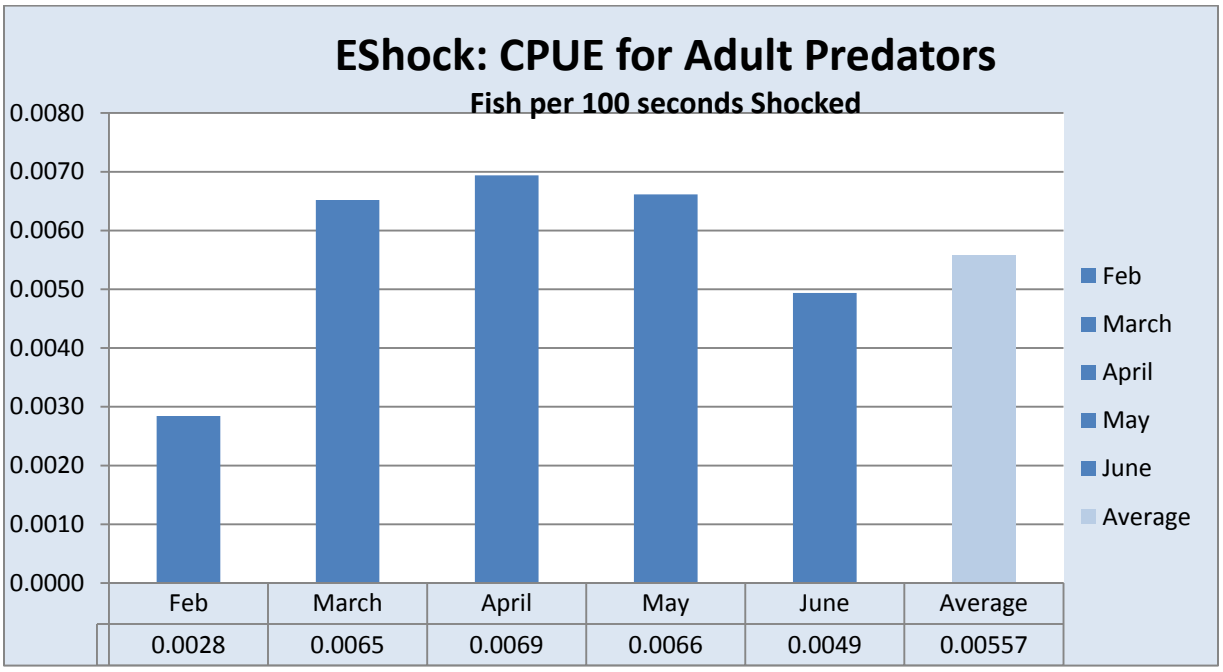

Figure 3. Catch per unit effort for boat electrofishing in the Reach 1 mine pit habitat in the San Joaquin River Restoration Area for February-June 2013.

Results

Both juveniles and adults of non-predatory species and predatory species were encountered during sampling. The thirteen non-predatory species encountered included: bigscale logperch (*Percina*

macrolepida), common carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas),* goldfish (*Carassius auratus*), golden shiner (*Notemigonus crysoleucas*), kern brook lamprey (*Entosphenus hubbsi),* pacific lamprey (*Entosphenus tridentatus),* prickly sculpin (*Cottus asper*), sacramento sucker (*Catostomus occidentalis*), threadfin shad (*Dorosoma petenense),* threespine stickleback (*Gasterosteus aculeatus*), western mosquitofish (*Gambusia affinis*), and chinook salmon (*Oncorhynchus tshawytscha*). The fifteen predatory species included: black bullhead (*Ameiurus melas*), brown bullhead (*Ameiurus nebulosus*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*) , channel catfish (*Ictalurus punctatus*), green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), rainbow trout (*Oncorhynchus mykiss),* redear sunfish (*Lepomis microlophus*), sacramento pikeminnow (*Ptychocheilus grandis*), spotted bass (*Micropterus punctulatus*), striped bass (*Morone saxatilis)* warmouth (*Lepomis gulosus),* and white catfish (*Ameiurus catus).*

The species richness in the mine pits ranged from a low of 5 to a high of 16 of 28 fish species captured during this year's sampling. The number of predators tagged, stomachs sampled, and recaptures all peaked in April. Our CPUE for electrofishing also peaked in April while the gill net CPUE did not peak until June. Gill nets were not used in March due to limited staff availability. Individuals from twelve of the sixteen predator species captured were large enough for floy tagging and stomach sampling.

Of the 36 recaptured fish 32 were largemouth bass (lmb), 2 spotted bass, 1 black crappie and 1 redear sunfish (rsf). Only 12 have been in different pits than the location of original capture (11LMB, 1 RSF), and of those only 5 lmb moved farther than an adjacent pit, and always stayed with in the same pit complex. Three fish have been recaptured from the 2012 sampling season. One lmb has been caught 3 times in 3 different pits.

Chinook Salmon mobile tracking data

Concurrent data collection on acoustically tagged juvenile Chinook salmon was being conducted to determine movement and survival of juvenile Chinook through the system in April-June. Mobile tracking of these fish revealed a number of tag detections within the mine pit habitat. These data will be analyzed further in the near future, but an example of tag presence in the mine pit area is represented in Figure 4 and Table 5 below showing relative abundance of tags in mine pits in the Sycamore Island section of the study area. It is yet to be determined if these fish represent Chinook salmon detections, or detections from the stomachs of predators at the time of detecting, but we also captured one unmarked juvenile Chinook salmon (41mm) in late February, which is presumed to be the result of natural redds placed in the river by adults transported upstream from Reach 5 in the fall. This detection shows that these fish may use these habitat areas as they move downstream, and may not necessarily stay in the main channel as they migrate downstream.

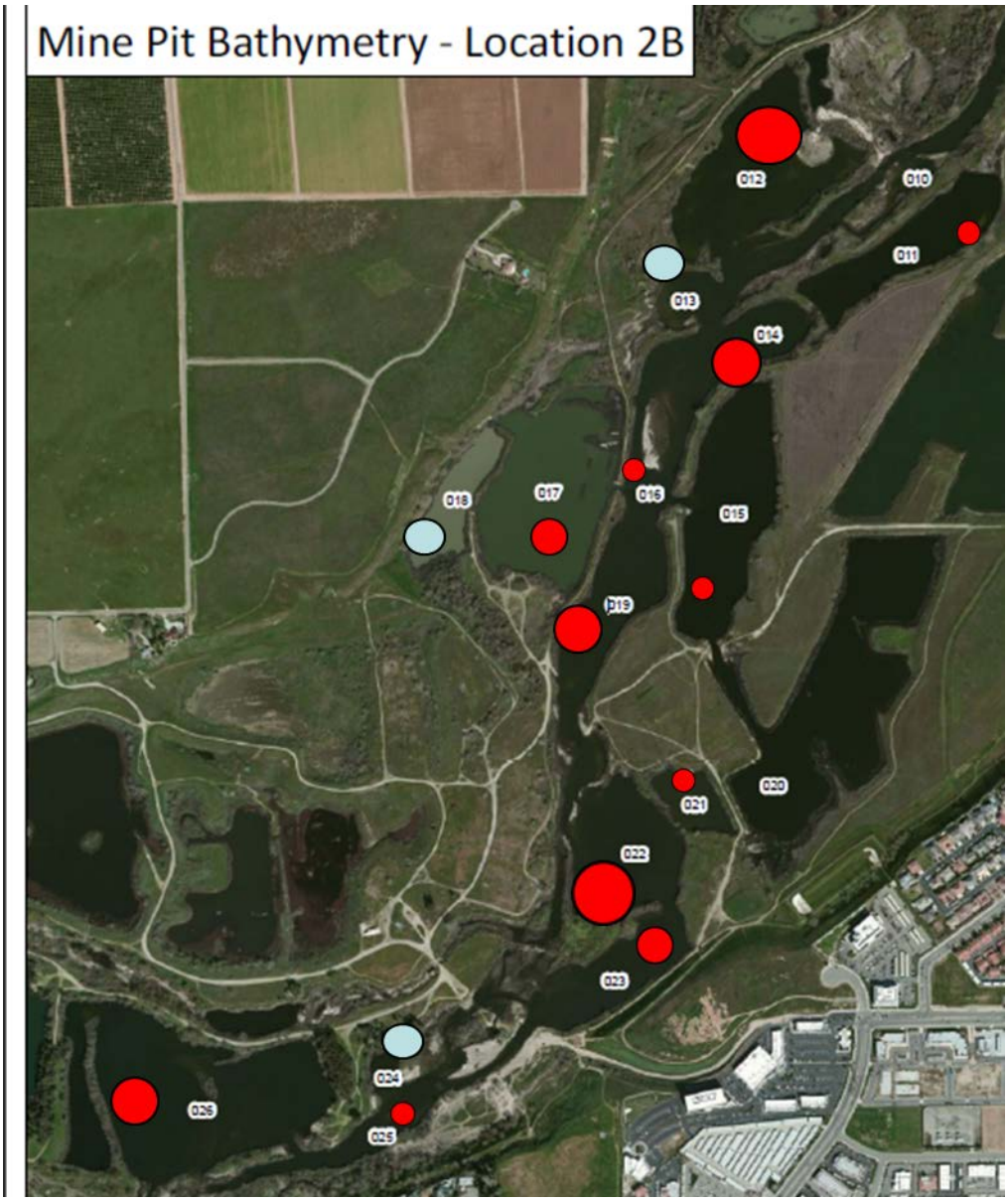

Figure 4. Detections of acoustic tags (from Chinook salmon survival study) in the mine pit habitat of Reach 1 in the San Joaquin River Restoration Area. Red circles represent detections, grey circles represent no detections, size of circles represents relative numbers.

Table 5. Mine Pit numbers, tag detections, and surface temperature (C^{o}) at time of detection for acoustic tags (from juvenile Chinook salmon released below Friant Dam)

Sycamore Island - May 7th		
Pit ID	# of Tags	temperature
12	30	18.1
13	0	16.3
11	1	21
14	13	17.6
18	0	22
17	10	20.3
15	5	20.3
20	1	20.8
16	1	16.6
19	27	16.8
22	30	17.2
above 22	6	16.8
21	6	20.5
23	18	17.7
24	0	18.6
25	2	18.1
26	35	17.5

Discussion

Discussion items will be addressed in future reporting efforts.

Conclusions and Recommendations

Conclusions and Recommendations will be made in future reporting efforts.

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References

California Department of Fish and Game (CDFG). San Joaquin Valley-Southern Sierra Region. 2007. San Joaquin River Fishery and Aquatic Resources Inventory. Cooperative Agreement 03FC203052.

Fish Management Work Group (FMWG). 2009a. Conceptual models of stressors and limiting factors for San Joaquin River Chinook salmon. 178 pages. June 2009.

FMWG. 2009b. Fisheries management Plan: a framework for adaptive management in the San Joaquin River Restoration Program. 147 pages plus appendices. June 2009.

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