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Yolo Bypass Invertebrate Drift Sample Collection Metadata
Aquatic Ecology Section, DWR
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I. Contact Information

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II. Study Elements and Objectives

Largely supported by the Interagency Ecological Program (IEP), DWR has operated a fisheries and invertebrate monitoring program in the Yolo Bypass since 1998. The project has provided a wealth of information regarding the significance of seasonal floodplain habitat to native fishes. Basic objectives of the project are to collect baseline data on lower trophic levels (phytoplankton, zooplankton and invertebrate drift), juvenile and adult fish, hydrology, and physical conditions. As the Yolo Bypass has been identified as a high restoration priority by the US Fish and Wildlife Service and National Marine Fisheries Service biological opinions for Delta Smelt (*Hypomesus transpacificus)* and winter and spring-run Chinook Salmon (*Oncorhynchus tshawytscha*), and by California EcoRestore, these baseline data are critical for evaluating success of future restoration projects. In addition, the data have already served to increase our understanding of the role of the Yolo Bypass in the life history of native fishes and its ecological function in the San Francisco Estuary. Key findings include: (1) Yolo Bypass is a major factor regulating year class strength of splittail, *Pogonichthys macrolepidotus* (Sommer et al., 1997; Feyrer et al., 2006; Sommer et al., 2007a); (2) Yolo Bypass is a key migration corridor for adult fish of several listed and sport fish (Harrell and Sommer 2003); (3) it is one of the most important regional rearing areas for juvenile Chinook Salmon (Sommer et al., 2001a; 2005); and (4) Yolo Bypass is a source of phytoplankton to the food web of the San Francisco Estuary (Jassby and Cloern 2000; Schemel et al., 2004; Sommer et al., 2004a).

The collection of invertebrate drift is one element of the Aquatic Ecology Section's (AES), Yolo Bypass Fish Monitoring Program's (YBFMP) lower trophic monitoring that is conducted under the IEP umbrella. The monitoring of invertebrate drift was initiated to compare the seasonal variations in densities and species trends of aquatic and terrestrial insects/non-insects within (1) Sacramento River channel, and (2) the Yolo Bypass, the river's seasonal floodplain. Aquatic and terrestrial insects are an important component in the diet of juvenile and adult fishes within the San Francisco Estuary, including two important native fishes: juvenile Chinook Salmon and Sacramento Splittail.

Key findings to date: (1) Chinook Salmon sampled in the floodplain had diets comprised of 90% Dipterans and zooplankton, with Chironomidae being the dominant Diptera family (Sommer et al., 2001), (2)The floodplain of the Yolo Bypass contains significantly higher densities of Diptera (Diptera densities being positively associated with flow) and terrestrial invertebrates than the adjacent Sacramento River (Sommer et al. 2001b: Sommer et al. 2004: Sommer et al. 2007), (3) A major portion of the diet of juvenile Sacramento Splittail are chironomid larvae (Kurth and Nobriga 2001, Moyle et al. 2004, Sommer et al. 2007), and (4) The Yolo Bypass was the site of the recent discovery of a new aestivating and winter emerging chironomid; *Hydrobaenus saetheri* (Cranston et al. 2007).

III. Study Area and Sample Sites

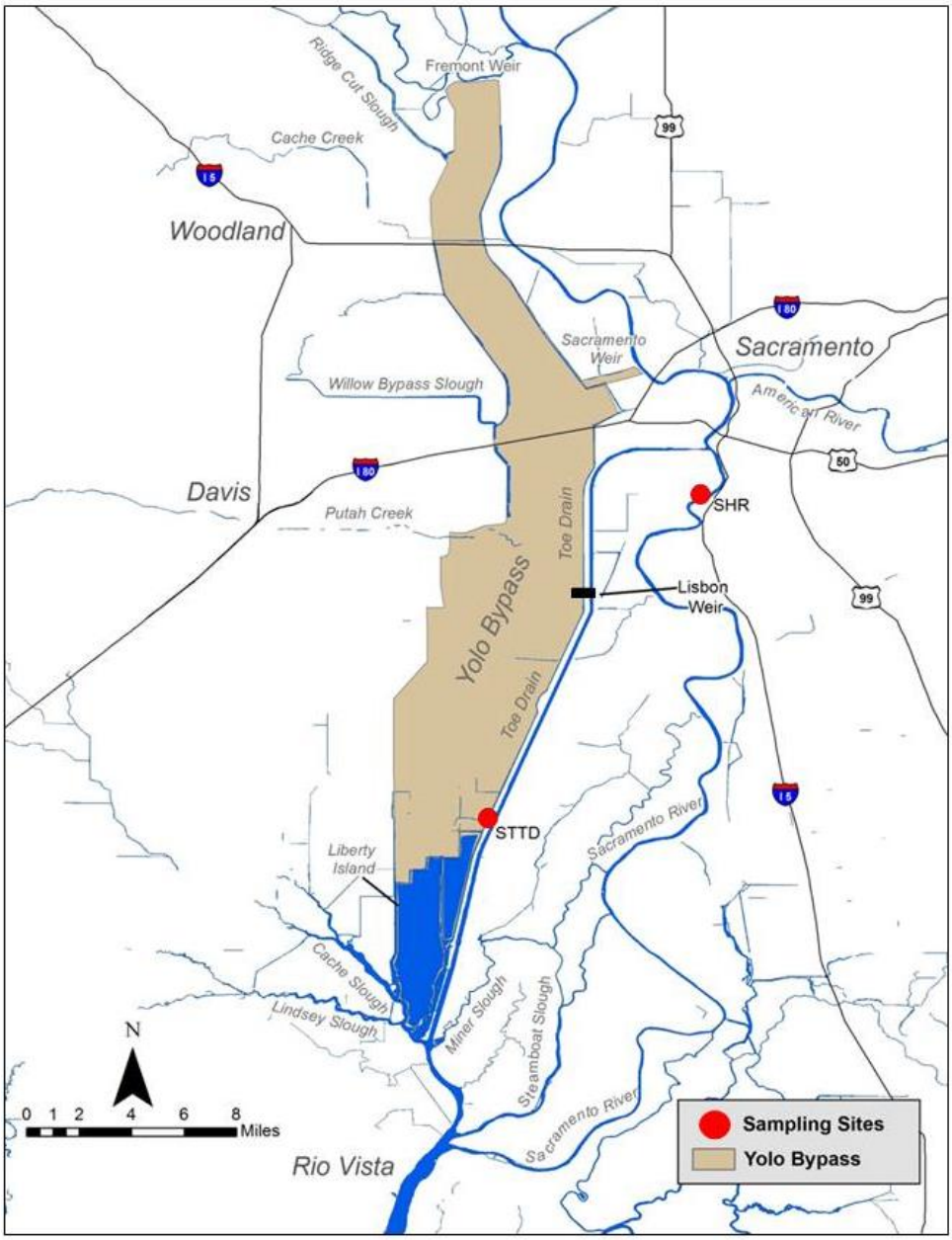
A. *General Information*

There are two fixed sampling site locations for this study: (1) Toe Drain of Yolo Bypass (STTD) at our rotary screw trap, and (2) Sacramento River at Sherwood Harbor (SHR). These sites are sampled on an ebb tide on the same day or within one day of one another.

B. *Name and Location Information of Current Invertebrate Drift Sampling Sites*

Station	Location	latitude			longitude			Start Year
		degrees	minutes	seconds	degrees	minutes	seconds	
STTD	Yolo Bypass - Screw Trap at Toe Drain	38	21	12.46	121	38	34.71	1998
SHR	Sacramento River at Sherwood Harbor	38	31	56.77	121	31	41.1	1998

Map of Currently Sampled Sites



IV. Period of Record

Invertebrate drift monitoring began in 1998 and continues through the present. The drift invertebrate dataset includes the proper sorting, identification, and enumeration of (1) aquatic insects, (2) aquatic non-insects, (3) terrestrial insects, and (4) terrestrial non-insects.

V. Sampling Frequency

Early in the monitoring program, sampling was generally conducted once monthly from February-April. Beginning in 2001, sampling was conducted at least once monthly during January-June. In some years, sampling was conducted weekly during the inundation and draining of the Yolo Bypass floodplain. Since 2011, sampling is conducted biweekly (every other week) year-round and weekly during floodplain inundation and drainage events.

Sampling Frequency by Month and Year

Yolo Bypass Screw Trap at Toe Drain (STTD)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1998	0*	5*	4*	2*	0*	0*	0	0	0	0	0	0*	11
1999	0	2*	5*	3	0	0	0	0	0	0	0	0	10
2000	0	4*	3*	0	0	0	0	0	0	0	0	0	7
2001	1	2	2	2	1	0	0	0	0	0	0	0	8
2002	4*	2	2	2	3	2	0	0	0	0	0	0*	15
2003	6*	0	2	2	3*	2	0	0	0	0	0	0	15
2004	2*	2*	1*	2	1	1	0	0	0	0	0	1	10
2005	5	3	4	4	2*	2	0	0	0	0	0	0*	20
2006	3*	2*	4*	2*	2*	2	0	0	0	0	0	0	15
2007	0	1	2	2	2	2	0	0	0	0	0	0	9
2008	2	2	2	2	2	2	0	0	0	0	0	0*	12
2009	2	2	2	2	2	2	0	0	0	0	0	0	12
2010	4*	3	3	2	2	0	0	0	0	0	0	0*	14
2011	2*	2	2*	3*	2	3	2	2	2	2	3	2	27
2012	2	2	2	2	3	2	2	2	3	3	2	2*	27
2013	5	4	3	3	2	2	2	2	2	3	1	2	31
2014	3	2	2	2	2	2	2	3	2	2	2	3	27
2015	4	4	7	5	3	6	4	4	2	3	2	2	46
2016	2	3	4	4	2	3	2	3	2	3	2	3	33
2017	3*	4*	4*	4*	4*	2	2	3	2	2	3	2	35
Total	50	51	60	50	38	35	16	19	14	18	15	17	384

*****Months with overtopping at Fremont Weir.

Sacramento River at Sherwood Harbor (SHR)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1998	0*	5*	4*	2*	1*	0*	0	0	0	0	0	0*	12
1999	0	2*	5*	3	0	0	0	0	0	0	0	0	10
2000	0	3*	3*	0	0	0	0	0	0	0	0	0	6
2001	1	2	2	2	1	0	0	0	0	0	0	0	8
2002	4*	2	2	2	3	2	0	0	0	0	0	0*	15
2003	6*	1	2	2	3	2	0	0	0	0	0	0	16
2004	1*	2*	1*	2	1	1	0	0	0	0	0	1	9
2005	5	3	4	4	2*	2	0	0	0	0	0	0*	20
2006	2*	2*	4*	2*	2*	2	0	0	0	0	0	0	14
2007	0	1	2	2	2	2	0	0	0	0	0	0	9
2008	2	2	2	2	2	1	0	0	0	0	0	0*	11
2009	2	2	2	2	2	2	0	0	0	0	0	0	12
2010	4*	4	3	2	2	0	0	0	0	0	0	0*	15
2011	2*	2	2*	3*	2	3	2	2	2	2	3	2	27
2012	2	2	2	2	3	2	2	2	2	3	2	2*	26
2013	5	4	3	3	2	2	2	2	2	3	1	2	31
2014	3	2	2	2	2	2	2	3	2	2	2	3	27
2015	4	4	6	5	4	4	5	5	2	2	2	2	45
2016	2	2	4	2	3	2	2	3	2	2	3	3	30
2017	2	2	2	2	3	2	1	2	2	2	3	2	25
Total	47	49	57	46	40	29	16	19	14	16	16	17	368

*Months with overtopping at Fremont Weir

Number of Sampling Events by Station and by Year (All Conducted Sampling Events)

Station	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
STTD	11	10	7	8	15	15	10	20	15	9	12	12	14	27	27	31	27	46	33	35	384
SHR	12	10	6	8	15	16	9	20	14	9	11	12	15	27	26	31	27	45	30	25	368
Total	23	20	13	16	30	31	19	40	29	18	23	24	29	54	53	62	54	101	63	60	752

VI. Field Collection Methods

An aquatic drift net is used to capture: (1) Aquatic insects (*Ephemeroptera, Trichoptera, Odonata, Hemiptera, Coleoptera*, and *Diptera*), (2) Aquatic non-insects (*Oligochaeta, Gastropoda, Amphipoda*, and *Ostracoda*), (3) Terrestrial insects (*Hemiptera, Coleoptera, Diptera*, and *Lepidoptera*) and (4) Terrestrial non-insects (*Mollusca, Acari* etc.).

Water quality parameters are recorded when the sample is collected. Temperature (C), electrical conductivity (uS/cm), dissolved oxygen (mg/L), and pH are measured using a YSI 556 Multiprobe System. Turbidity is measured from a water sample collected in a glass vial and later analyzed at the office using a Hach 2100Q Portable Turbidimeter. Secchi depth (cm) is also measured. Other factors including tide stage, weather, and trap condition code are also recorded.

A. Aquatic Drift Net

The aquatic drift net is made of 500 micron mesh net, with a 0.46 m by 0.3 m rectangular mouth and 0.91 m long, harnessed to a floated stainless steel frame. It tapers to 0.076 m at the cod-end where a polyethylene jar screened with 500 micron mesh collects the organisms. When there is sufficient flow (typically from January – June), Toe Drain samples are collected during the ebb tide from the rotary screw trap anchored in the middle of the channel and Sacramento River/Sherwood Harbor samples are taken dockside. In the absence of sufficient downstream flow, typically from July-Nov, Sacramento River and Yolo Bypass samples are taken from a boat moving approximately 2-3 mph upstream near the screw trap or dock. Net tow times have varied through the years, with shorter tows occurring with high flows or debris loads. Generally, tows have been 10 minutes long. Exact tow times are recorded with every sampling event.

The flow is measured with a General Oceanics Model 2030R flow meter. Samples are preserved in the field with 10% formalin with Rose Bengal dye to aid in separating organisms from detritus and algae.

VII. Lab Processing Methods

***Current Procedure (1998-Current*):** All aquatic and terrestrial drift invertebrate samples are rinsed and passed through a 250 micron mesh sieve. Large debris (leaves, sticks, etc.) are carefully rinsed and removed with all the remaining material within the sieve being retained for identification. Within 2-3 weeks of collection, each invertebrate drift sample preserved in formalin in the field is transferred to 70-80% ETOH in the laboratory, for sorting, identification, and enumeration by the contractor: EcoAnalysts, Inc. (1420 South Blaine Street, Suite 14 Moscow, Idaho 83843). All the aquatic insects and non-insects are counted and identified to the family level. The terrestrial insects and non-insects are counted and identified to the order level.

Aquatic Drift Taxanomic Level Identification Table

AQUATIC INSECT		TERRESTRIAL NON-INSECT	
Ephemeroptera	Baetidae	**Other Organisms**	Araneae
Trichoptera	Hydroptilidae		Diplopoda
Odonata	Coenagrionidae		Geophilomorpha
	Gomphidae		
Hemiptera	Corixidae		
	Notonectidae		
AQUATIC NON-INSECT			
Annelida-Oligochaeta	Enchytraeidae		
	Naididae		
Mollusca-Gastropoda	Hydrobiidae		
	Lymnaeidae		
	Physidae		
	Planorbidae		
Crustacea-Amphipoda	Corophiidae		
	Crangonyctidae		
	Gammaridae		
	Hyalellidae		
Crustacea-Ostracoda	Ostracoda		
Acari	Acari		
	Arrenuridae		
	Limnesiidae		
	Oribatei		
Cnidaria	Hydridae		
Other Organisms	Nematoda		
TERRESTRIAL INSECT			
Hemiptera	Hemiptera		
Coleoptera	Coleoptera		
Diptera	Diptera		
Lepidoptera	Lepidoptera		
Other Insecta	Collembola		
	Hymenoptera		
	Neuroptera		
	Psocoptera		
	Thysanoptera		

The number per cubic meter for each aquatic and terrestrial organism taken in the aquatic drift net was calculated using the following equation:

N = C/V

Where:

N = the number of a taxon per cubic meter of water sampled
C = the total number of a taxon counted for the sample
V = the volume of water sampled through the net (m^3)
Calculations for volume of water sampled through the net is specific to the General Oceanics Flowmeter model 2030R, and is calculated as follows (General Oceanics Inc.):

$$\frac{(\text{Flowmeter count start} - \text{Flowmeter count end}) \times \text{Rotor Constant}}{999999} \times \frac{\text{Net mouth area}}{4}$$

The rotor constant depends upon which the flowmeter rotor was used during each sampling event, and is identified in the sampling database. Rotor constants are specified in the General Oceanics Flowmeter 2030R manual as:

Standard Speed Rotor Constant = 26,873
Low Speed Rotor Constant R6 = 57,560

X. Data Management and Quality Assurance/Quality Control

A. *Field Data*

Field data are collected and recorded onto datasheets by DWR personnel. These data are then entered monthly by DWR personnel into an Access database. Field data are reviewed monthly for accuracy and completeness. Annually, after all samples are processed by the contractor for the year, lab data are reviewed for accuracy and completeness.

B. *Field Datasheet*

Paper datasheets are digitized and archived in binders that are stored at the West Sacramento, Industrial Blvd. DWR office.

Field Datasheet

LOWER TROPHIC SAMPLING – YOLO BYPASS STUDY
2015/2016

Location: _____

Crew: | Date: | Time: | pH: | DO: | SpCnd: | Cnd (EC):

Secchi Depth: | m | Water Temp: | °C | Weather: | Vial #: | Turb: | NTU

Light Attenuation:

LI-COR Calibration
-143.27 (in air)
-232.10 (in water)

Surface Irradiance (in **air** avg): | µmol

0.75 =	µmol
0.50 =	µmol
0.25 =	µmol
0.01 =	µmol

Subsurface Irradiance (in **water** avg)(~75%, ~50%, ~25%, ~1%):

Depth: | m | ① | µmol
Depth: | m | ② | µmol
Depth: | m | ③ | µmol
Depth: | m | ④ | µmol

Drift Sample :

Condition Code:

Start Time: | Stop Time: | Set Time: | **min**

Flow Meter:
Regular or Low Speed
*For low speed, record initial meter reading in "end meter" box

Flow : Start Meter: | End Meter:

Comments:

Egg & Larval Fish Sample :

Condition Code:

1st Start Time: | 1st Stop Time: | 2nd Start Time: | 2nd Stop Time: | Set Time: | **min**

Flow Meter:
Regular or Low Speed
*For low speed, record initial meter reading in "end meter" box

Flow :
(Mid-West) Start Meter: | End Meter:
(Near-West) Start Meter: | End Meter:
(Mid-East) Start Meter: | End Meter:
(Near-East) Start Meter: | End Meter:

Comments:

Zooplankton Sample :

Condition Code:

Start Time: | 150 Stop Time: | 50 Stop Time: | 150 Set Time: | **min** | 50 Set Time: | **min**

Flow Meter:
Regular or Low Speed
*For low speed, record initial meter reading in "end meter" box

Flow :
150µm: Start Meter: | End Meter:
50µm: Start Meter: | End Meter:

Comments:

Chlorophyll Sample :

Yes ☐ **No** ☐ **Replicate** ☐ Time: | Filtered: 500mL OR 250mL

Phytoplankton Sample :

☐ ☐ 60 mL Amber Bottle w/ Lugol Solution

Entered by :_____ Date:_____ Checked by :_____ Date:_____

C. Taxonomic Data

Taxonomic results are received via email from the contractor, and entered into the AES Access database by DWR personnel. Electronic copies of results for taxonomic analyses are archived on DWR/AES Network drives. Hard copies are printed and archived in binders at the West Sacramento, Industrial Blvd. DWR office.

Catch-per-unit effort data, in number per cubic meter of water sampled, for each valid sample are available in Excel with the associated field data by contacting the DWR project lead Jared Frantzich (see contact information at beginning of document).

VIII. Chain of Custody and Sample Handling

Samples are securely packaged to prevent leakage or breakage. All bottles are inspected and verified, and a chain of custody form is filled out with the sample collection time and date, study, site, and number of jars per sample. Signatures are required of both the person responsible for sending the sample package, and the person receiving it. The chain of custody form is signed and sent to the EcoAnalyst contractor with the samples, and the contractor is notified of approximate date of delivery.

Chain of Custody Form

EcoAnalyst Inc.
Chain of Custody

Page 1 of 1

Samples sent from:	West Sacramento	Samples sent to:	Moscow, Idaho
Samples sent by:	DWR, Jared Frantzich	Contract #: 4600009721	
Date:		Date:	
Transported By:	UPS	Samples received by:	
Signature: _____		Signature:_____	
Requested Analysis:			

	Collection Date	Study	Time	Station	# of Jars	Add Notes
1						
2						
3						
4						
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6						
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